Lecture-3

CSE-3101

Computer Networking

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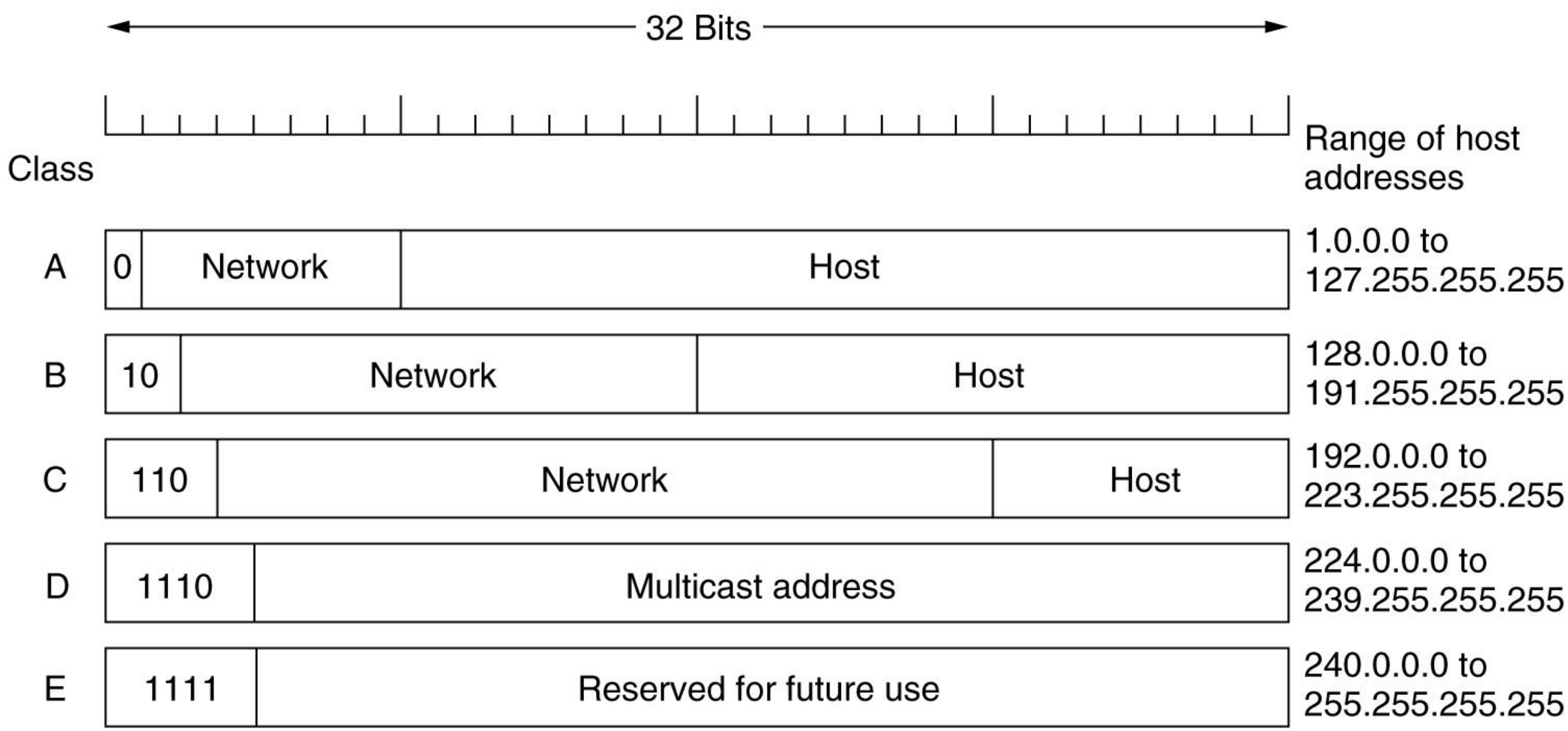
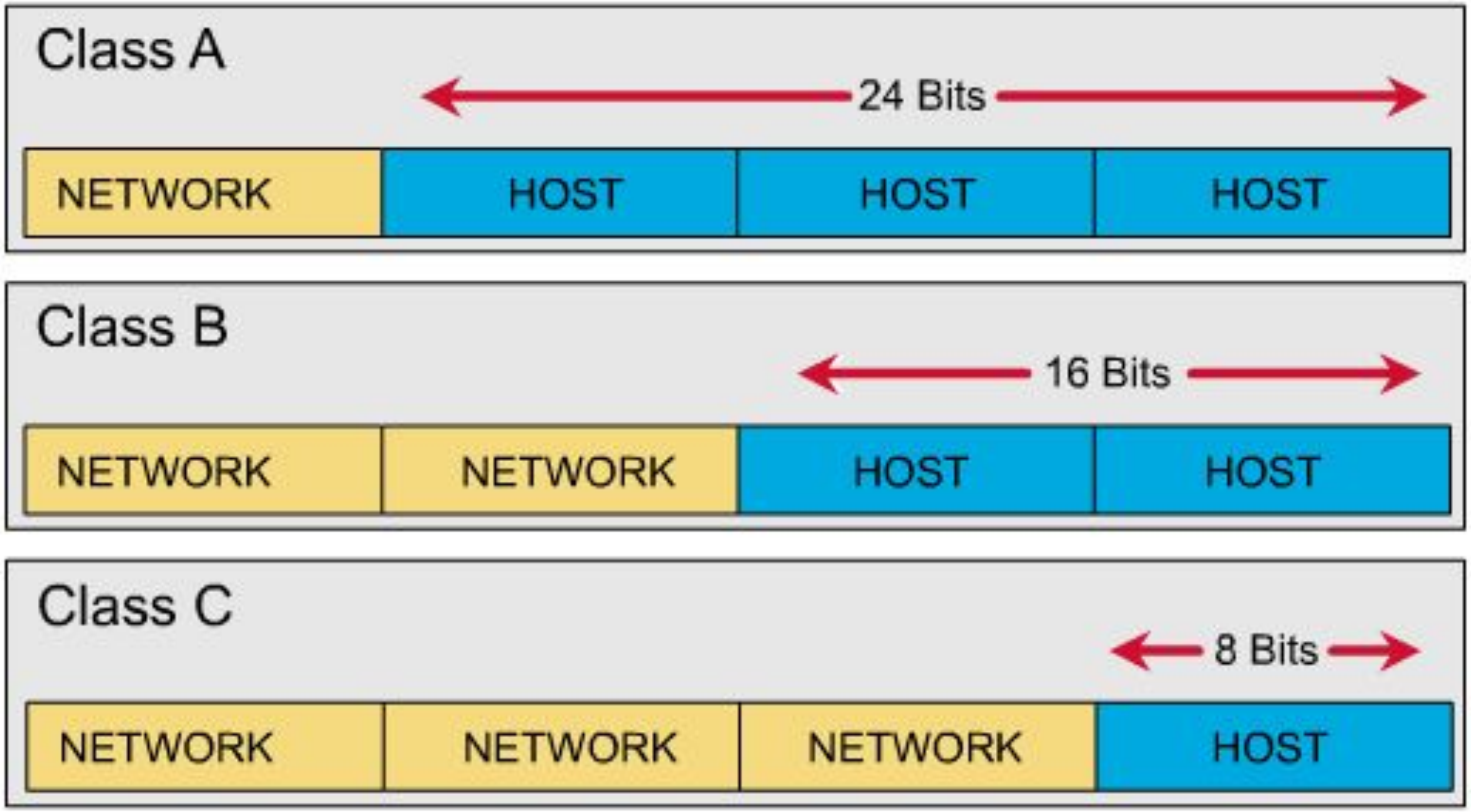
IP Addresses





Class A (24 bits for hosts) $2^{24} - 2^{*}$ = 16,777,214 maximum hosts

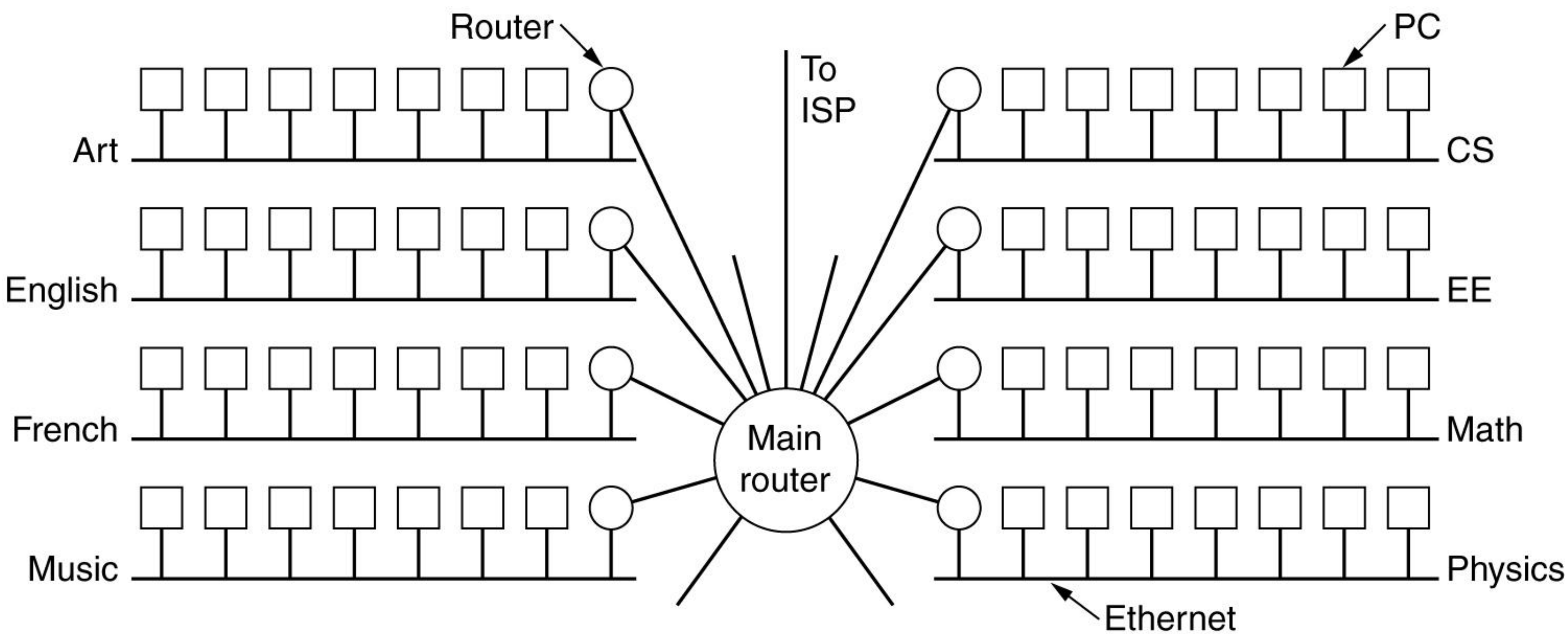
Class B (16 bits for hosts) $2^{16} - 2^{*}$ = 65,534 maximum hosts

Class C (8 bits for hosts) $2^{8} - 2^{*}$ = 254 maximum hosts

* *Subtracting the network and broadcast reserved address*

Subnets

- A big network usually spitted into several small parts for internal use but still act like a single network to the outside world.
- A typical campus network might look like fig below, with a main router connected to an ISP or regional network and numerous Ethernets spread around campus in different departments. Each of the Ethernets has its own router connected to the main router (via backbone LAN). In the internet literature, the part of the network (in this case, Ethermets) are called subnets.



