

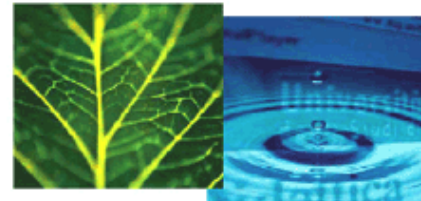
Routing Information Protocol (RIP)

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Seminar for “*Advanced Networking*”

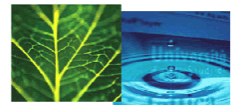


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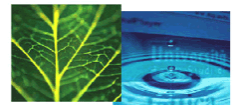
RIP - History

- ❑ Late 1960s: Distance Vector protocols were used in the ARPANET
- ❑ Mid-1970s: XNS (Xerox Network system) routing protocol is the precursor of RIP in IP (and Novell's IPX RIP and Apple's routing protocol)
- ❑ 1982: Release of routed for BSD Unix
- ❑ 1988: RIPv1 (RFC 1058)
 - classful routing
- ❑ 1993: RIPv2 (RFC 1388)
 - adds subnet masks with each route entry
 - allows classless routing
- ❑ 1998: Current version of RIPv2 (RFC 2453 and STD 56)



RIP at a glance

- ❑ A simple intradomain protocol
- ❑ Straightforward implementation of Distance Vector Routing...
 - Distributed version of Bellman-Ford (DBF)
- ...with well known issues
 - slow convergence
 - works with limited network size
- ❑ Strengths
 - simple to implement
 - simple management
 - widespread use



RIP at a glance

❑ Metric based on hop count

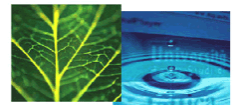
- maximum hop count is 15, with “16” equal to “ ∞ ”
 - imposed to limit the convergence time
- the network administrator can also assign values higher than 1 to a single hop

❑ Each router advertises its distance vector every 30 seconds (or whenever its routing table changes) to all of its neighbors

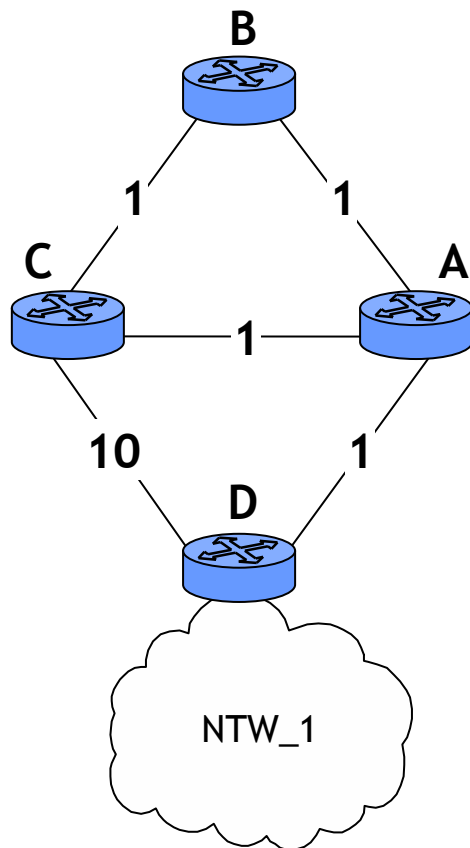
- RIP uses UDP, port 520, for sending messages

