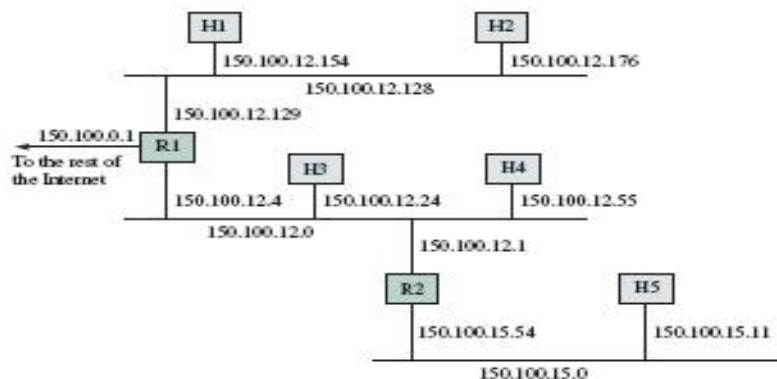


# IP ROUTING AND CIDR

## IP Routing

- ❖ IP layer in end-system hosts and in the router work together to route packets from source to destination.
- ❖ IP layer in each host and router maintains a routing table, which is used to route the packets based on IP address.
- ❖ If a destination host is directly connected to the originating host by a link or by a LAN, then the packet is sent directly to destination host using appropriate network interface, otherwise, the routing table specifies that the packet is to send to default gateway.
- ❖ When a router receives an IP packet from one of the network interfaces, then router examines its routing table to see whether the packet is destined to itself or not, if so, delivers to router's own address, then the router determines the next-hop router and associated network interface, and then forwards the packet.
- ❖ Each row in routing table must provide information like: destination IP address, IP address of next-hop router, several flag fields, outgoing network interface, and other information such as subnet mask, physical address.
- ❖ H flag indicates whether the route in the given row is to a host (H=1) or to a network.
- ❖ G flag indicates whether the route in the given row is to a router (gateway, G=1) or to a directly connected destination (G=0).
- ❖ Each time a packet is to be routed, the routing table is searched in the following order.
- ❖ First, the destination column is searched to see whether table contains an entry for complete destination IP address.
- ❖ If so, then IP packet is forwarded according to next-hop entry and G flag.
- ❖ Second, if the table does not contain complete destination IP address, then routing table is searched for the destination network ID.
- ❖ If an entry found, the IP packet is forwarded according to next-hop entry and G flag.
- ❖ Third, if table does not contain destination network ID, the table is searched for default router entry, and if one is available, the packet is forwarded there.
- ❖ Finally if none of the above searches are successful, the packet is declared undeliverable and an ICMP "host unreachable error" packet is sent back to originating host.



### Example—Routing with Subnetworks

Suppose that host H5 wishes to send an IP packet to host H2 in Figure 8.7. H2 has IP address 150.100.12.176 (1001 0110. 0110 0100. 0000 1100. 1011 0110). Let us trace the operations in carrying out this task.

The routing table in H5 may look something like this:

Destination	Next-Hop	Flags	Network Interface
127.0.0.1	127.0.0.1	H	lo0
default	150.100.15.54	G	emd0
150.100.15.0	150.100.15.11		emd0

The first entry is the loopback interface, the H indicates a host address, and lo0 by convention is always the loopback interface. The second entry is the default entry, with next-hop router R2 (150.100.15.54), which is a router, so G = 1, and with Ethernet interface emd0. The third entry does not have H set, so it is a network address; G is also not set, so a direct route is indicated and the next-hop entry is the IP address of the outgoing network interface.

### CIDR

- ❖ CIDR stands for Classless Inter-Domain Routing.
- ❖ CIDR was developed in the 1990s as a standard scheme for routing network traffic across the Internet.
- ❖ Before CIDR technology was developed, Internet routers managed network traffic based on the class of IP addresses. In this system, the value of an IP address determines its subnetwork for the purposes of routing.
- ❖ CIDR is an alternative to traditional IP subnetting that organizes IP addresses into subnetworks independent of the value of the addresses themselves. CIDR is also known as supernetting as it effectively allows multiple subnets to be grouped together for network routing.

CIDR Notation: - CIDR specifies an IP address range using a combination of an IP address and its associated network mask. CIDR notation uses the following format -

xxx.xxx.xxx.xxx/n

where n is the number of (leftmost) '1' bits in the mask. For example,

192.168.12.0/23 applies the network mask 255.255.254.0 to the 192.168 network, starting at 192.168.12.0. This notation represents the address range 192.168.12.0 - 192.168.13.255. Compared to traditional class-based networking, 192.168.12.0/23 represents an aggregation of the two Class C subnets 192.168.12.0 and 192.168.13.0 each having a subnet mask of 255.255.255.0. In other words,

192.168.12.0/23 = 192.168.12.0/24 + 192.168.13.0/24

Additionally, CIDR supports Internet address allocation and message routing independent of the traditional class of a given IP address range. For example,

10.4.12.0/22 represents the address range 10.4.12.0 - 10.4.15.255 (network mask 255.255.252.0). This allocates the equivalent of four Class C networks within the much larger Class A space.

You will sometimes see CIDR notation used even for non-CIDR networks. In non-CIDR IP subnetting, however, the value of n is restricted to either 8 (Class A), 16 (Class B) or 24 (Class C). Examples:

- 10.0.0.0/8
- 172.16.0.0/16
- 192.168.3.0/24

CIDR aggregation requires the network segments involved to be contiguous (numerically adjacent) in the address space. CIDR cannot, for example, aggregate 192.168.12.0 and 192.168.15.0 into a single route unless the intermediate .13 and .14 address ranges are included (i.e., the 192.168.12/22 network).

Source : <http://elearningatria.files.wordpress.com/2013/10/unit2.pdf>