A campus network consisting of LANs for various departments.

Subnets (2)

- An IP address has two components, the network address and the host address. A subnet mask separates the IP address into the network and host addresses (<network> <host>). Subnetting further divides the host part of an IP address into a subnet and host address (<network> <subnet> <host>).

- ✔ A Subnet mask is a 32-bit number that masks an IP address, and divides the IP address into network address and host address. Subnet Mask is made by setting network bits to all "1"s and setting host bits to all "0"s.

- ✔ Within a given network, two host addresses are reserved for special purpose. The "0" address is assigned a network address and "255" is assigned to a broadcast address, and they cannot be assigned to a host.

- ✔ It is called a subnet mask because it is used to identify network address of an IP address by performing bitwise AND operation on the subnet mask.

The default subnet mask used for class A, B, C and D are:

Class A: 11111111.00000000. 00000000. 00000000
255.0.0.0

Class B: 11111111. 11111111. 00000000. 00000000
255.255.0.0

Class C: 11111111. 11111111. 11111111. 00000000
255.255.255.0

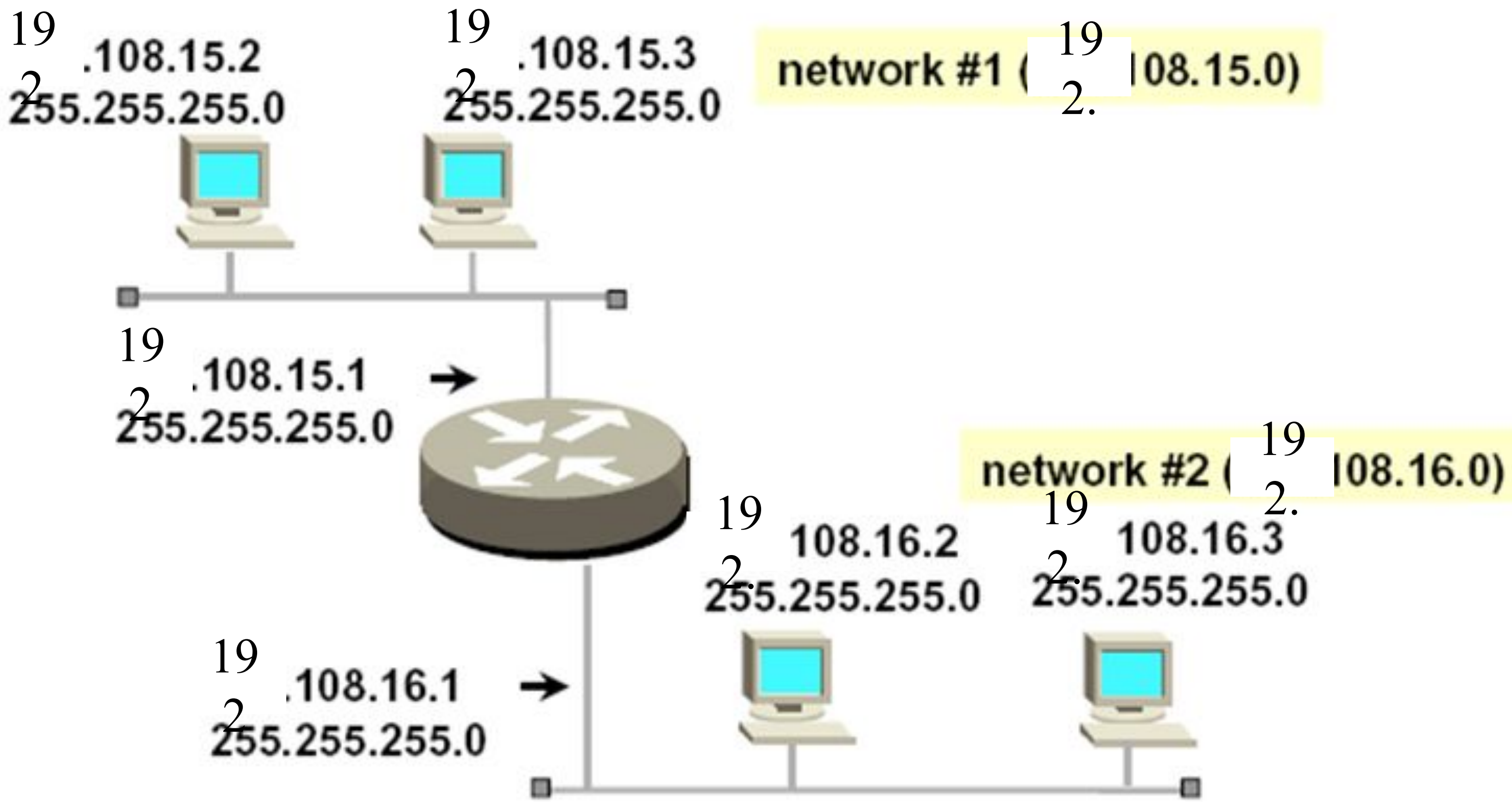
For example we have a class C IP address of a host: 192.168.23.4
Anding the IP address with default subnet mask 255.255.255.0 give the result of 192.168.23.0 which is the net ID part of the IP address.

The possible hosts will be:
192.168.23.1
192.168.23.2
192.168.23.3
192.168.23.4
....
192.168.23.254

192.168.23.0 and 192.168.23.255 are excluded as mentioned before. Therefore the number of hosts is $2^8-2 = 254$

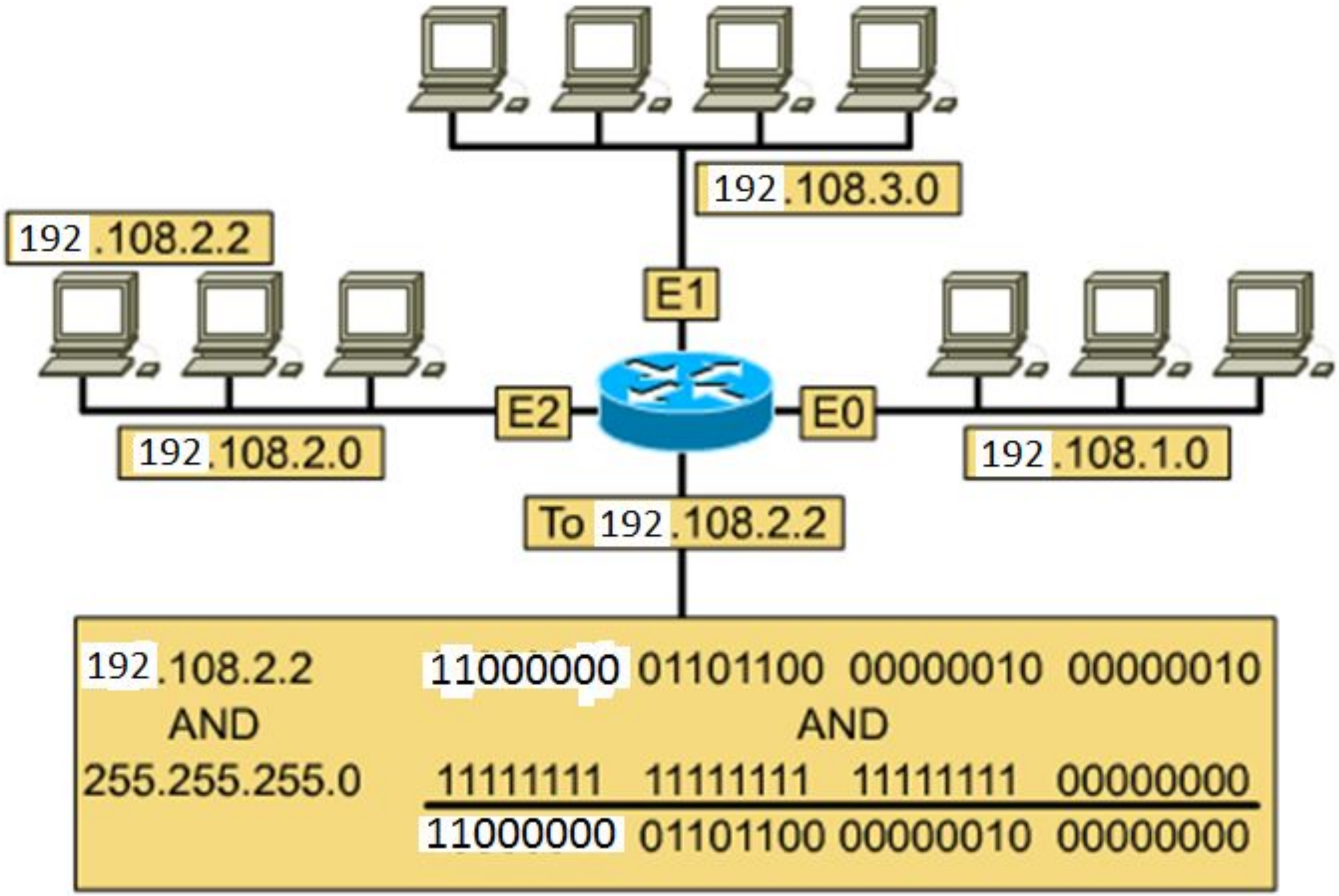
Example-1

router is used to separate network



Performing the AND Function

Example-2: A host wants to send packet to a host 192.108.2.2. First the sender has to find the net ID of the receiver.