❑ Changes are propagated across network

❑ Routes are timeout (set to 16) after 3 minutes if they are not updated



Recall: “counting to infinity” problem



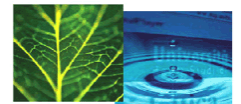
Router A		
Dest	Next	Metric
NTW_1	D	2

Router B		
Dest	Next	Metric
NTW_1	A	3

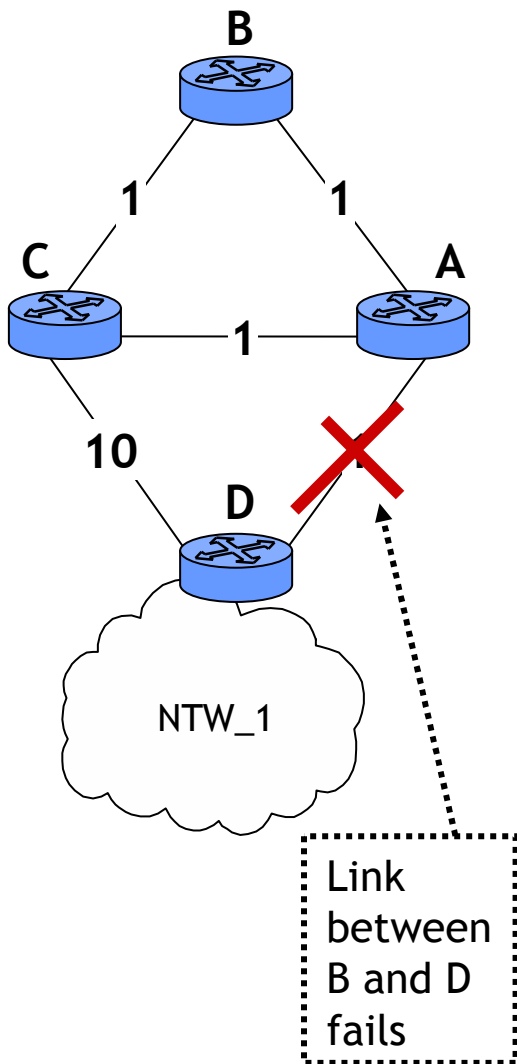
Router C		
Dest	Next	Metric
NTW_1	A	3

Router D		
Dest	Next	Metric
NTW_1	dir	1

- ❑ Consider the entries in each routing table for network NTW_1
- ❑ Router D is directly connected to NTW_1



Recall: “counting to infinity” problem (2)



