CHAPTER 22

Network Layer: Delivery, Forwarding, and Routing

Solutions to Odd-Numbered Review Questions and Exercises

Review Questions

1. We discussed two different methods of delivery: direct and indirect. In a ***direct delivery***, the final destination of the packet is a host connected to the same physical network as the deliverer. In an ***indirect delivery*** the packet goes from router to router until it reaches the one connected to the same physical network as its final destination.

3. A routing table can be either static or dynamic. A ***static routing*** table contains information entered manually. A ***dynamic routing table*** is updated periodically by using one of the dynamic routing protocols such as RIP, OSPF, or BGP.

5. A RIP ***message*** is used by a router to request and receive routing information about an autonomous system or to periodically share its knowledge with its neighbors.

7. The ***hop count limit*** helps RIP instability by limiting the number of times a message can be sent through the routers, thereby limiting the back and forth updating that may occur if part of a network goes down.

9. In OSPF, four types of links have been defined: point-to-point, transient, stub, and virtual. A ***point-to-point*** link connects two routers without any other host or router in between. A ***transient*** link is a network with several routers attached to it. The packets can enter and leave through any of the routers. A ***stub*** link is a network that is connected to only one router. The data packets enter the network through this single router and leave the network through this same router. This is a special case of the transient network. When the link between two routers is broken, the administrator may create a ***virtual*** link between them, using a longer path that probably goes through several routers.

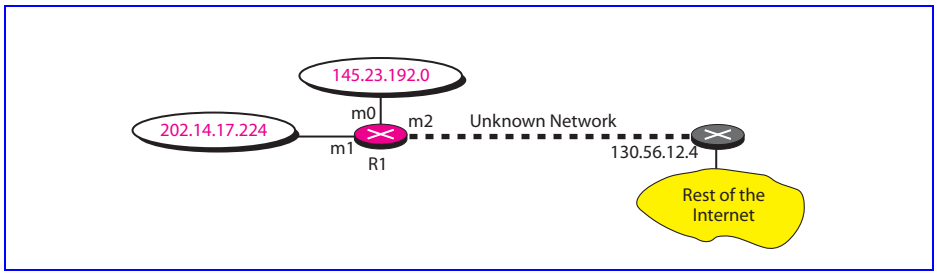
11. BGP is an ***interdomain*** routing protocol using path vector routing.

Exercises

13. A host that is totally isolated needs no routing information. ***The routing table has no entries***.

15. See Figure 22.1.

Figure 22.1 *Solution to Exercise 15*



17. R1 cannot receive a packet with this destination from ***m0*** because if any host in Organization 1 sends a packet with this destination address, the delivery is direct and does not go through R1. R1 can receive a packet with this destination from interfaces ***m1*** or ***m2***. This can happen when any host in Organization 2 or 3 sends a packet with this destination address. The packet arrives at R1 and is sent out through ***m0***. R1 can also receive a packet with this destination from interface **m3**. This happens in two cases. First, if R2 receives such a packet, the /24 is applied The packet is sent out from interface m0, which arrives at interface ***m3*** of R1. Second, if R3 receives such a packet, it applies the default mask and sends the packet from its interface ***m2*** to R2, which, in turn, applies the mask (/24) and sends it out from its interface ***m0*** to the interface ***m3*** of R1.

19. See Table 22.1.

Table 22.1 *Solution to Exercise 19: Routing table for local ISP 1*

Mask	Network address	Next-hop address	Interface
/23	120.14.64.0	---	**m0**
/23	120.14.66.0	---	**m1**
/23	120.14.68.0	---	**m2**
/23	120.14.70.0	---	**m3**
/23	120.14.72.0	---	**m4**
/23	120.14.74.0	---	**m5**
/23	120.14.76.0	---	**m6**
/23	120.14.78.0	---	**m7**
/0	0.0.0.0	**default router**	**m8**

21. See Table 22.2.

Table 22.2 *Solution to Exercise 21: Routing table for local ISP 3*

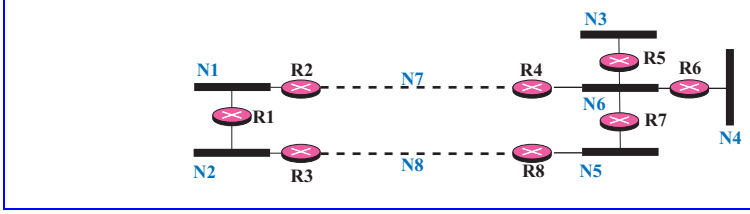
Mask	Network address	Next-hop address	Interface
/24	120.14.112.0	---	**m0**
/24	120.14.113.0	---	**m1**

Table 22.2 *Solution to Exercise 21: Routing table for local ISP 3*

Mask	Network address	Next-hop address	Interface
/24	120.14.114.0	---	**m2**
/24	120.14.115.0	---	**m3**
/24	120.14.116.0	---	**m4**
/24	120.14.117.0	---	**m5**
/24	120.14.118.0	---	**m6**
/24	120.14.119.0	---	**m7**
/24	120.14.120.0	---	**m8**
/24	120.14.121.0	---	**m9**
/24	120.14.122.0	---	**m10**
/24	120.14.123.0	---	**m11**
/24	120.14.124.0	---	**m12**
/24	120.14.125.0	---	**m13**
/24	120.14.126.0	---	**m14**
/24	120.14.127.0	---	**m15**
/0	0.0.0.0	**default router**	**m16**

23. In distance vector routing each router ***sends all of its knowledge about an autonomous system to all of the routers on its neighboring networks at regular intervals***. It uses a fairly simple algorithm to update the routing tables but results in a lot of unneeded network traffic. In link state routing a router ***floods an autonomous system with information about changes in a network only when changes occur***. It uses less network resources than distance vector routing in that it sends less traffic over the network but it uses the much more complex Dijkstra Algorithm to calculate routing tables from the link state database.
25. There are **2 + (10 × N)** = Empty bytes in a message advertising N networks
27. See Figure 22.2.

Figure 22.2 *Solution to Exercise 27*



29. **Transient networks**: **N1**, **N2**, **N5**, and **N6**. **Stub networks**: **N3** and **N4**
31. No, ***RPF*** does not create a shortest path tree because a network can receive more than one copy of the same multicast packet. RPF creates a graph instead of a tree.

33. Yes, ***RPM*** creates a shortest path tree because it is actually RPB (see previous answer) with pruning and grafting features. The leaves of the tree are the networks.