The Network Layer: Data Plane

R25.

Suppose an application generates chunks 40 bytes of data every 20 msec, and each chunk gets encapsulated in a TCP segment and then an IP datagram. What percentage of each datagram will be overhead and what percentage will be application data?

ANS:

50% overhead.

P5.

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 through 11100000 00111111 11111111 11111111	0
11100000 01000000 00000000 00000000 through 11100000 01000000 11111111 11111111	1
11100000 01000001 00000000 00000000 through 11100001 01111111 11111111 11111111	2
otherwise	3

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

ANS:

Prefix Match	Link Interface
11100000 00	0
11100000 01000000	1
1110000	2
11100001 1	3
otherwise	3

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

11111000 10010001 01010001 01010101

11100000 00000000 11000011 00111100

11100001 10000000 00010001 01110111

ANS:
Prefix match for first address is 5th entry: link interface 3
Prefix match for second address is 1st entry: link interface 0
Prefix match for third address is 4th entry: link interface 3

P8.

Consider a router that interconnects three subnets: Subnet 1, Subnet 2 and Subnet 3. Suppose all the interfaces in each of these three subnets are required to have the prefix 223.1.17/24.Also suppose that Subnet 1 is required to support up to 62 interfaces, Subnet 2 is required to support up to 106 interfaces and Subnet 3 is required to support up to 15 interfaces. Provide three network addresses (of the form a.b.c.d/x) that satisfy these constraints.

ANS:
223.1.17.0/26
223.1.17.128/25
223.1.17.192/28

The Network Layer: Control Plane

R5.

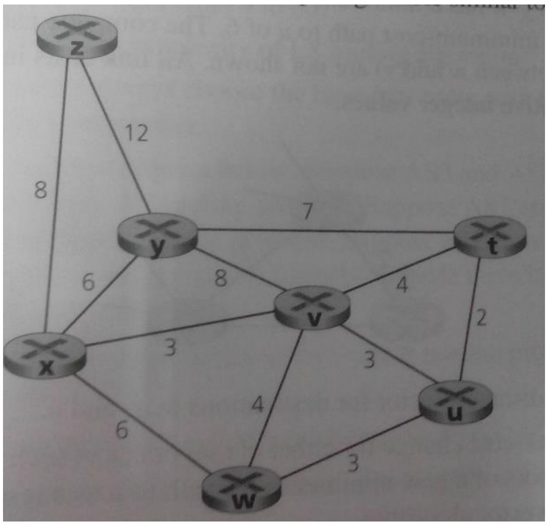
What is the "count to infinity" problem in distance vector routing?

ANS:

The count-to-infinity problem refers to a problem of distance vector routing. The problem means that it takes a long time for a distance vector routing algorithm to converge when there is a link cost increase. For example, consider a network of three nodes x, y, and z. Suppose initially the link costs are c(x,y)=4, c(x,z)=50, and c(y,z)=1. The result of distance-vector routing algorithm says that z's path to x is z→y→ x and the cost is 5(=4+1). When the cost of link (x,y) increases from 4 to 60, it will take 44 iterations of running the distance-vector routing algorithm for node z to realize that its new least-cost path to x is via its direct link to x, and hence y will also realize its least-cost path to x is via z.

P3.

Consider the following network. With the indicated link costs, use Dijkstra's shortest-path algorithm to compute the shortest path from x to all network nodes. Show how the algorithm works by computing a table similar to Table 5.1.

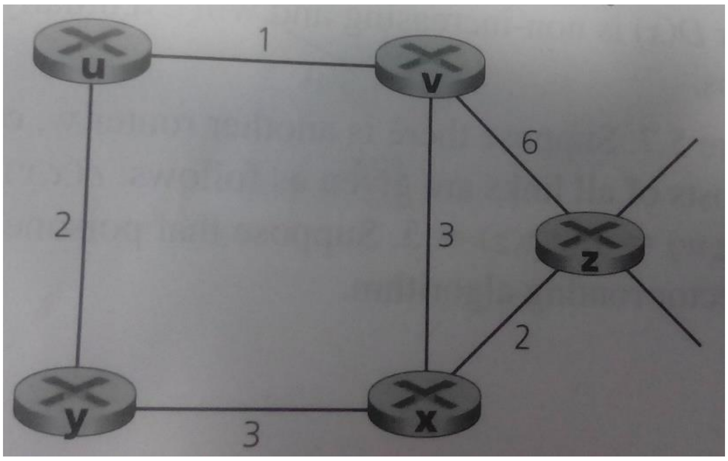


ANS:

Step	N'	D(t),p(t)	D(u),p(u)	D(v),p(v)	D(w),p(w)	D(y),p(y)	D(z),p(z)
0	x	∞	∞	3,x	6,x	6,x	8,x
1	xv	7,v	6,v	3,x	6,x	6,x	8,x
2	xvu	7,v	6,v	3,x	6,x	6,x	8,x
3	xvuw	7,v	6,v	3,x	6,x	6,x	8,x
4	xvuwy	7,v	6,v	3,x	6,x	6,x	8,x
5	xvuwyt	7,v	6,v	3,x	6,x	6,x	8,x
6	xvuwytz	7,v	6,v	3,x	6,x	6,x	8,x

P5.

Consider the network shown below, and assume that each node initially knows the costs to each of its neighbors. Consider the distance-vector algorithm and show the distance table entries at node z.