time

Router A		
Dest	Next	Metric
NTW_1	Unr.	-

Router B		
Dest	Next	Metric
NTW_1	A	3

Router C		
Dest	Next	Metric
NTW_1	A	3

Router D		
Dest	Next	Metric
NTW_1	dir	1

Router A		
Dest	Next	Metric
NTW_1	C	4

Router B		
Dest	Next	Metric
NTW_1	C	4

Router C		
Dest	Next	Metric
NTW_1	B	4

Router D		
Dest	Next	Metric
NTW_1	dir	1

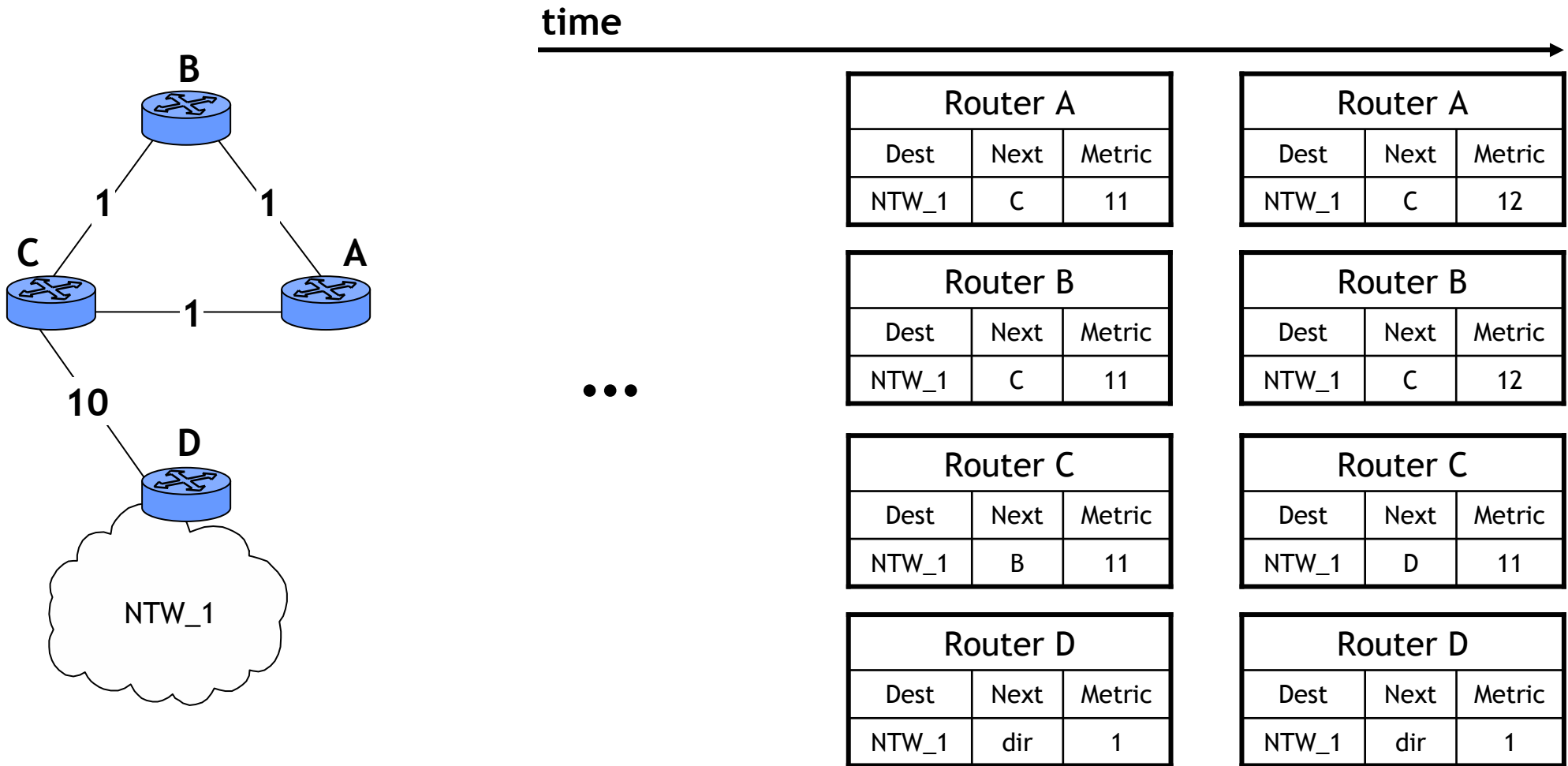
Router A		
Dest	Next	Metric
NTW_1	C	5

Router B		
Dest	Next	Metric
NTW_1	C	5

Router C		
Dest	Next	Metric
NTW_1	B	5

Router D		
Dest	Next	Metric
NTW_1	dir	1

Recall: “counting to infinity” problem (3)



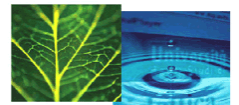
RIP: solution to “counting to infinity”

❑ Maximum number of hops bounded to 15

- this limits the convergence time

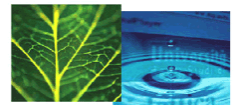
❑ Split Horizon

- simple
 - each node *omits* routes learned from one neighbor in update sent to that neighbor
- with poisoned reverse
 - each node *include* routes learned from one neighbor in update sent to that neighbor, setting their metrics to infinity
 - drawback: routing message size greater than simple Split Horizon



