

Chapter 4 Problems

Problem 5. Consider a datagram network using 32-bit host addresses. Suppose a router has four links, numbered 0 through 3, and packets are to be forwarded to the link interfaces as follows:

Destination Address Range	Link Interface
11100000 00000000 00000000 00000000 11100000 00111111 11111111 11111111	0
11100000 01000000 00000000 00000000 11100000 01000000 11111111 11111111	1
11100000 01000001 00000000 00000000 11100001 01111111 11111111 11111111	2
otherwise	3

- a. Provide a forwarding table that has five entries, uses the longest prefix matching, and forwards packets to the correct link interfaces.

[Answer]

Prefix Match	Link Interface
11100000 00	0
11100000 01000000	1
11100000	2
11100001 1	3
otherwise	3

- b. Describe how your forwarding table determines the appropriate link interface for datagrams with destination addresses:

[Answer]

The address which matches prefix of 4th entry will be forwarded into interface 3. 4th entry would effectively filter packets which are not fit to interface 2 in advance by using longest prefix matching system.

Problem 6. Consider a datagram network using 8-bit host addresses. Suppose a router uses the longest prefix matching and has the following forwarding table:

Prefix Match	Interface
00	0
010	1
011	2
10	2
11	3

For each of the four interfaces, give the associated range of destination host addresses and the number of addresses in the range.

[Answer]

Interface	0	1	2	2	3
Range	[00000000, 00111111]	[01000000, 01011111]	[01100000, 01111111]	[10000000, 10111111]	[11000000, 11111111]
Number of addresses	64	32	96		64

Problem 12. Consider the topology shown in Figure 4.20. Denote the three subnets with hosts (starting clockwise at 12:00) as Networks A, B, and C. Denote the subnets without hosts as Networks D, E, and F.

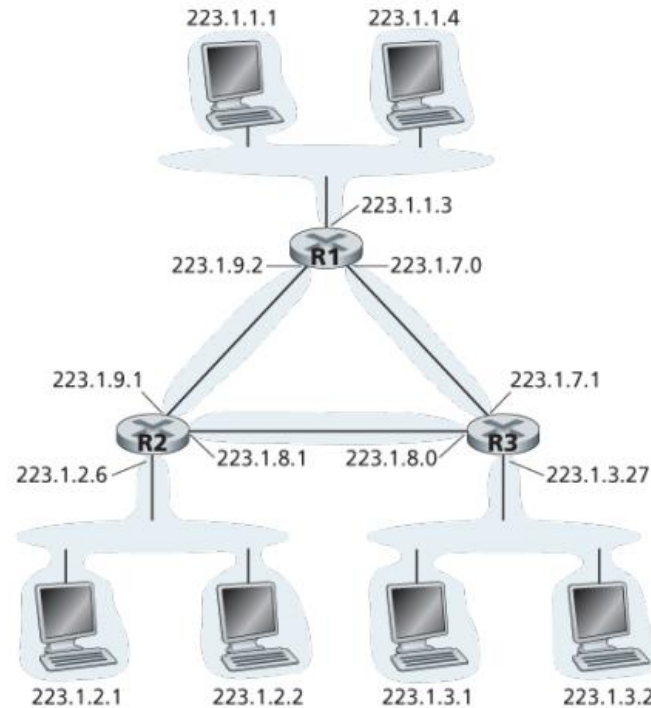


Figure 4.20 Three routers interconnecting six subnets

- a. Assign network addresses to each of these six subnets, with the following constraints: All addresses must be allocated from 214.97.254/23; Subnet A should have enough addresses to support 250 interfaces; Subnet B should have enough addresses to support 120 interfaces; and Subnet C should have enough addresses to support 120 interfaces. Of course, subnets D, E and F should each be able to support two interfaces. For each subnet, the assignment should take the form a.b.c.d/x or a.b.c.d/x – e.f.g.h/y.

[Answer]

Subnet A: 214.97.255/24 (256 \geq 250)

Subnet B: 214.97.254.0/25 – 214.97.254.0/29 (128 – 8 \geq 120)

Subnet C: 214.97.254.128/25 (128 \geq 120)

Subnet D: 214.97.254.0/31 (2 \geq 2)

Subnet E: 214.97.254.2/31 (2 \geq 2)

Subnet F: 214.07.254.4/30 (4 \geq 2)

- b. Using your answer to part (a), provide the forwarding tables (using longest prefix matching) for each of the three routers.

[Answer]

Router 1

Longest Prefix Match	Outgoing Interface
11010110 01100001 11111111	A
11010110 01100001 11111110 0000000	D
11010110 01100001 11111110 000001	F

Router 2

Longest Prefix Match	Outgoing Interface
11010110 01100001 11111110 1	C
11010110 01100001 11111110 0000001	E
11010110 01100001 11111110 000001	F

Router 3

Longest Prefix Match	Outgoing Interface
11010110 01100001 11111110 0	B
11010110 01100001 11111110 0000000	D
11010110 01100001 11111110 0000001	E

Problem 17. Suppose you are interested in detecting the number of hosts behind a NAT. You observe that the IP layer stamps an identification number sequentially on each IP packet. The identification number of the first IP packet generated by a host is a random number, and the identification numbers of the subsequent IP packets are sequentially assigned. Assume all IP packets generated by hosts behind the NAT are sent to the outside world.

- a. Based on this observation, and assuming you can sniff all packets sent by the NAT to the outside, can you outline a simple technique that detects the number of unique hosts behind a NAT? Justify your answer.

[Answer]

Yes. If each IP packet has its own id and sequential sequences for each id, the number of different hosts beyond NAT can be estimated by sniffing out the number of independent sequences.

- b. If the identification numbers are not sequentially assigned but randomly assigned, would your technique work? Justify your answer.

[Answer]

No. Detecting the number of hosts inside NAT is difficult because if all id in an ip packet is randomly allocated, sniffing outside NAT will not find any association between id.