ANS:

		Cost to				
		u	v	x	y	z
From	v	∞	∞	∞	∞	∞
	x	∞	∞	∞	∞	∞
	z	∞	6	2	∞	0

		Cost to				
		u	v	x	y	z
From	v	1	0	3	∞	6
	x	∞	3	0	3	2
	z	7	5	2	5	0

		Cost to				
		u	v	x	y	z
From	v	1	0	3	3	5
	x	4	3	0	3	2
	z	6	5	2	5	0

		Cost to				
		u	v	x	y	z
From	v	1	0	3	3	5
	x	4	3	0	3	2
	z	6	5	2	5	0

P14.

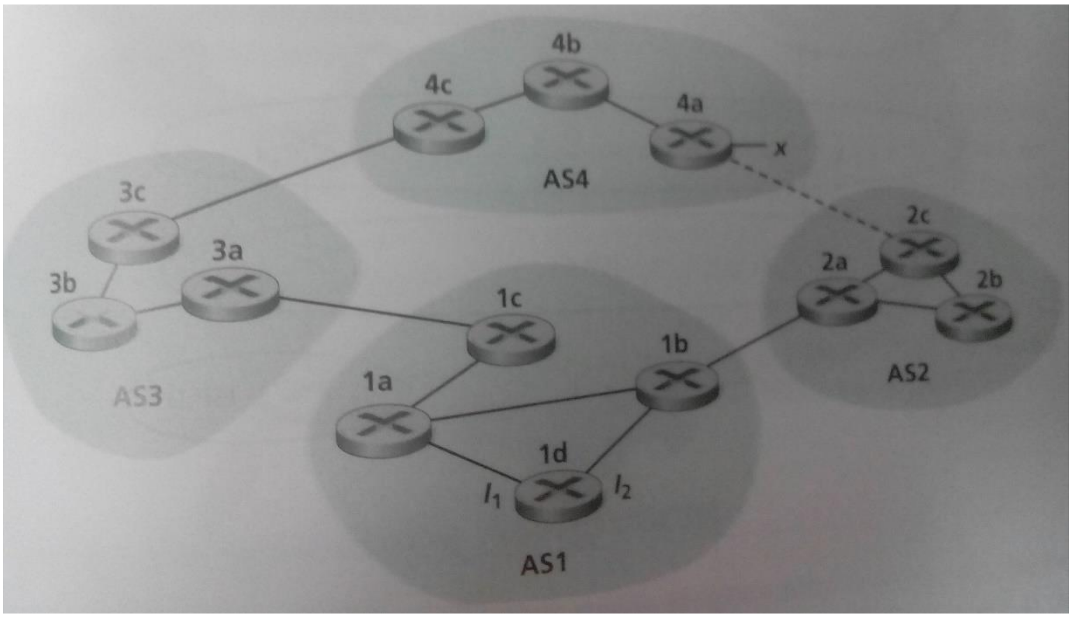
Consider the network shown below. Suppose AS3 and AS2 are running OSPF for their intra-AS routing protocol. Suppose AS1 and AS4 are running RIP for their intra-AS routing protocol. Suppose eBGP and iBGP are used for the inter-AS routing protocol. Initially, suppose there is no physical link between AS2 and AS4.

a. Router 3c learns about prefix x from which routing protocol: OSPF, RIP, eBGP, or iBGP?

b. Router 3a learns about x from which routing protocol?

c. Router 1c learns about x from which routing protocol?

d. Router 1d learns about x from which routing protocol?

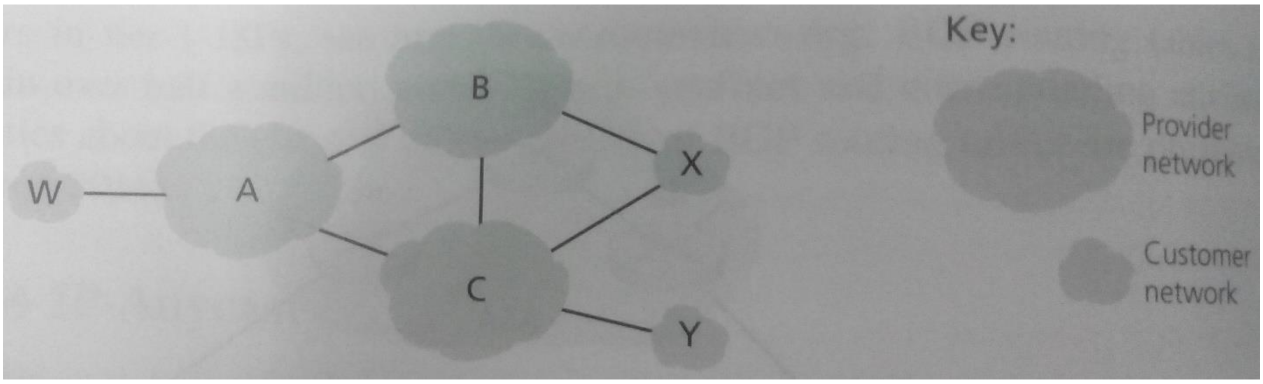


ANS:

a) eBGP b) iBGP c) eBGP d) iBGP

P19.

In Figure 5.13, suppose that there is another stub network V that is a customer of ISP A. Suppose that B and C have a peering relationship, and A is a customer of both B and C. Suppose that A would like to have the traffic destined to W to come from B only, and the traffic destined to V from either B or C. How should A advertise its routes to B and C? What AS routes does C receive?



ANS:

A should advise to B two routes, AS-paths A-W and A-V.

A should advise to C only one route, A-V.

C receives AS paths: B-A-W, B-A-V, A-V.