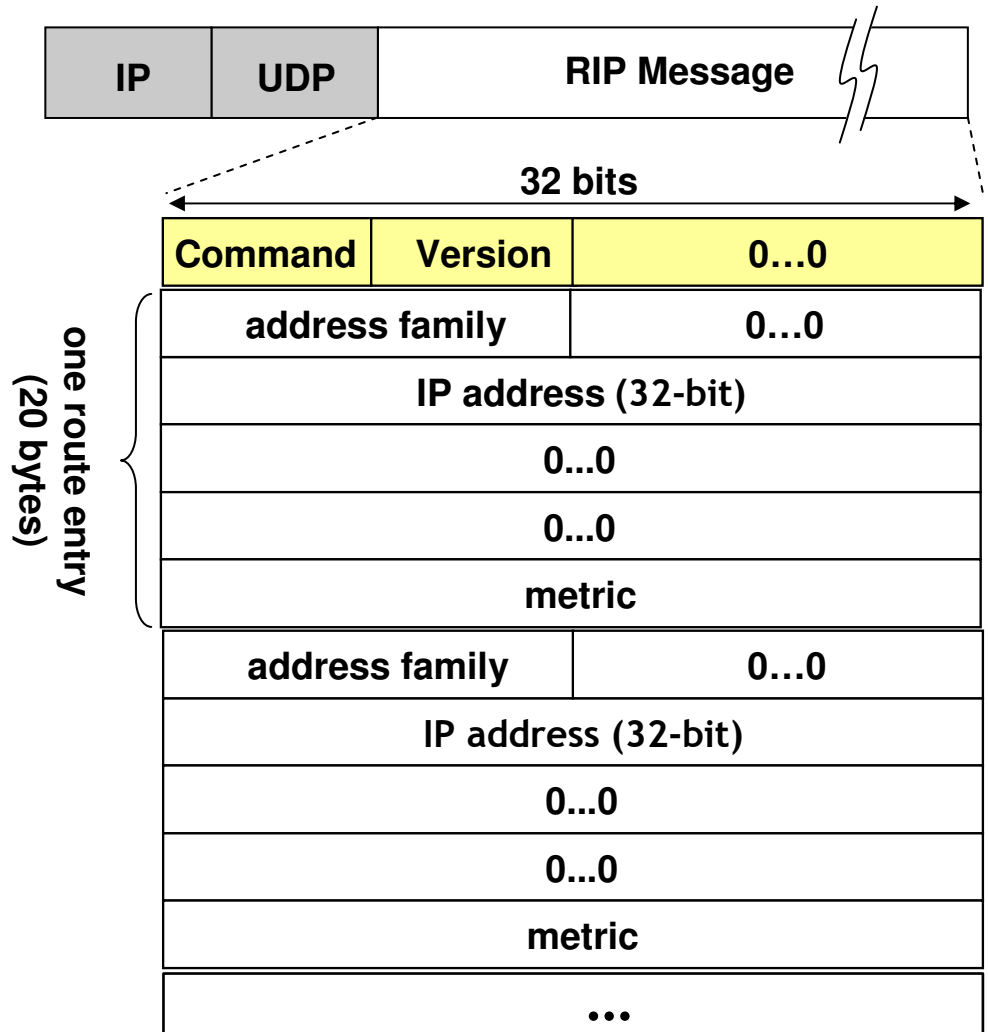
RIP: solution to “counting to infinity” (cont’d)

- ❑ Triggered updates: nodes send messages as soon as they notice a change in their routing tables
 - only routes that has changed are sent
 - faster reaction...
 - ...but more resources are used (bandwidth, processing)
 - cascade of triggered updates
 - superposition with regular updates