in decimal 192.108.2.0

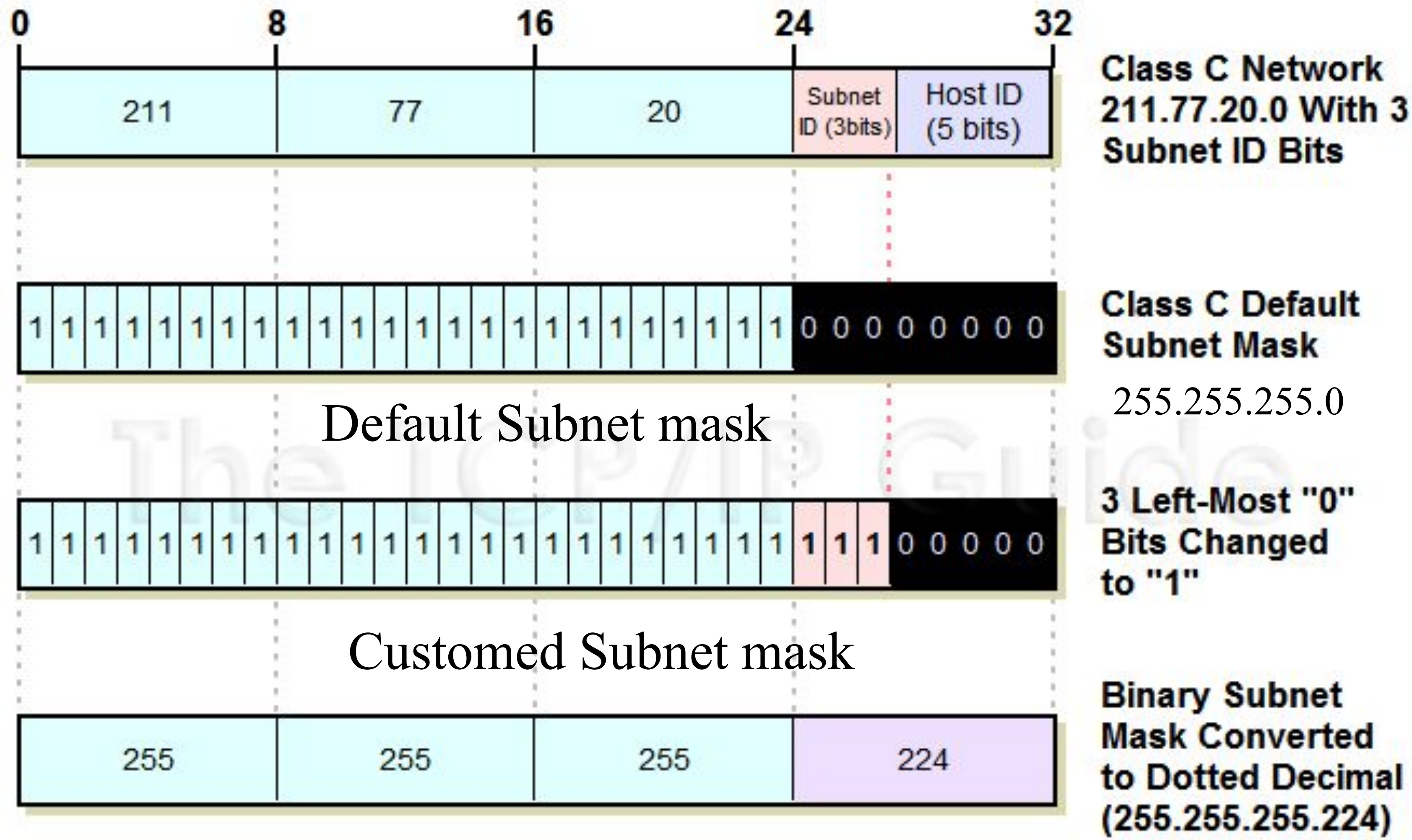
Subnet Mask

- Follow these steps to determine the subnet mask:
  - ✔ Replace the network and subnet portion of the address with all 1s.
  - ✔ Replace the host portion of the address with all 0s.
  - ✔ Convert the binary expression back to dotted-decimal notation.

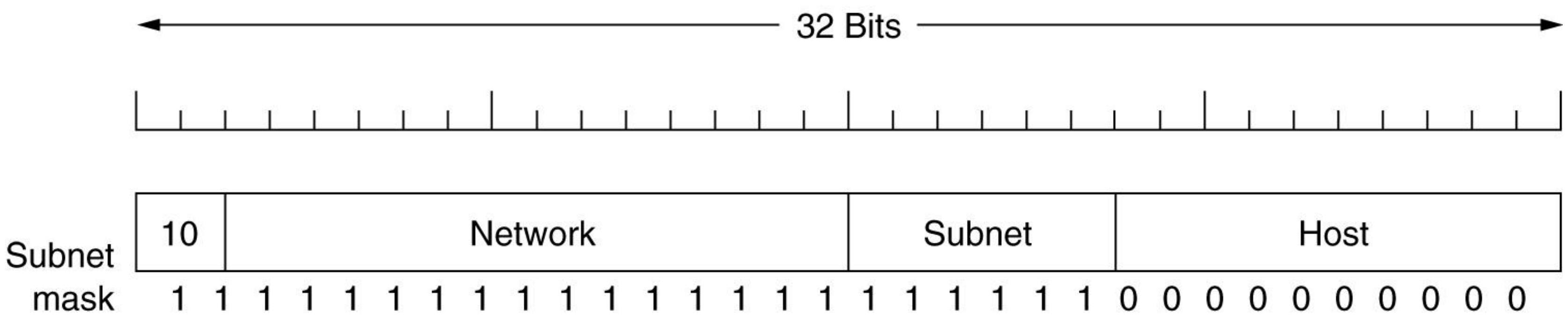
11111111.11111111.11110000.00000000

Class B Network
16 bits for the Network
4 bits for the Subnetwork
12 bits for the Host

- 32 bits long
- Divided into four octets
- Network and subnet portions all 1's
- Host portion all 0's


0
8
16
24
32
211
77
20
Subnet ID (3bits)
Host ID (5 bits)
Class C Network 211.77.20.0 With 3 Subnet ID Bits
1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 0 0 0 0 0 0 0 0
Class C Default Subnet Mask
255.255.255.0
Default Subnet mask
1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 0 0 0 0 0
3 Left-Most "0" Bits Changed to "1"
Customed Subnet mask
255
255
255
224
Binary Subnet Mask Converted to Dotted Decimal (255.255.255.224)
The TCP/IP Guide

The example of a customed subnet mask for class B is like:



A class B network subnetted into 64 subnets.

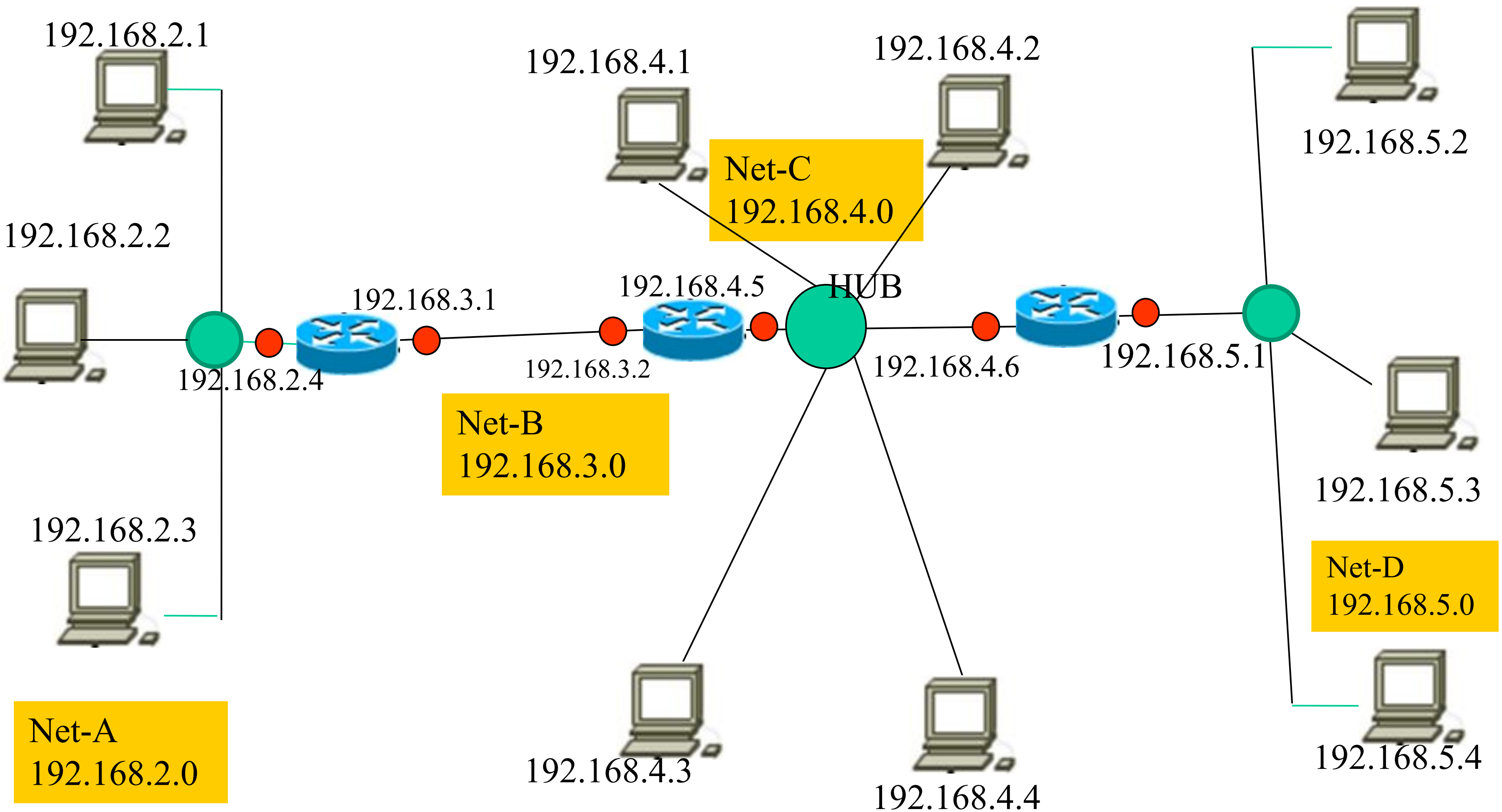
Example: Determine the number of subnet and host per subnet

