14.3 RIP

The Routing Information Protocol (RIP) is an intradomain routing protocol used inside an autonomous system. It is a very simple protocol based on distance vector routing.

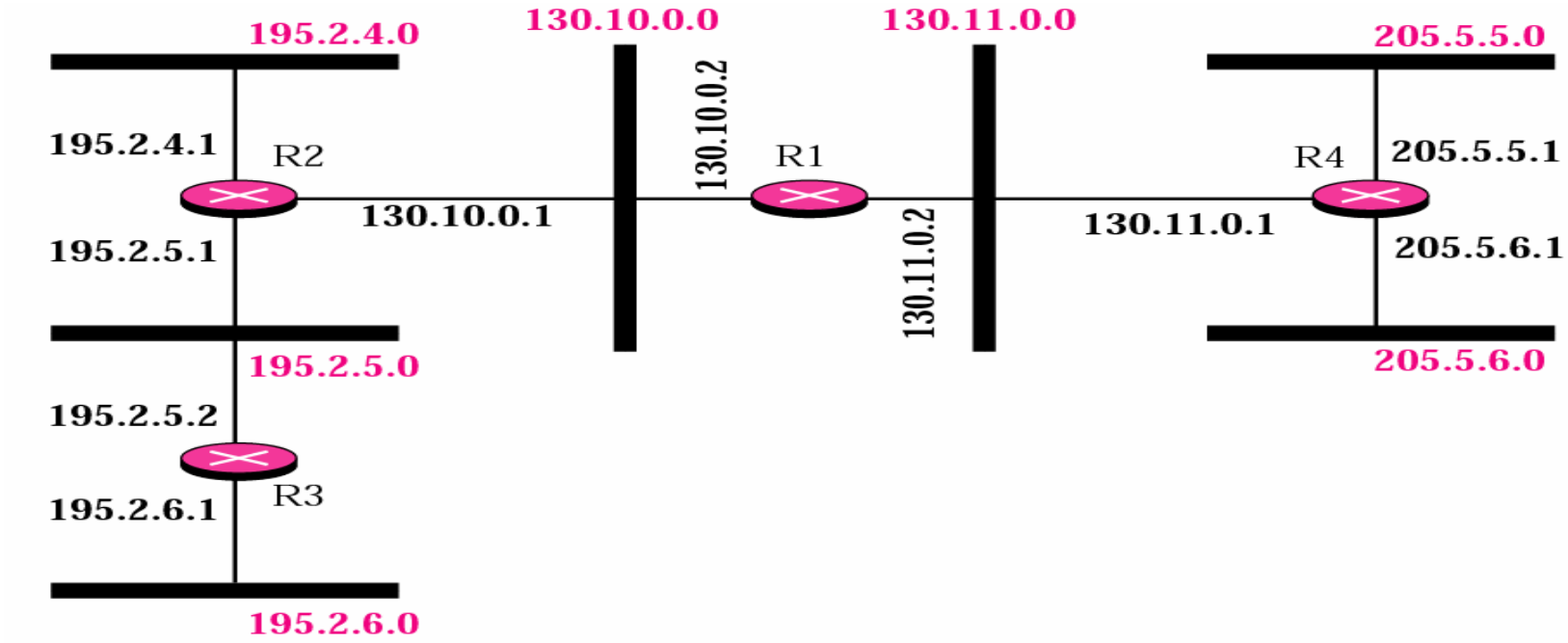
The topics discussed in this section include:

RIP Message Format
Requests and Responses
Timers in RIP
RIP Version 2
Encapsulation

RIP

- RIP: Routing Information Protocol
  - Based on *distance vector routing*
- Design considerations
  - In a AS, RIP deals with routers and networks (links)
  - The destination in a routing table is a network
    - The first column defines a ***network address***
  - The metric used in RIP is ***hop count***
  - Infinity is defined as 16
    - Any route in an AS cannot have more than 15 hops

Figure 14.8: Example of a Domain Using RIP



R1 Table

Dest.	Hop	Next
130.10.0.0	1	————
130.11.0.0	1	————
195.2.4.0	2	130.10.0.1
195.2.5.0	2	130.10.0.1
195.2.6.0	3	130.10.0.1
205.5.5.0	2	130.11.0.1
205.5.6.0	2	130.11.0.1

