20.7 The Mask Field And Datagram Forwarding

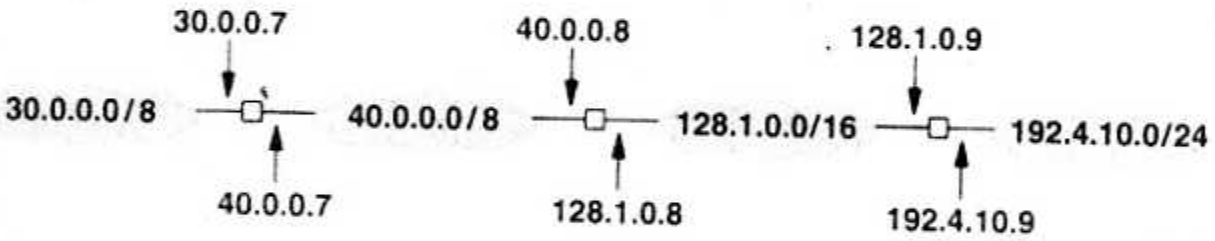
The process of using a routing table to select a next hop for a given datagram is called *routing* or *forwarding*. Recall from Chapter 18 that the *Mask* field in a routing table entry is used to extract the network part of an address during lookup. To understand the mask, imagine that the routing software is given a datagram to forward. Also assume that the datagram contains a destination IP address *D*. The routing software must find an entry in the routing table that specifies a next hop for *D*. To do so, the software examines each entry in the table by using the mask in the entry to extract a prefix of address *D* and comparing the result to the *Destination* field of the entry. If the two are equal, the datagram will be forwarded to the *Next Hop* in the entry.

A bit mask representation makes extraction efficient — software computes the Boolean *and* of the mask and the datagram destination address, *D*. Thus, the computation to examine the i^{th} entry in the table can be expressed as:

if ((Mask[i] & D) == Destination[i]) forward to NextHop[i];

As an example, consider a datagram destined for address *192.4.10.3*, and assume the datagram arrives at a router that contains the routing table Figure 20.3 illustrates. Further assume software searches entries of the table in order. The first entry fails because *255.0.0.0 & 192.4.10.3* is not equal to *30.0.0.0*. After rejecting the second and third entries in the table, the routing software eventually chooses next hop *128.1.0.9* because

255.255.255.0 & 192.4.10.3 == 192.4.10.0



(a)

Destination	Mask	Next Hop
30.0.0.0	255.0.0.0	40.0.0.7
40.0.0.0	255.0.0.0	deliver direct
128.1.0.0	255.255.0.0	deliver direct
192.4.10.0	255.255.255.0	128.1.0.9

(b)

Figure 20.3 (a) An internet of four networks and three routers with an IP address assigned to each router interface, and (b) the routing table found in the center router. Each entry in the table lists a destination, a mask, and the next hop used to reach the destination.