Ans. The number of subnet = $2^6 = 64$

The number of hosts/subnet = $2^{10}-2= 1022$

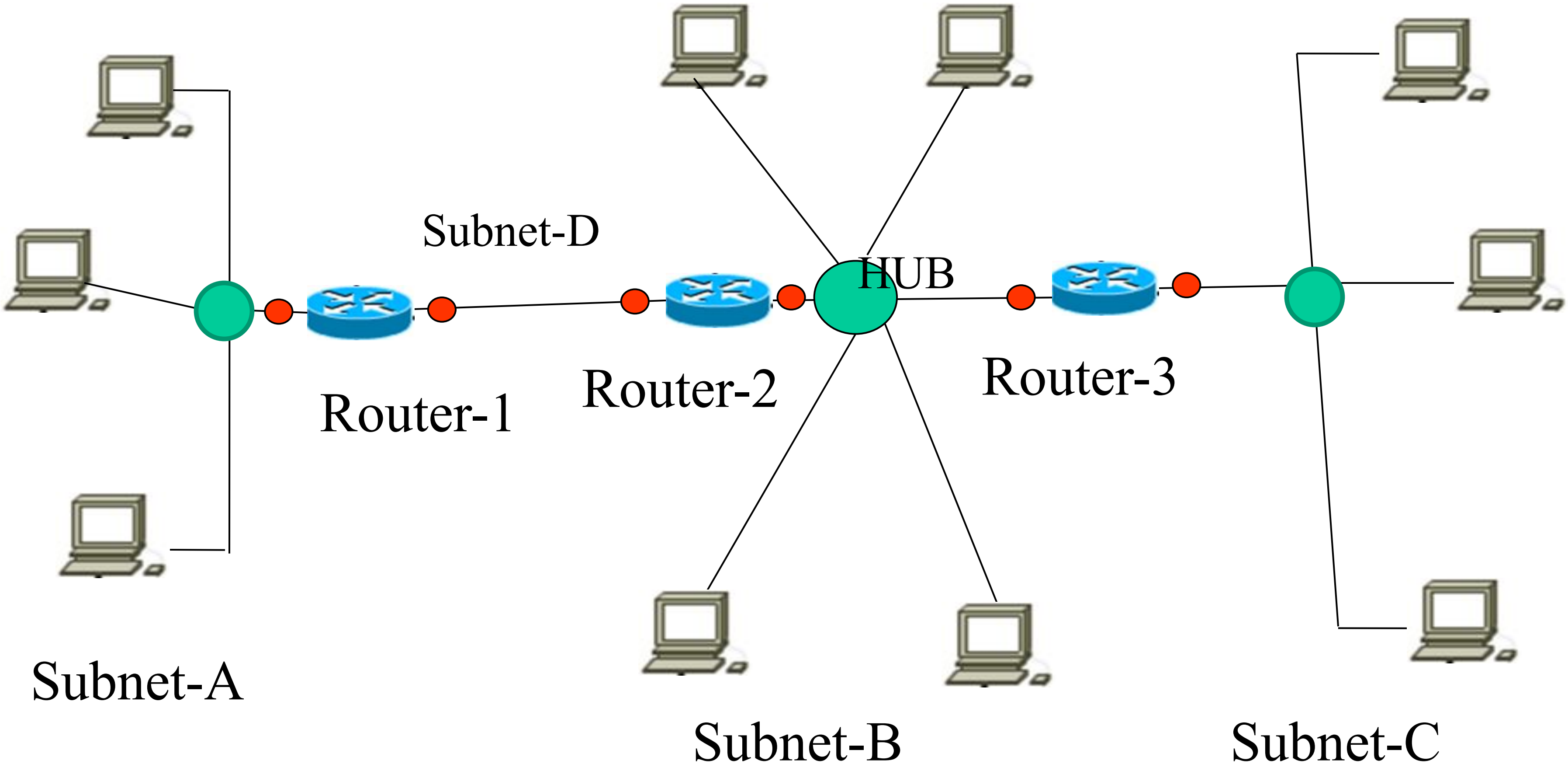
Examples

Example-1: Put default class C IP address to each node



The drawback of the network is that it needs 4 IP address from ISP for 4 networks.

Example-2 Design the network with proper subnetting using class B IP.



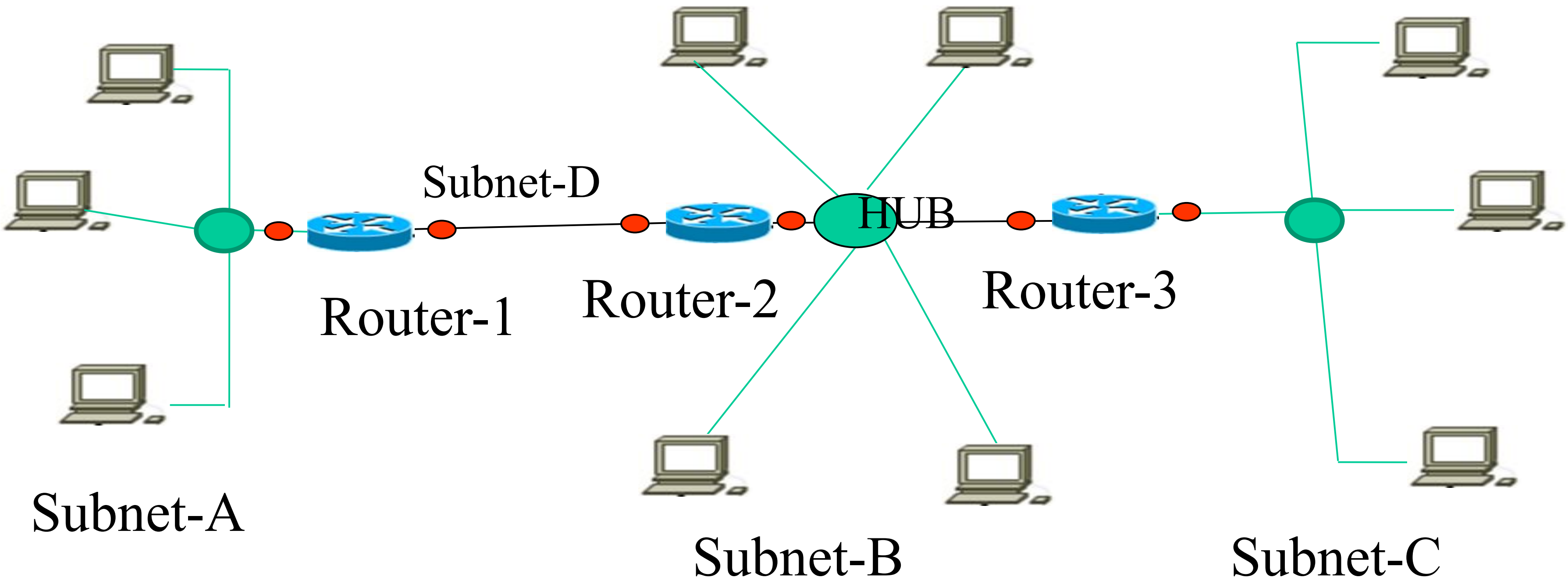
We have four subnets.

a)The subnet–A has four hosts (3 PCs and 1 router interface)

b) subnet-B has 6 hosts (4 PCs and 2 router interfaces)

c) subnet-C has 4 hosts (3 PCs and 1 router interface)

d) the network has another two hosts correspond to subnet-D i.e between router-1 and router-2 which are directly connected. Here we have 4 subnets.



If we keep 3 bits for the subnet ID (we can also take 2 bits for subnet for above network) of then we have $2^3 = 8$ subnets which is greater than 4 subnets of above figure. We can also use 2 bits for 4 subnets. Considering class B IP address. Our custom subnet mask will be ,

11111111	11111111	11100000	00000000

255	255	224	0

Let we have class B IP address 191.1.0.0 where net ID is 191.1 then possible 8 subnets will be:

191	1	00100000	00000000

191.1.32.0

191	1	01000000	00000000

191.1.64.0

191	1	01100000	00000000

191.1.96.0

191	1	10000000	00000000

191.1.128.0

191	1	10100000	00000000

191.1.160.0

191	1	11000000	00000000

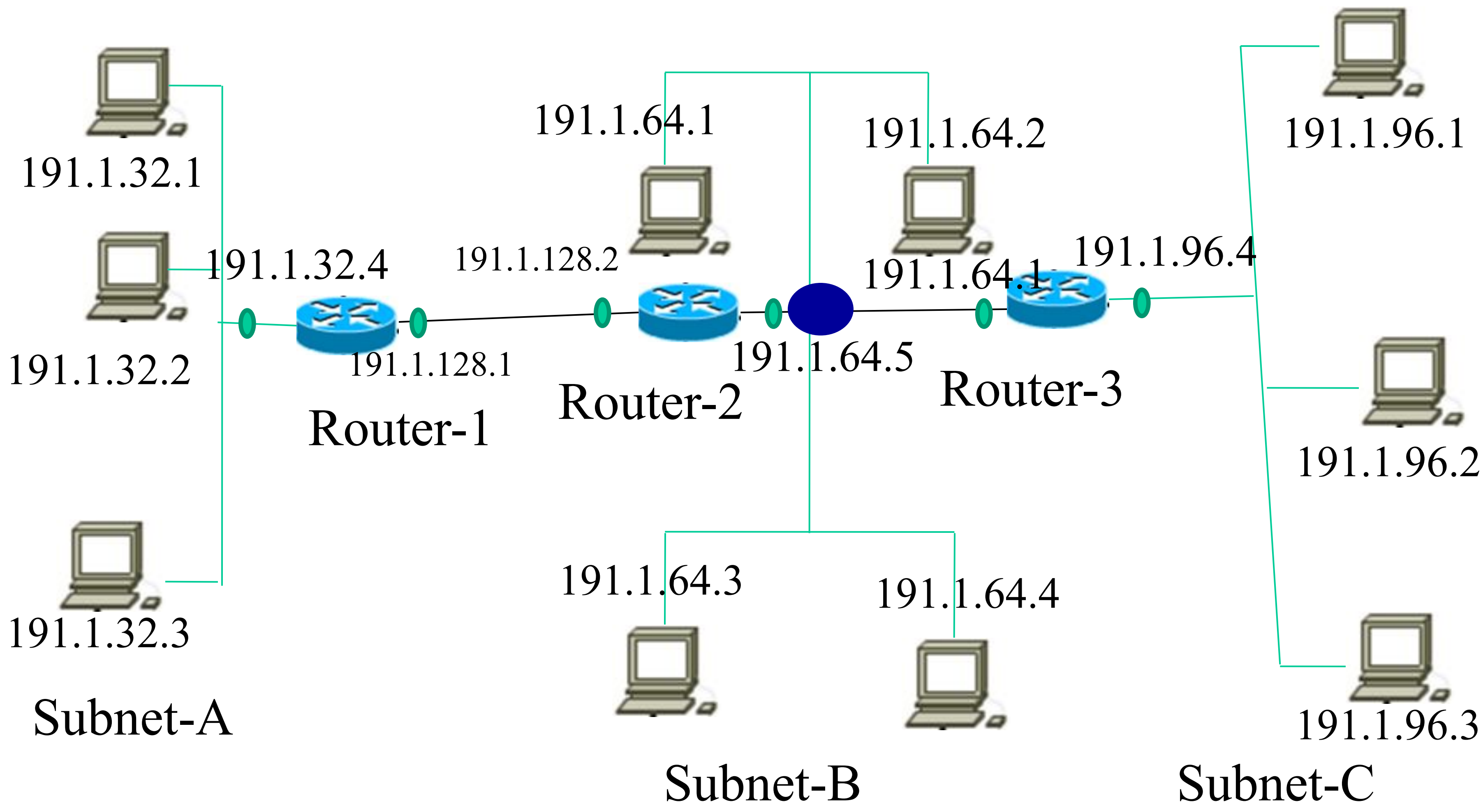
191.1.192.0

191	1	00000000	00000000

191.1.0.0

191	1	11100000	00000000

191.1.224.0



The advantage of the network is that it needs only one IP address from ISP.