R2 Table

Dest.	Hop	Next
130.10.0.0	1	————
130.11.0.0	2	130.10.0.2
195.2.4.0	1	————
195.2.5.0	1	————
195.2.6.0	2	195.2.5.2
205.5.5.0	3	130.10.0.2
205.5.6.0	3	130.10.0.2

R3 Table

Dest.	Hop	Next
130.10.0.0	2	195.2.5.1
130.11.0.0	3	195.2.5.1
195.2.4.0	2	195.2.5.1
195.2.5.0	1	————
195.2.6.0	1	————
205.5.5.0	4	195.2.5.1
205.5.6.0	4	195.2.5.1

R4 Table

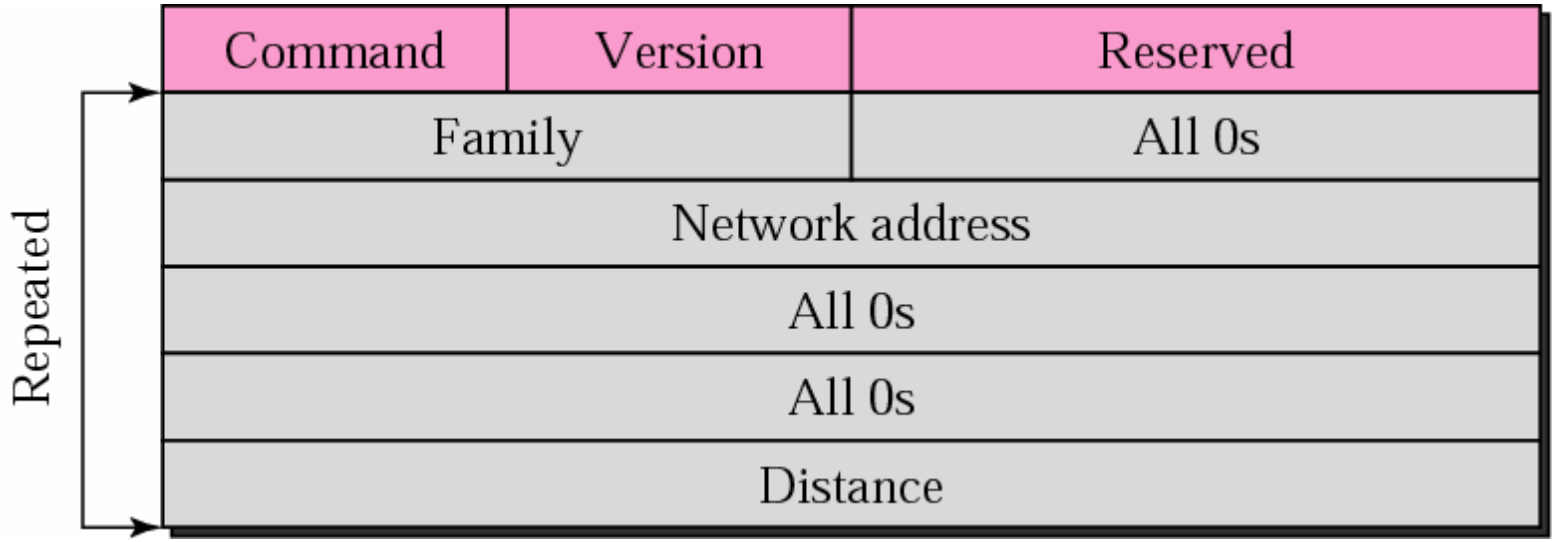
Dest.	Hop	Next
130.10.0.0	2	130.11.0.2
130.11.0.0	1	————
195.2.4.0	3	130.11.0.2
195.2.5.0	3	130.11.0.2
195.2.6.0	4	130.11.0.2
205.5.5.0	1	————
205.5.6.0	1	————

RIP Message Format

- Command: 8-bit
  - The type of message: request (1) or response (2)
- Version: 8-bit
  - Define the RIP version
- Family: 16-bit
  - Define the family of the protocol used
  - TCP/IP: value is 2
- Network Address: 14 bytes
  - Defines the address of the destination network
  - 14 bytes for this field to be applicable to any protocol
  - However, IP currently uses only 4 bytes, the rest are all 0s
- Distance: 32-bit
  - The hop count from the advertising router to the destination network