The possible hosts for the subnet 191.1.32.0 (we may chose for the subnet-A of previous figure) will be,

191	1	001xxxxx	xxxxxxxx

Decimal	Binary
191.1.32.1	10111111.00000001.00100000.00000001
191.1.32.2	10111111.00000001. 00100000.00000010
191.1.32.3	10111111.00000001. 00100000.00000011
………….	……………………………………………..
………….	……………………………………………..
191.1.63.254	10111111.00000001. 00111111.11111110

Total number of hosts will be 2^{13}-2

The possible hosts for the subnet 191.1.64.0 (we may chose for the subnet-B of previous figure) will be,

191	1	010xxxxx	xxxxxxxx

Decimal	Binary
191.1.64.1	10111111.00000001.01000000.00000001
191.1.64.2	10111111.00000001.01000000.00000010
191.1.64.3	10111111.00000001.01000000.00000011
………….	………………………………………..
………….	………………………………………..
191.1.95.254	10111111.00000001.01011111.11111110

Total number of hosts will be 2^{13}-2

The possible hosts for the subnet 191.1.96.0 (we may chose for the subnet-C of previous figure) will be,

191	1	011xxxxx	xxxxxxxx

191.1.96.1
191.1.96.2
191.1.96.3
…………
…………
191.1.127.254

10111111.00000001.01100000.00000001
10111111.00000001.01100000.00000010
10111111.00000001.01100000.00000011
………………………………………
………………………………………
10111111.00000001.01111111.11111110

Total number of hosts will be 2^{13}-2

The possible hosts for the subnet 191.1.128.0 (we may chose for the for the point to point link of Router-1 and Router-2 of previous figure) will be,

191	1	100xxxxx	xxxxxxxx

191.1.128.1	10111111.00000001.10000000.00000001
191.1.128.2	10111111.00000001. 10000000.00000010
191.1.128.3	10111111.00000001. 10000000.00000011
………….	………………………………………..
………….	………………………………………..
191.1.159.254	10111111.00000001. 10011111.11111110

Total number of hosts will be 2^{13}-2

The possible hosts for the subnet 191.1.160.0 (we may chose for the for the point to point link of Router-1 and Router-2 of previous figure) will be,

191	1	101xxxxx	xxxxxxxx

191.1.160.1	10111111.00000001.10100000.00000001
191.1.160.2	10111111.00000001.10100000.00000010
191.1.160.3	10111111.00000001.10100000.00000011
………….	………………………………………..
………….	………………………………………..
191.1.191.254	10111111.00000001.10111111.11111110

Total number of hosts will be 2^{13}-2

The possible hosts for the subnet 191.1.192.0 (we may chose for the for the point to point link of Router-1 and Router-2 of previous figure) will be,

191	1	110xxxxx	xxxxxxxx

191.1.192.1	10111111.00000001.11000000.00000001
191.1.192.2	10111111.00000001.11000000.00000010
191.1.192.3	10111111.00000001.11000000.00000011
………….	…………………………………………..
………….	…………………………………………..
191.1.223.254	10111111.00000001.11011111.11111110

Total number of hosts will be 2^{13}-2

The subnets and possible host IDs are shown below.

Subnet	1^{st} host ID	Last host ID
191.1.32.0	191.1.32.1	191.1.63.254
191.1.64.0	191.1.64.1	191.1.95.254
191.1.96.0	191.1.96.1	191.1.127.254
191.1.128.0	191.1.128.1	191.1.159.254
191.1.260.0	191.1.160.1	191.1.191.254
191.1.192.0	191.1.192.1	191.1.223.254

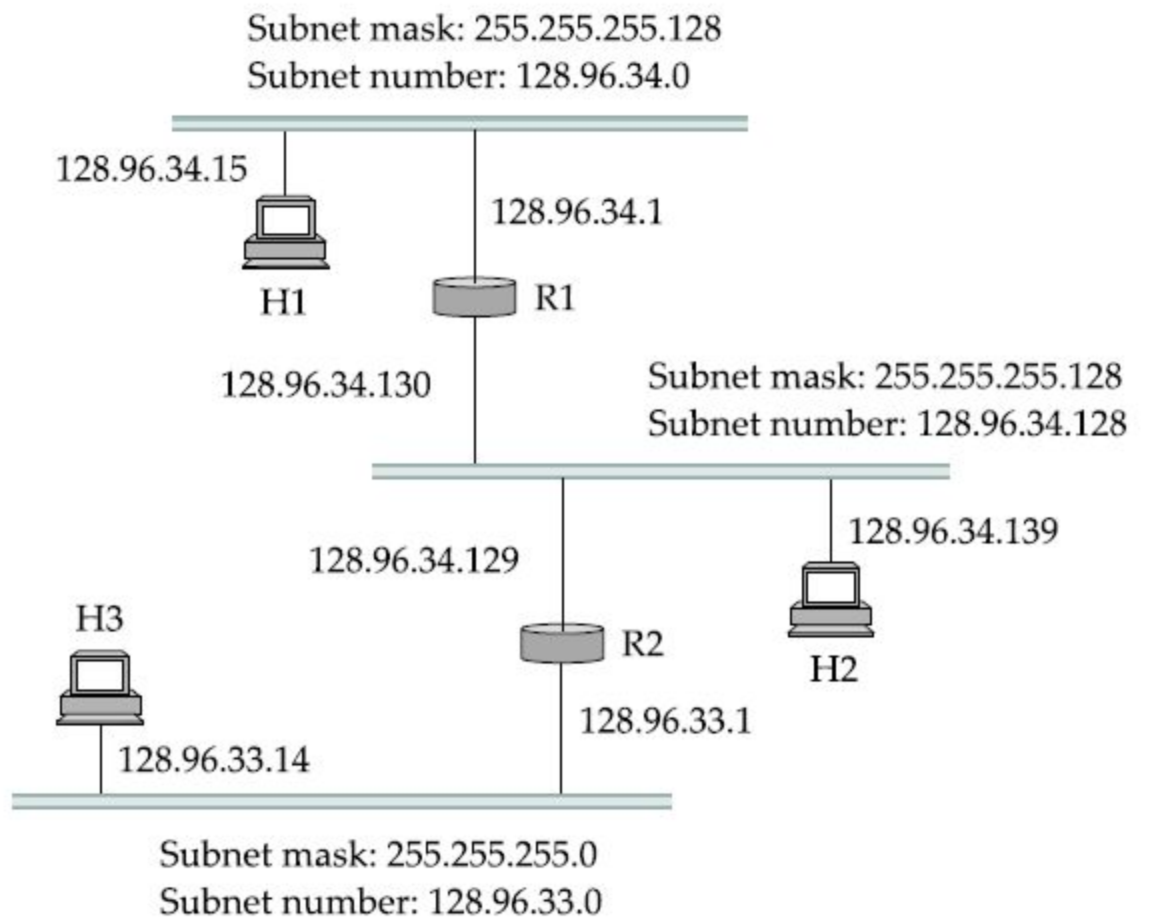
From above table we get two formulas:

The 1^{st} host ID = subnet ID + 1

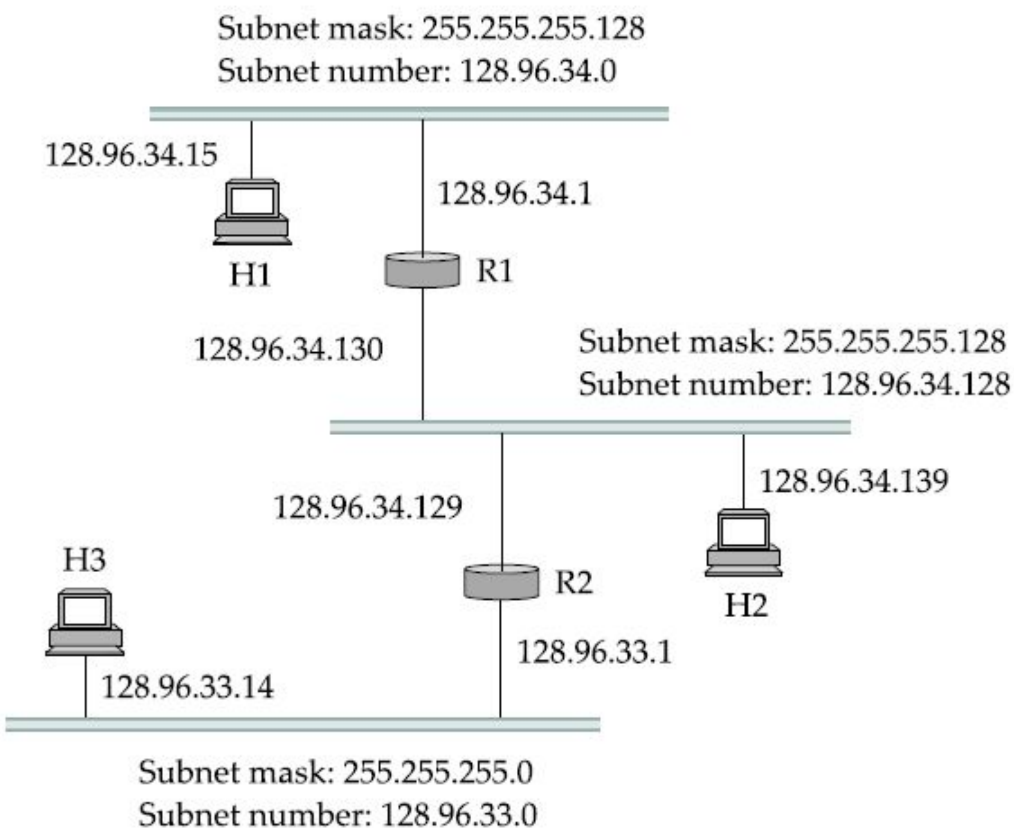
The last host ID of a range = next subnet ID - 2

Example-3

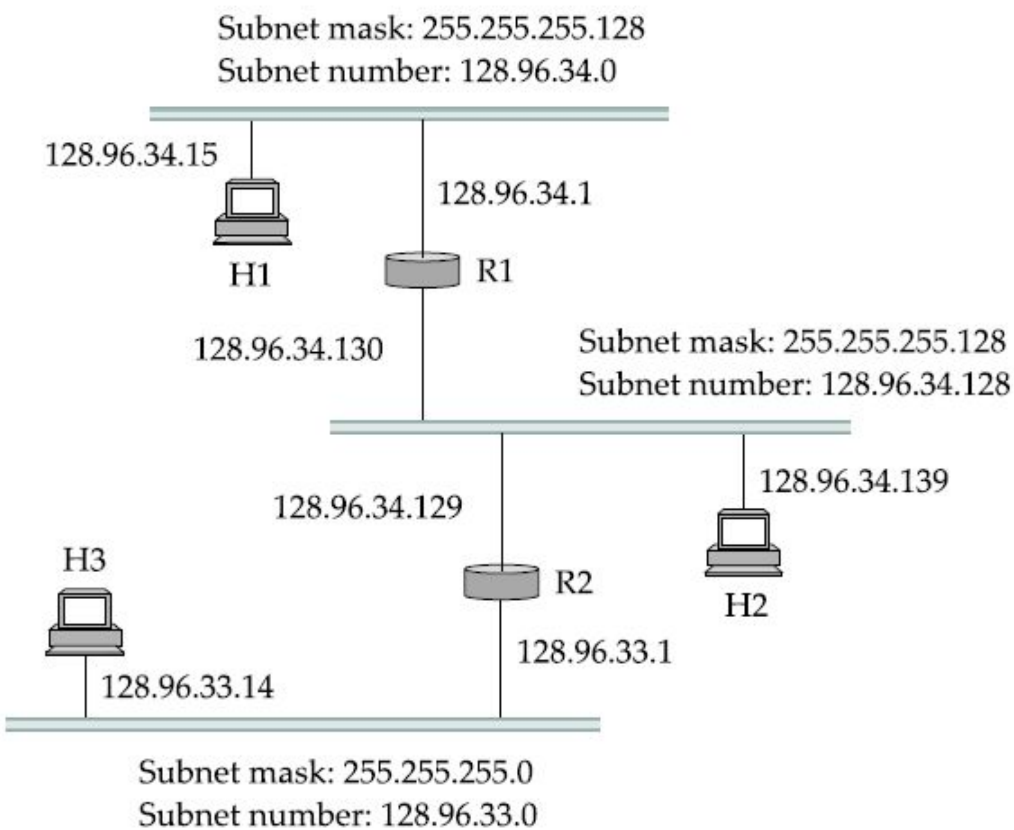
Host H1 in Figure below is configured with an address of 128.96.34.15 and a subnet mask of 255.255.255.128. The bitwise AND of these two numbers defines the subnet number of the host and of all other hosts on the same subnet. In this case, 128.96.34.15 AND 255.255.255.128 equals 128.96.34.0, so this is the subnet number for the topmost subnet in the figure.



For example, if H1 is sending to H2, then H1 ANDs its subnet mask (255.255.255.128) with the address for H2 (128.96.34.139) and the result is found as: 128.96.34.128. This does not match the subnet number for H1 (128.96.34.0) so H1 knows that H2 is on a different subnet. Since H1 cannot deliver the packet to H2 directly over the subnet, it sends the packet to its default router R1.



R1 would AND H2's address (128.96.34.139) with the subnet mask of the first entry (255.255.255.128) and compare the result (128.96.34.128) with the network number for that entry (128.96.34.0). Since this is not a match, it proceeds to the next entry. This time a match does occur, so R1 delivers the datagram to H2 using interface 1, which is the interface connected to the same network as H2.



Example-4

A class B IP address is 150.100.14.163 and the corresponding subnet mask is 255.255.255.128 Determine the maximum number of hosts per subnet.

Ans. The subnet mask in both binary and decimal is like:

11111111. 11111111. 11111111. 10000000

255.255.255.128

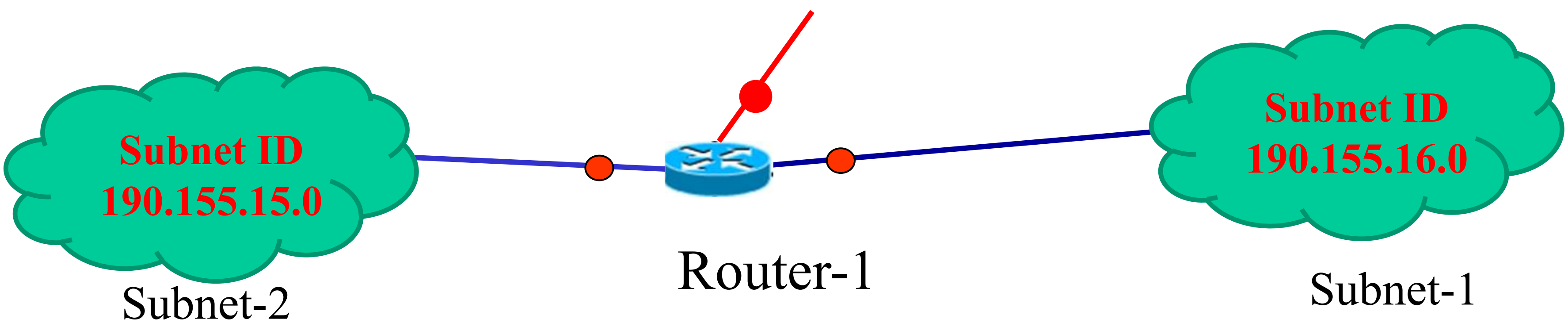
Here 9 bits are for subnets and 7 bits for hosts.

Therefore the number of hosts per subnet 2^7-2 = 126

The number of subnets = 2^9 = 512

Example-5

A router is connected to network has two subnets 190.155.16.0 and 190.155.15.0 where the net_ID is 190.155.0.0 i.e. class B IP. Assume 8 bits for subnet ID. How the router will deal with a datagram destined to 190.155.16.16.



Ans. Since 8 bits for subnet ID and 16 bits for net ID (class B address) therefore the custom subnet mask will be 255.255.255.0 for both the subnets. Now making 'and' operation of 190.155.16.16 and 255.255.255.0 gives 190.155.16.0. Therefore the router will route the datagram to its subnet 190.155.16.0.

Example-6
If the subnet mask 255.255.240.0 is used for a class B IP address then find the number of subnets and number of hosts/subnet.

Binary: 11111111 . 11111111 . 11110000 . 00000000
Decimal: 255.255.240.0
The number of hosts/subnet = $2^{12} - 2 = 4094$
The number of subnets = $2^{4} = 16$

Example-7
If the subnet mask 255.255.255.192 is used for a class C IP address then fined the number of subnets and number of hosts/subnet.

The number of hosts/subnet = $2^{6} - 2 = 62$
The number of subnets = $2^{3} = 8$

Exercise-1

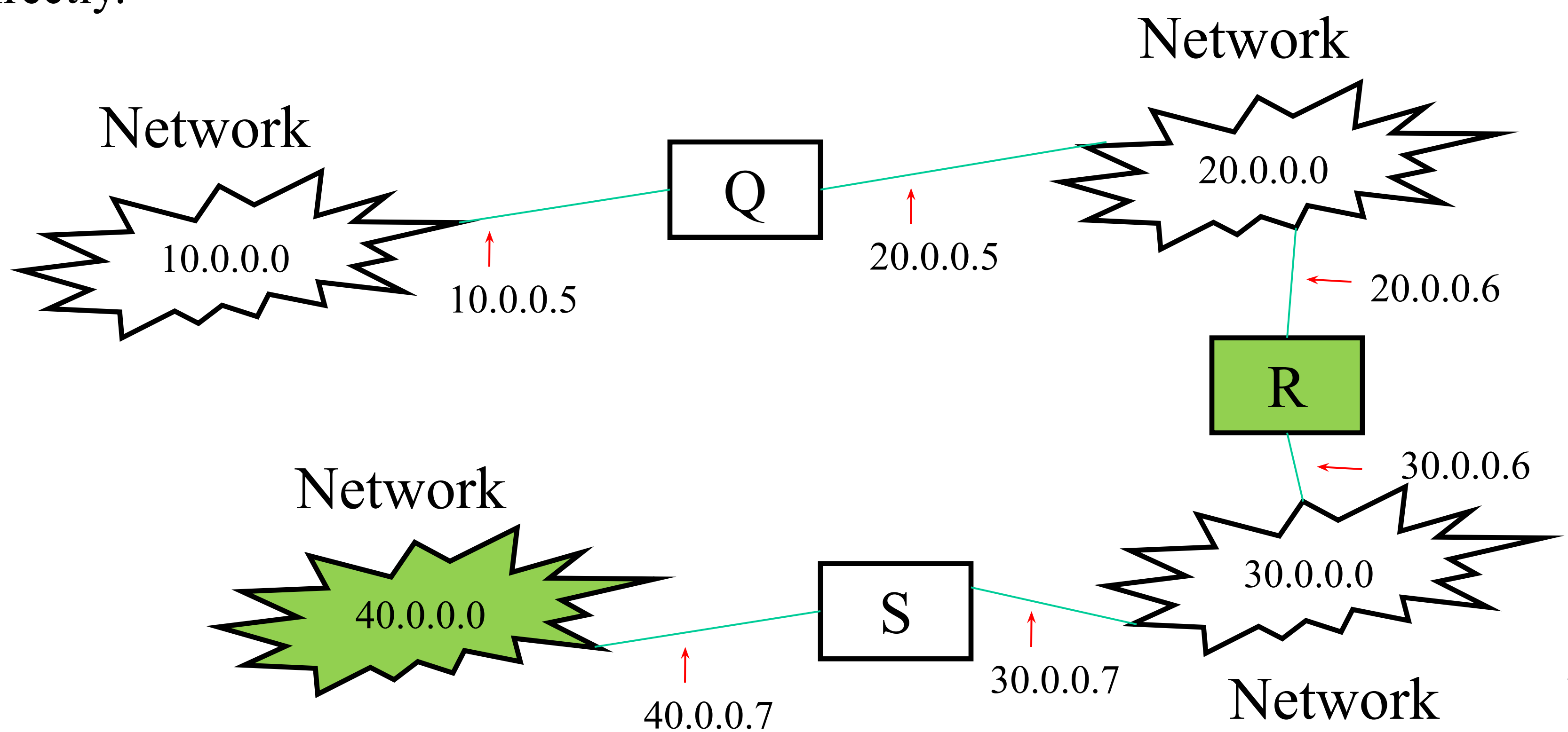
Using class C subnet mask 255.255.255.0 for a class B IP, you can divide class B network 172.16.0.0 into 256 possible subnets. Justify with numerical example.

We can now describe the datagram forwarding algorithm in the following way:

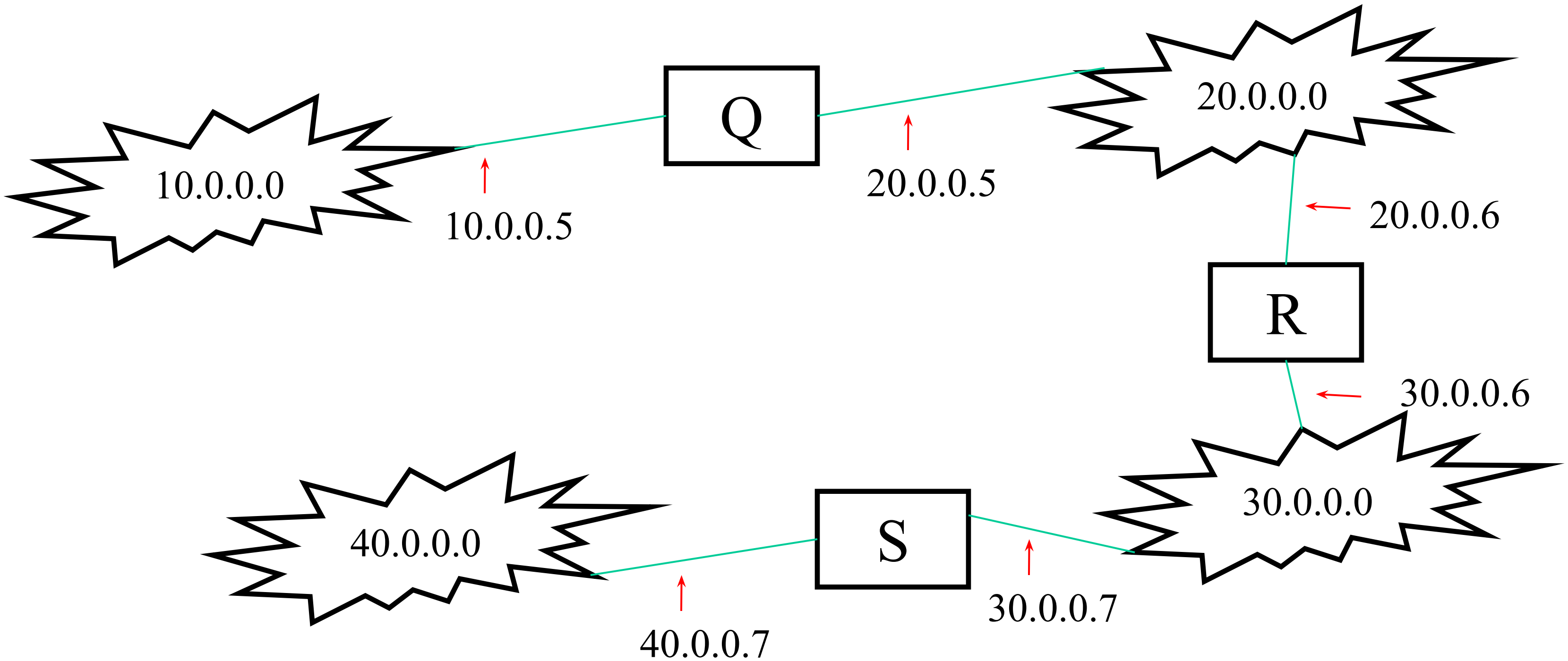
D = destination IP address
for each forwarding table entry SubnetNumber, SubnetMask, NextHop
D1 = SubnetMask & D
if D1 = SubnetNumber
if NextHop is an interface
deliver datagram directly to destination
else
deliver datagram to NextHop (a router)