Figure 13-6

RIP Message Format



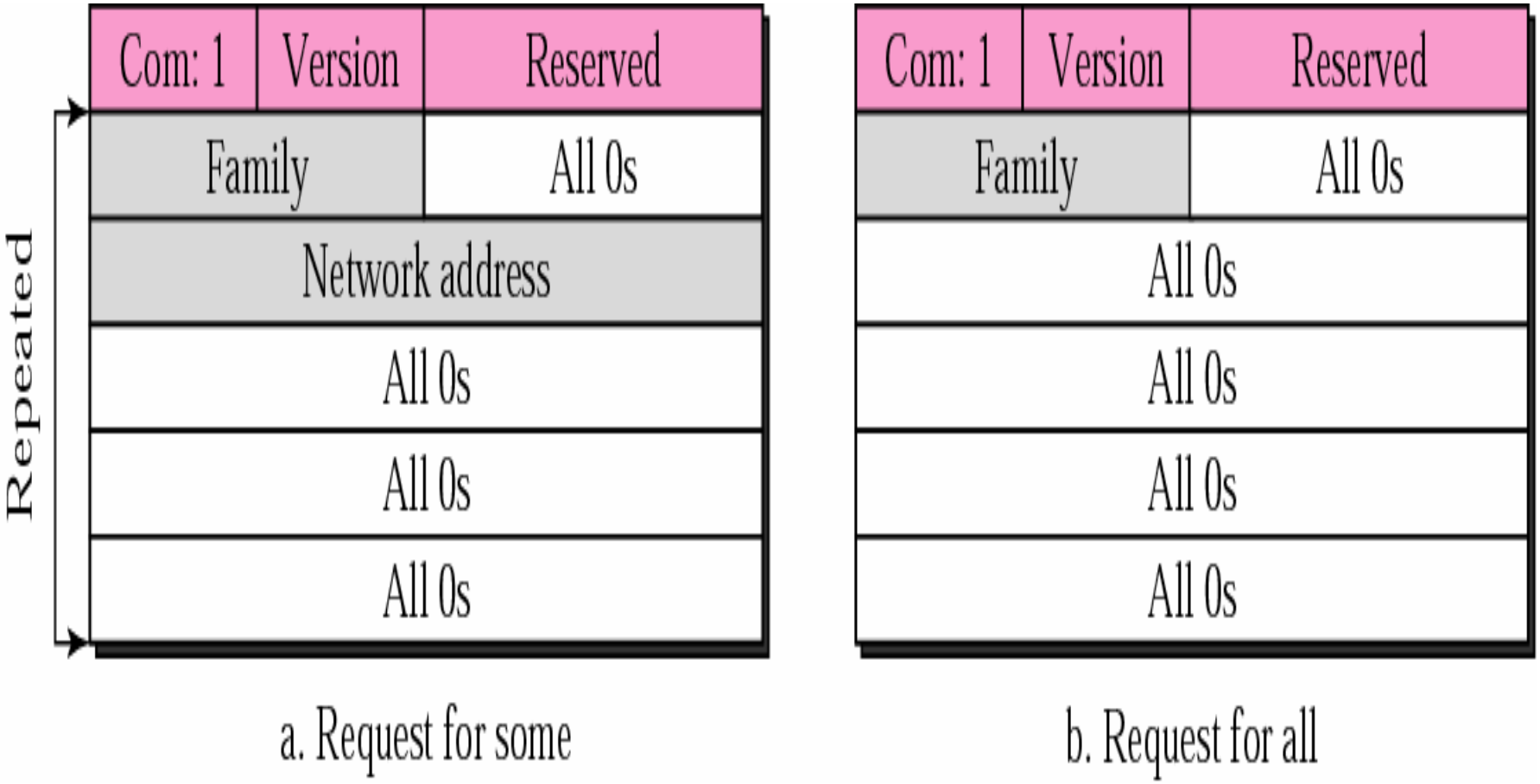
Requests and Response

- RIP uses two type of messages
  - *Request* and *response*

- Request
  - Sent by a router that *has just come up* or *has some time-out entries*
  - Can ask *specific entries* or *all entries*

Figure 13-7

Request Messages



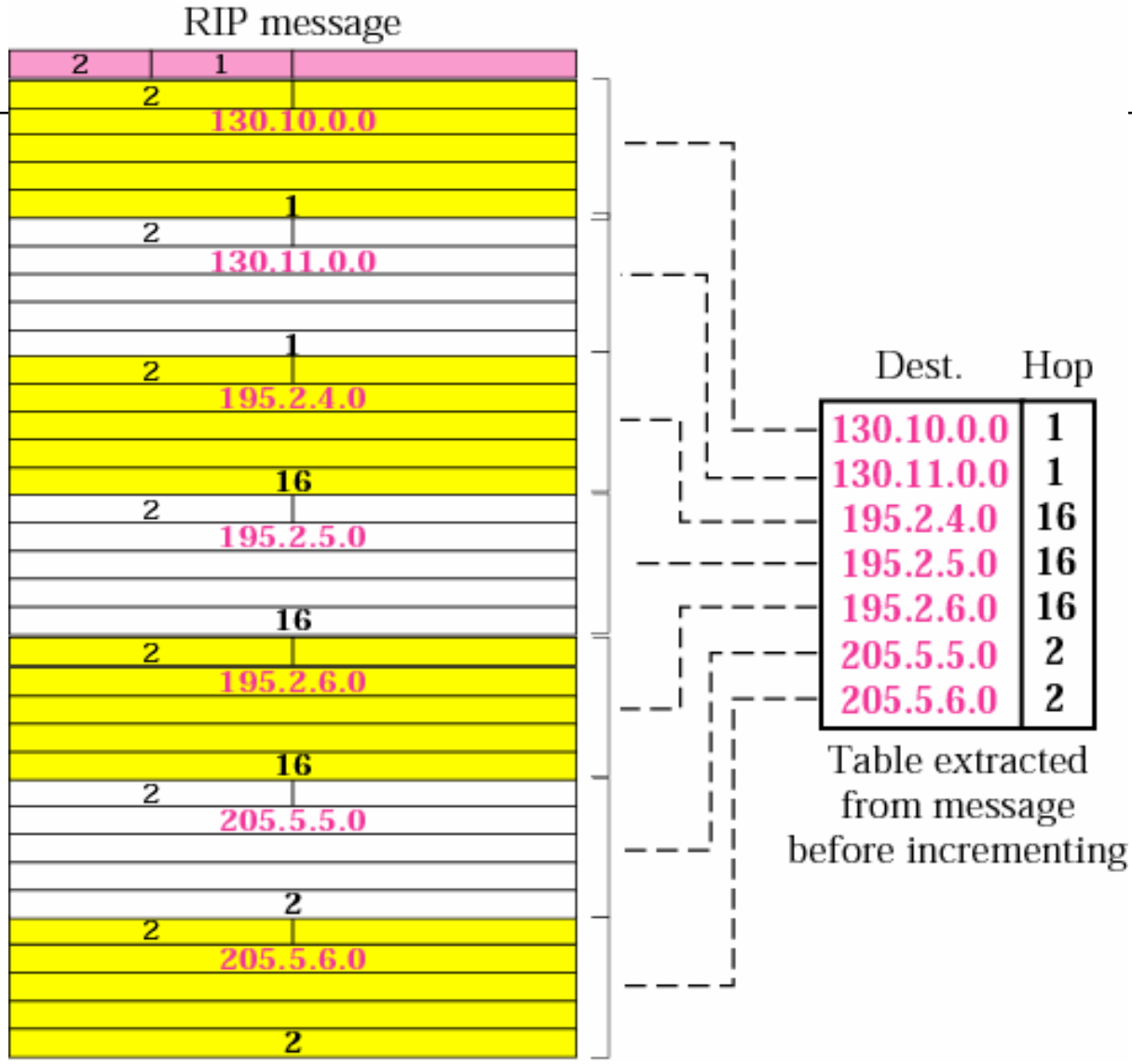
Requests and Response (Cont.)