IP Routing Table

- Typically a routing table contains pair (N, R) where N is the net ID of the destination network and R is the IP address of the next router along the path to network N.
- Fig below will help to explain routing tables. Let us concentrate on router R which is directly connected to network 20.0.0.0 and 30.0.0.0 (class A net_ID) can use direct delivery to send to host on either of these networks.
- A datagram destined for a host on network 40.0.0.0, R routes it to address of router S, 30.0.0.7. R can reach on 30.0.0.7 directly and S can reach on network 40.0.0.0 directly.

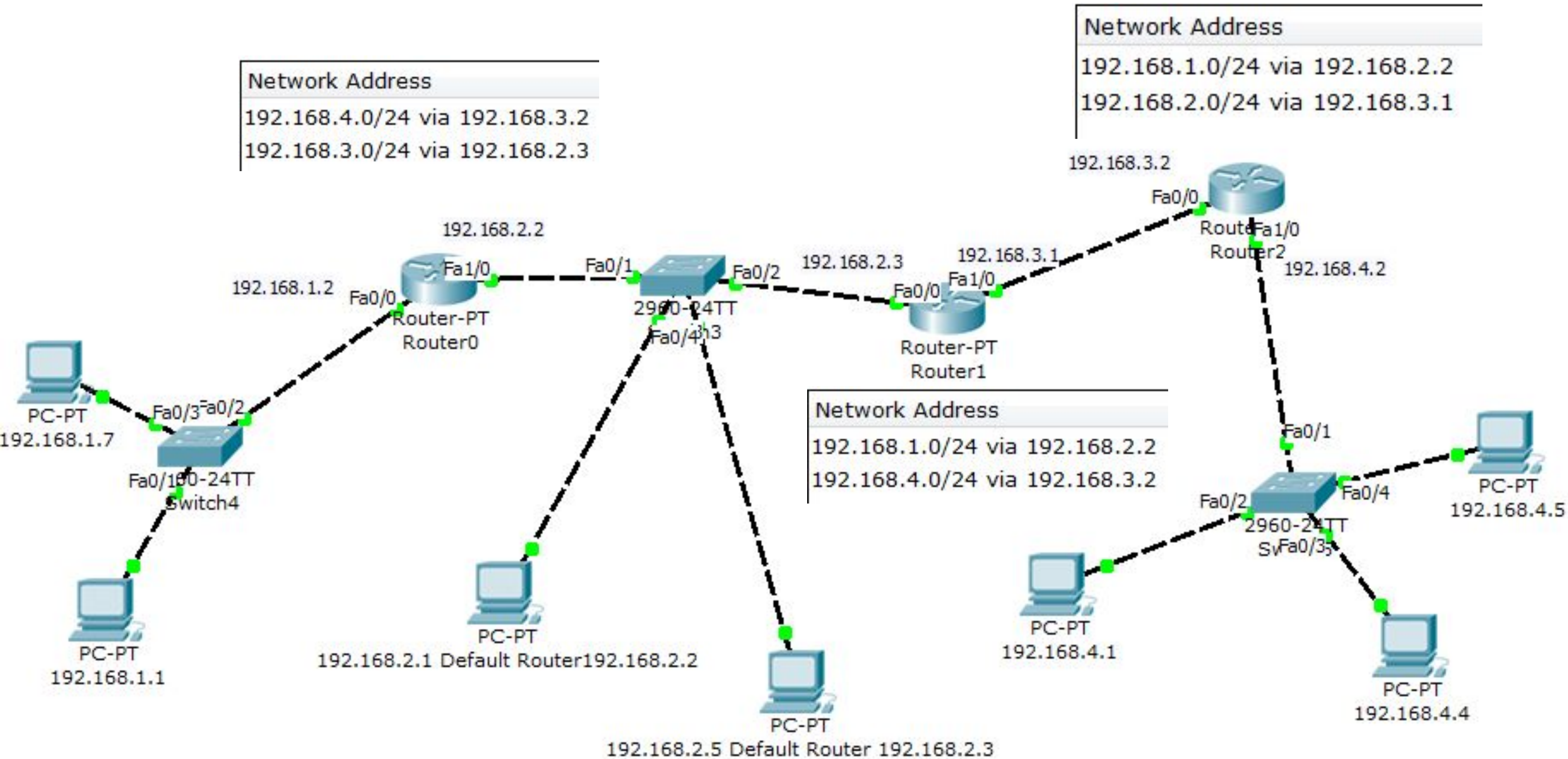


Example-4 Show the routing table of router R



Routing table of R

To Reach Hosts on Network	Route to this address
20.0.0.0	Deliver Directly
30.0.0.0	Deliver Directly
10.0.0.0	20.0.0.5
40.0.0.0	30.0.0.7


Network Address
192.168.4.0/24 via 192.168.3.2
192.168.3.0/24 via 192.168.2.3
Network Address
192.168.1.0/24 via 192.168.2.2
192.168.2.0/24 via 192.168.3.1
Network Address
192.168.1.0/24 via 192.168.2.2
192.168.4.0/24 via 192.168.3.2
192.168.3.2
Fa0/0
Fa1/0
Router2
192.168.4.2
192.168.2.2
Fa1/0
Fa0/1
Fa0/2
192.168.2.3
192.168.3.1
Fa1/0
Fa0/0
192.168.1.2
Fa0/0
Router-PT
Router0
Router-PT
Router1
PC-PT
192.168.1.7
Fa0/3
Fa0/2
Switch4
PC-PT
192.168.1.1
PC-PT
192.168.2.1 Default Router192.168.2.2
PC-PT
192.168.2.5 Default Router 192.168.2.3
Fa0/1
Fa0/4
Fa0/2
PC-PT
192.168.4.5
PC-PT
192.168.4.1
PC-PT
192.168.4.4

Classless Interdomain Routing (CIDR) or Supernetting

Classless interdomain routing (CIDR, pronounced “cider”) is a technique that addresses two scaling concerns in the Internet:

i) the growth of backbone routing tables as more and more network numbers need to be stored in them

ii) the potential for the 32-bit IP address space to be exhausted well before the 4 billionth host is attached to the Internet.

- ✔Supernetting, also called Classless Inter-Domain Routing (CIDR), is a way to aggregate multiple Internet addresses of the same class. Supernetting is the idea of combining two or more blocks of IP addresses that together compose a continuous range of addresses (no missing addresses in the middle). You create a supernet when you have a need to place more hosts on a single network than currently will work in a classful configuration.

- ✔The original Internet Protocol (IP) defines IP addresses in four major classes of address structure, Classes A through D. Each class allocates one portion of the 32-bit Internet address format to a network address and the remaining portion to the specific host machines within the network.

- ✔ Using supernetting, the network address 192.168.2.0/24 and an adjacent address 192.168.3.0/24 can be merged into 192.168.2.0/23. The "23" at the end of the address says that the first 23 bits are the network part of the address, leaving the remaining nine bits for specific host addresses.
- ✔ Supernetting is most often used to combine Class C network addresses and is the basis for most routing protocols currently used on the Internet.
- ✔ The Border Gateway Protocol (BGP), the prevailing exterior (interdomain) gateway protocol and the Open Shortest Path First (OSPF) router protocol both support supernetting, but the older exterior or interdomain protocols, the Exterior Gateway Protocol (EGP) and the Routing Information Protocol (RIP) do not support it.

- ✔For any class C IP address 192.168.1.0 and default subnet mask 255.255.255.0 we have 2^8-2 = 254 hosts. Let us now see how class C address an produce more than 254 hosts.

- ✔The basic principle is to take one or more bits from the net ID part as the host ID part. For example if we use subnet mask of 23 bits instead of 24 bits of default subnet mask then we get 9 bits for host ID the the number of hosts will be 2^9-2.

- ✔In this case net ID does not fall in any category hence called classless IP. Such mask is called CIDR mask.

Let the available IP addresses are 192.168.20.0 through 192.168.31.0 i.e. 12 continuous class C addresses. Listing the third byte in binary value provides the flowing results. The four leftmost bites of third byte are the same. Thus we can implement a 20-bits subnet mask which allows 12 bits for the host addresses. The total number of hosts will be 2^{12}-2 = 4094.

Decimal	Binary of third byte
192.168.20.0	00010100
192.168.21.0	00010101
192.168.22.0	00010110
192.168.23.0	00010111
192.168.24.0	00011000
192.168.25.0	00011001
192.168.26.0	00011010
192.168.27.0	00011011
192.168.28.0	00011100
192.168.29.0	00011101
192.168.30.0	00011110
192.168.31.0	00011111

The entire IP addresses acts as a single IP hence reduce the size of table of a router.

Example-8

For the CIDR address of 192.168.10.0/20 determine the range of class C IP address.

Ans.

Decimal	Binary of third byte
192.168.10.0	00001010
192.168.11.0	00001011
192.168.12.0	00001100
192.168.13.0	00001101
192.168.14.0	00001110
192.168.15.0	00001111

The range of class C IP address is 192.168.10.0 to 192.168.15.0

Example-9

Suppose you got three consecutive IP addresses: 203.100.200.0, 203.100.201.0 and 203.100.202.0 of class C.

IP address				
203.100.200.0	11001011	01100100	11001 000	00000000
203.100.201.0	11001011	01100100	11001 001	00000000
203.100.202.0	11001011	01100100	11001 010	00000000
Default subnet mask	11111111	11111111	11111111	00000000
Supernet mask	11111111	11111111	11111 000	00000000

Therefore 8 subnet can be converted to a supernet using supernet mask of 255.255.248.0.

IPv6

IPv6 uses 128 bit and expressed in 32 hexadecimal numbers like:

EFAC: BA89: 7529:AFDC: 92AF:8654:1293 :29A2

After every 4 digits a colon ‘:’ is used therefore 32 digits + 7 colons = 39 characters hence called addressing system of 39 characters.