- Response: solicited or unsolicited
  - A solicited response: sent only in answer to a request
    - Contain information about the destination specified in the corresponding request
  - An unsolicited response: sent *periodically*
    - Every 30s
    - Contains information about the entire routing table
    - Also called *update packet*

Example 1

- Following Figure shows the update message sent from router R1 to router R2 in Figure 14.8.
  - The message is sent out of interface 130.10.0.2
- The message is prepared with the combination of split horizon and poison reverse strategy in mind.
  - Router R1 has obtained information about networks 195.2.4.0, 195.2.5.0, and 195.2.6.0 from router R2.
  - When R1 sends an update message to R2,
    - Replace the actual value of the hop counts for these three networks with 16 (infinity) to prevent any confusion for R2.
- The figure also shows the table extracted from the message.
  - Router R2 uses the source address of the IP datagram carrying the RIP message from R1 (130.10.02) as the next hop address.

Figure 14.11 *Solution to Example 1*

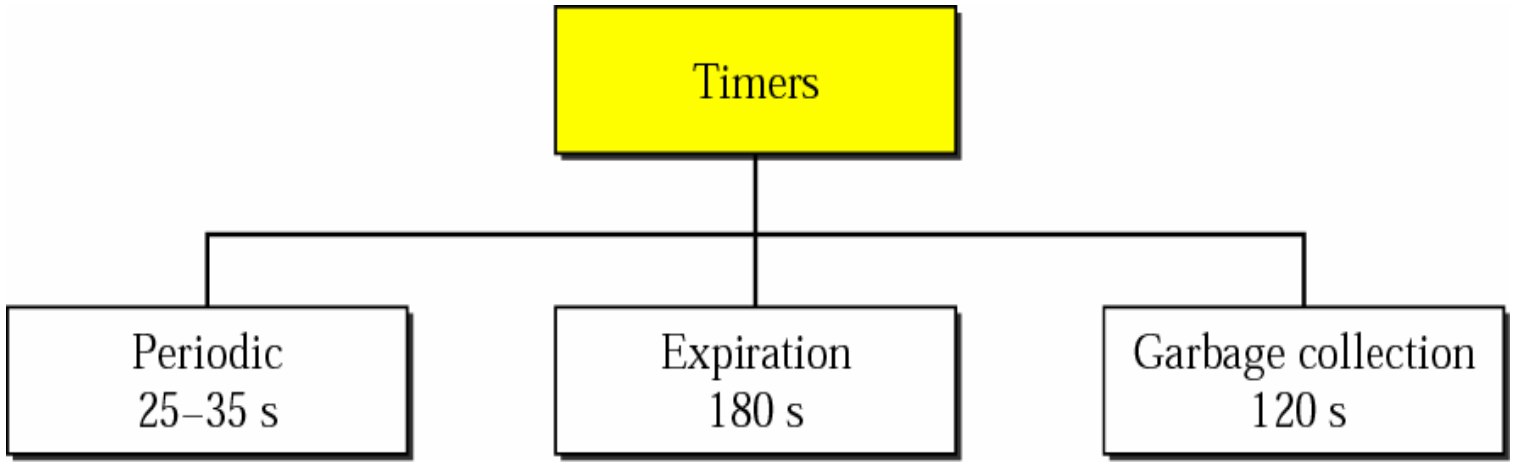


Timers in RIP

- RIP uses three timers
  - Periodic timer
  - Expiration timer
  - Garbage collection timer

Figure 12-19

RIP Timers



Periodic Timer

- Periodic timer
  - Control the advertising of regular update message
  - Although protocol specifies 30 s, the working model uses a random number between 25 and 35 s
    - Prevent routers update simultaneously

Expiration Timer

- Govern the validity of a route
- Set to 180 s for a route when a router receives update information for a route
  - If a new update for the route is received, the timer is reset
  - In normal operation, this occurs every 30 s
- If timer goes off, the route is considered expired
  - The hop count of the route is set to *16,* which means *destination is unreachable*

Garbage Collection Timer

- When a route becomes invalid, the router does not immediately purge that route from its table
- It continues advertise the route with a metric value of 16
- A garbage collection timer is set to 120 s for that route
- When the count reaches zero, the route is purged from the table
- *Allow neighbors to become aware of the invalidity of a route prior to purging*

Example 2

- A routing table has 20 entries.
- It does not receive information about five routes for 200 seconds.
- How many timers are running at this time?

Solution

- The timers are listed below:
  - Periodic timer: 1
  - Expiration timer: 20 - 5 = 15
  - Garbage collection timer: 5

RIP Version 2

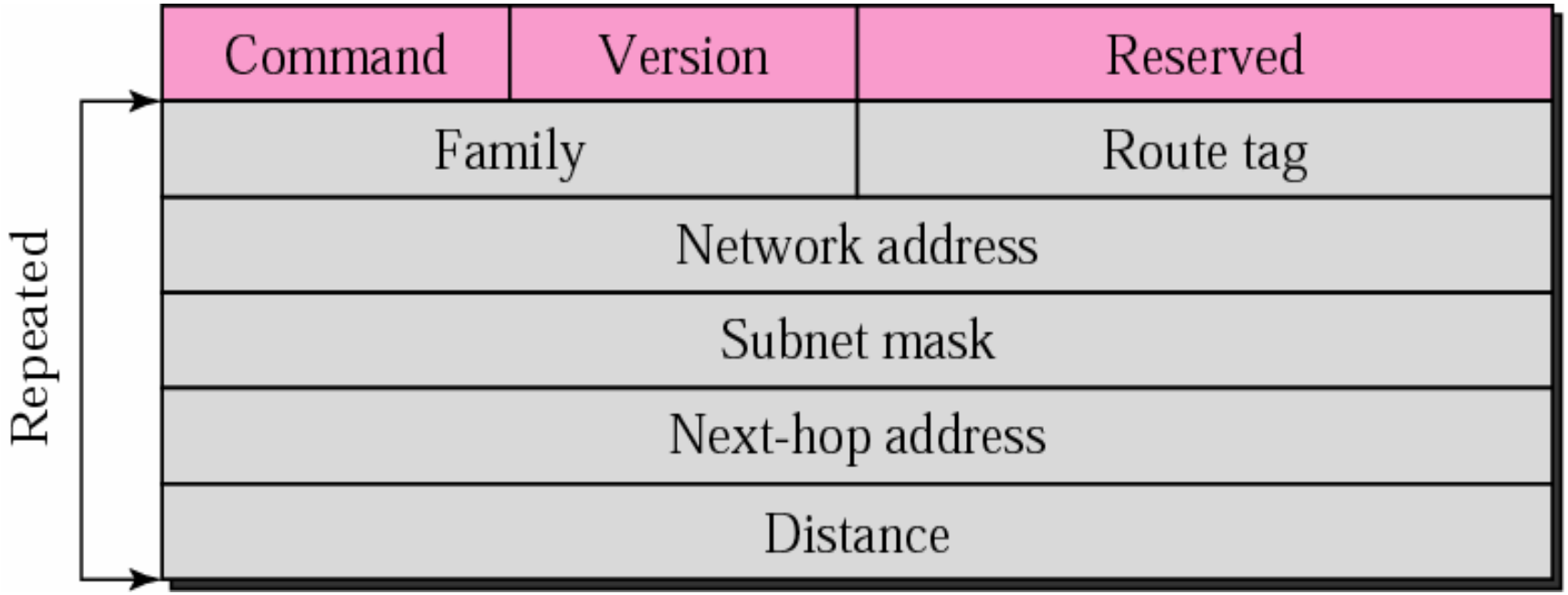
- Does not augment the length of the message of each entry
- Only replace those fields in version 1 that were filled with *0s* with some new fields

RIP Version 2

- New fields
  - **Routing Tag**: carries information such as the autonomous system number
    - Enable RIP to receive information from an exterior routing table
  - **Subnet mask**: carries the subnet mask (or prefix)
    - RIP2 support classless addressing and CIDR
  - **Next-hop address**: show the address of the next hop