In some addresses huge number of zeros exits like:

DFAC: 0000: 0000:0000: 0009:03AC1:5923 :FEA2

can be expressed as:

DFAC: 0: 0:0: 9:3AC1:5923 :FEA2

or

DFAC: : 9:3AC1:5923 :FEA2

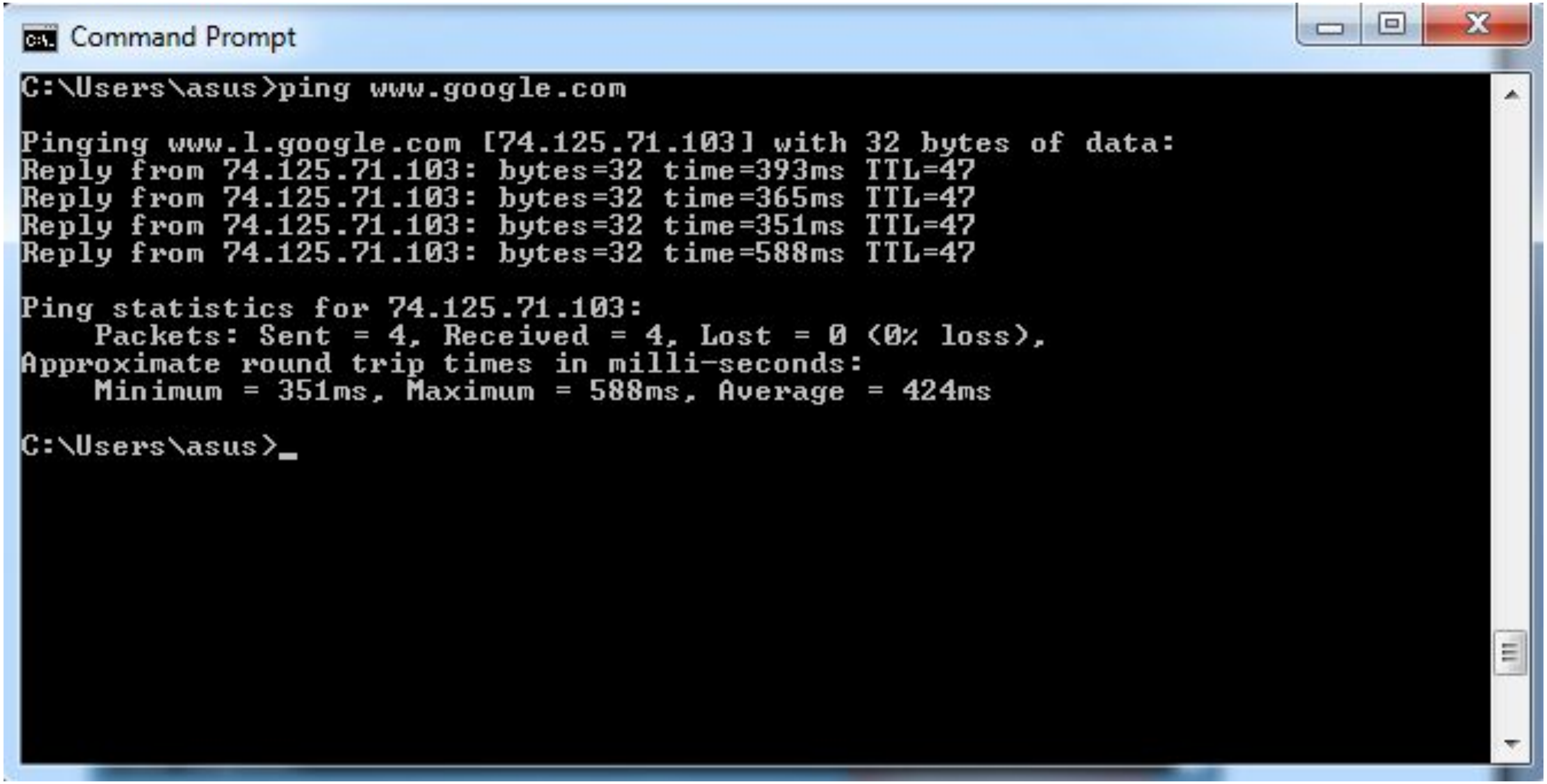
Double colon can be used only once in a IPv6 address.

How many subscriber is possible in IPv6?

Ans. 2^{128}

Try Running

```
Command Prompt
Microsoft Windows [Version 6.1.7600]
Copyright (c) 2009 Microsoft Corporation.  All rights reserved.

C:\Users\asus>tracert www.google.com

Tracing route to www.l.google.com [74.125.71.106]
over a maximum of 30 hops:

  1    <1 ms    <1 ms    <1 ms  192.168.2.201
  2    48 ms   101 ms    80 ms  10.10.1.1
  3    15 ms    15 ms    14 ms  123.49.60.209
  4    48 ms    19 ms    16 ms  123.49.13.94
  5   412 ms   429 ms   397 ms  1.9.241.73
  6     *        *        *     Request timed out.
  7   302 ms   307 ms   385 ms  72.14.215.22
  8   345 ms     *      384 ms  209.85.242.246
  9   384 ms   404 ms     *     209.85.243.113
 10   433 ms   444 ms   426 ms  216.239.43.19
 11   454 ms   354 ms   405 ms  216.239.48.230
 12   443 ms   429 ms   432 ms  hx-in-f106.1e100.net [74.125.71.106]

Trace complete.

C:\Users\asus>_
```


Command Prompt
C:\Users\asus>ping www.google.com
Pinging www.l.google.com [74.125.71.103] with 32 bytes of data:
Reply from 74.125.71.103: bytes=32 time=393ms TTL=47
Reply from 74.125.71.103: bytes=32 time=365ms TTL=47
Reply from 74.125.71.103: bytes=32 time=351ms TTL=47
Reply from 74.125.71.103: bytes=32 time=588ms TTL=47
Ping statistics for 74.125.71.103:
Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
Approximate round trip times in milli-seconds:
Minimum = 351ms, Maximum = 588ms, Average = 424ms
C:\Users\asus>_

```
C:\Users\asus>ipconfig

Windows IP Configuration


Ethernet adapter Bluetooth Network Connection 3:

   Media State . . . . . . . . . . . : Media disconnected
   Connection-specific DNS Suffix  . :

Ethernet adapter Local Area Connection:

   Connection-specific DNS Suffix  . :
   Link-local IPv6 Address . . . . . : fe80::e885:2c6e:1a15:469a%16
   IPv4 Address. . . . . . . . . . . : 192.168.2.249
   Subnet Mask . . . . . . . . . . . : 255.255.255.0
   Default Gateway . . . . . . . . . : 192.168.2.201

Wireless LAN adapter Wireless Network Connection:

   Media State . . . . . . . . . . . : Media disconnected
   Connection-specific DNS Suffix  . :

Tunnel adapter isatap.{23ED35EE-B765-464B-8B33-B7016F274E1D}:
```

```
C:\Documents and Settings\Administrator>arp -a

Interface: 172.16.48.85 --- 0x2
  Internet Address      Physical Address      Type
  172.16.48.1           00-00-0c-07-ac-30     dynamic
  172.16.48.78          00-19-d1-4f-43-20     dynamic

C:\Documents and Settings\Administrator>_
```

```
C:\Users\asus>pathping -q 2 -w 3 www.google.com

Tracing route to www.l.google.com [74.125.71.105]
over a maximum of 30 hops:
  0  asus-PC [192.168.2.249]
  1  192.168.2.201
  2     *     10.10.1.1
  3  123.49.60.209
  4     *        *     123.49.13.94
  5     *        *        *
Computing statistics for 2 seconds...
            Source to Here   This Node/Link
Hop  RTT    Lost/Sent = Pct  Lost/Sent = Pct  Address
  0                                           asus-PC [192.168.2.249]
                                0/   2 =  0%   |
  1    0ms     0/   2 =  0%     0/   2 =  0%  192.168.2.201
                                0/   2 =  0%   |
  2  115ms     0/   2 =  0%     0/   2 =  0%  10.10.1.1
                                0/   2 =  0%   |
  3   70ms     0/   2 =  0%     0/   2 =  0%  123.49.60.209
                                2/   2 =100%   |
  4  ---       2/   2 =100%     0/   2 =  0%  123.49.13.94

Trace complete.
```

Displays protocol statistics and current TCP/IP network connections.

```
C:\Documents and Settings\Administrator>netstat -an

Active Connections

  Proto  Local Address          Foreign Address        State
  TCP    0.0.0.0:135            0.0.0.0:0              LISTENING
  TCP    0.0.0.0:445            0.0.0.0:0              LISTENING
  TCP    127.0.0.1:2995         0.0.0.0:0              LISTENING
  TCP    127.0.0.1:2995         127.0.0.1:2996         ESTABLISHED
  TCP    127.0.0.1:2996         127.0.0.1:2995         ESTABLISHED
  TCP    172.16.48.85:139       0.0.0.0:0              LISTENING
  TCP    172.16.48.85:3008      85.17.72.66:80         TIME_WAIT
  TCP    172.16.48.85:3011      216.92.169.199:80      TIME_WAIT
  TCP    172.16.48.85:3014      94.75.236.122:80       TIME_WAIT
  TCP    172.16.48.85:3015      62.128.100.39:443      TIME_WAIT
  TCP    172.16.48.85:3016      94.75.236.122:80       TIME_WAIT
  UDP    0.0.0.0:445            *:*
  UDP    0.0.0.0:500            *:*
  UDP    0.0.0.0:1025           *:*
  UDP    0.0.0.0:1131           *:*
  UDP    0.0.0.0:1573           *:*
  UDP    0.0.0.0:1574           *:*
```

```
C:\Documents and Settings\Administrator>netstat -sp tcp

TCP Statistics for IPv4

  Active Opens                          = 1807
  Passive Opens                         = 1457
  Failed Connection Attempts            = 687
  Reset Connections                     = 29
  Current Connections                   = 4
  Segments Received                     = 49706
  Segments Sent                         = 46528
  Segments Retransmitted                = 210

Active Connections

  Proto  Local Address          Foreign Address        State
  TCP    pc_imdad_sir:2995      localhost:2996         ESTABLISHED
  TCP    pc_imdad_sir:2996      localhost:2995         ESTABLISHED
  TCP    pc_imdad_sir:3019      94.75.236.122:http     TIME_WAIT
  TCP    pc_imdad_sir:3020      180.211.201.22:http    ESTABLISHED
  TCP    pc_imdad_sir:3021      180.211.201.21:http    ESTABLISHED
  TCP    pc_imdad_sir:3023      wikipedia-lb.eqiad.wikimedia.org:http  TIME_WAIT
```

```
C:\Documents and Settings\Administrator>netstat -sp udp

UDP Statistics for IPv4

  Datagrams Received    = 12193
  No Ports              = 1494
  Receive Errors        = 110
  Datagrams Sent        = 1834

Active Connections

  Proto  Local Address          Foreign Address        State
```