Figure 13.16

RIP-v2 Format



Classless Addressing

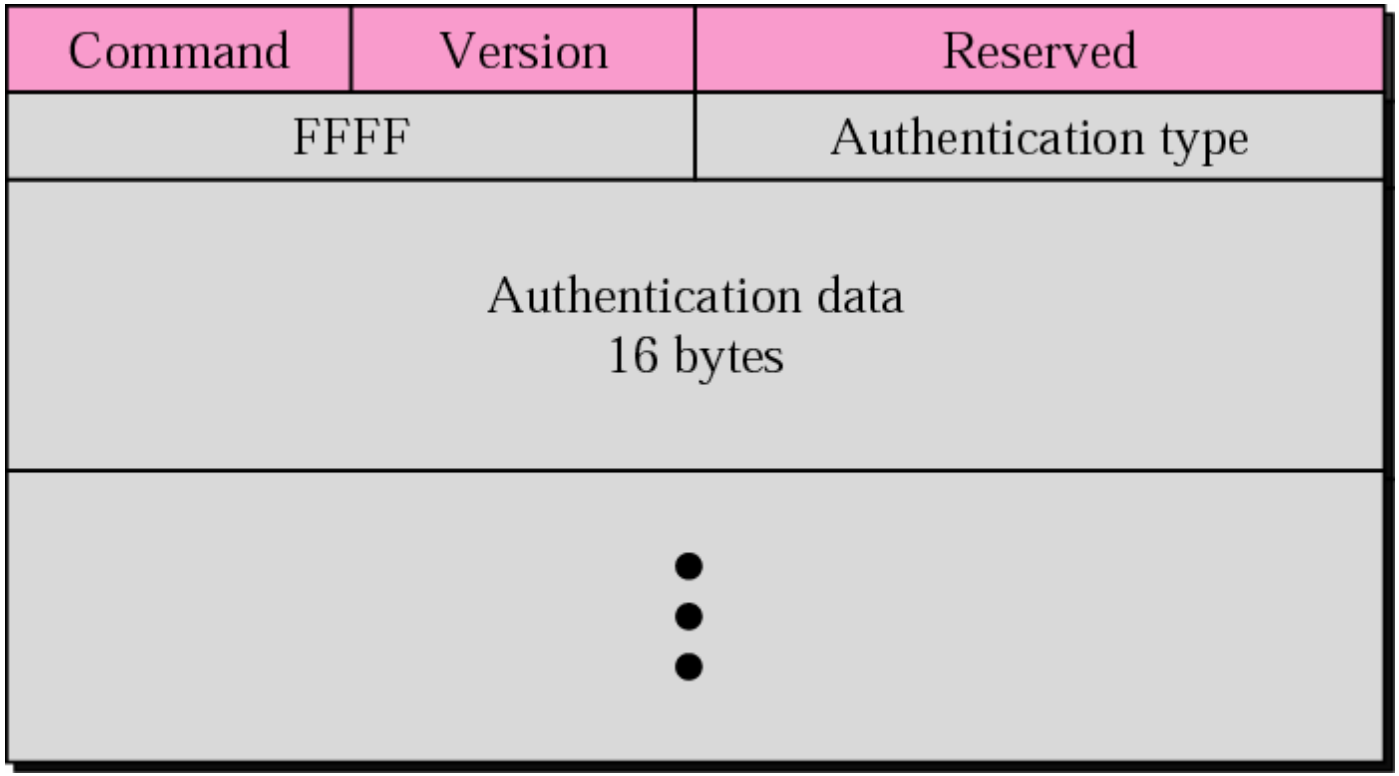
- The most important difference between the two versions
  - ***classful v.s. classless addressing***
- RIPv1 uses classful addressing
  - The only entry in the message format is the ***network address*** (with a default mask)
- RIPv2 support classless addressing
  - Adds one filed for the ***subnet mask***

Authentication

- Protect the message against unauthorized advertisement
- The first entry of the message is set aside for authentication information
  - Family field = $FFFF_{16}$
    - Not used for routing information but for authentication
  - Authentication type
    - Define the method used for authentication
  - Authentication data
    - Contain the actual authentication data

Figure 12-17

Authentication



Multicasting

- Version 1 of RIP uses broadcasting to send RIP message to every neighbor
  - All the routers and the hosts receive the packets
- RIP version 2
  - Uses the multicast address 224.0.0.9 to multicast RIP message only to RIP routers in the network

Encapsulation

- RIP message are encapsulated in UDP user datagram
- The well-known port assigned to RIP in UDP is port 520