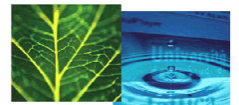
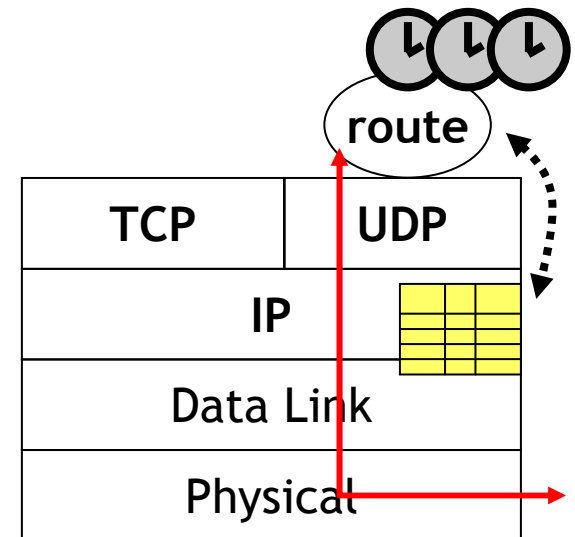
RIP: Message Format

- ❑ Command: 1=request 2=response
 - Updates are replies whether asked for or not
 - Initializing node broadcasts request
 - Requests are replied to immediately
- ❑ Version: 1
- ❑ Address family: 2 for IP
- ❑ IP address: non-zero network portion, zero host portion
 - Identifies particular network
- ❑ Metric
 - Path distance from this router to network
 - Typically 1, so metric is hop count



RIP procedures: introduction

- ❑ RIP routing tables are managed by application-level process
 - e.g., *routed* on UNIX machines
- ❑ Advertisements are sent in UDP packets (port 520)
- ❑ RIP maintains 3 different timers to support its operations
 - Periodic update timer (25-30 sec)
 - used to sent out update messages
 - Invalid timer (180 sec)
 - If update for a particular entry is not received for 180 sec, route is invalidated
 - Garbage collection timer (120 sec)
 - An invalid route in marked, not immediately deleted
 - For next 120 s. the router advertises this route with distance infinity



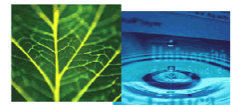
RIP procedures: input processing

❑ Request Messages

- they may arrive from routers which have just come up
- action: the router responds directly to the requestor's address and port
 - request is processed entry by entry

❑ Response Messages

- they may arrive from routers that perform regular updates, triggered updates or respond to a specific query
- action: the router updates its routing table
 - in case of new route or changed routes, the router starts a triggered update procedure



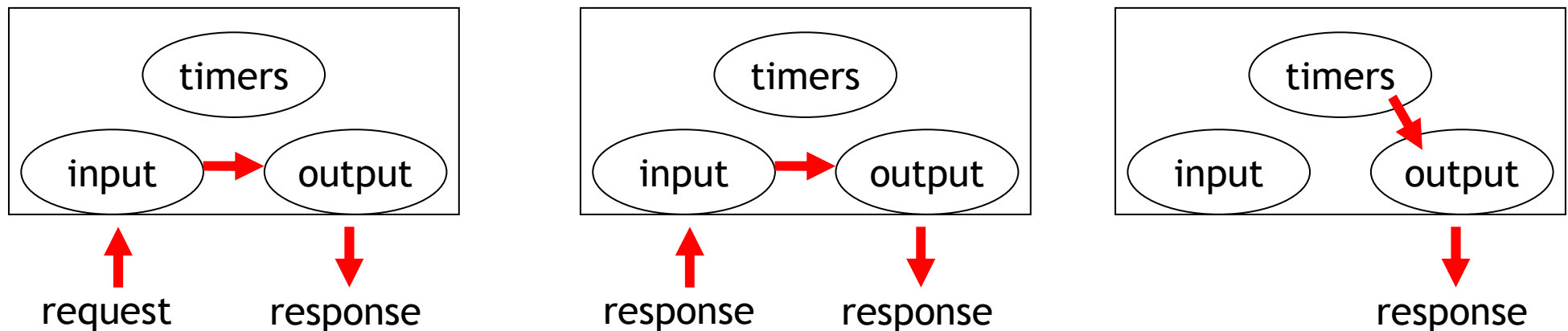
RIP procedures: output processing

❑ Output are generated

- when the router comes up in the network
- if required by the input processing procedures
- by regular routing update

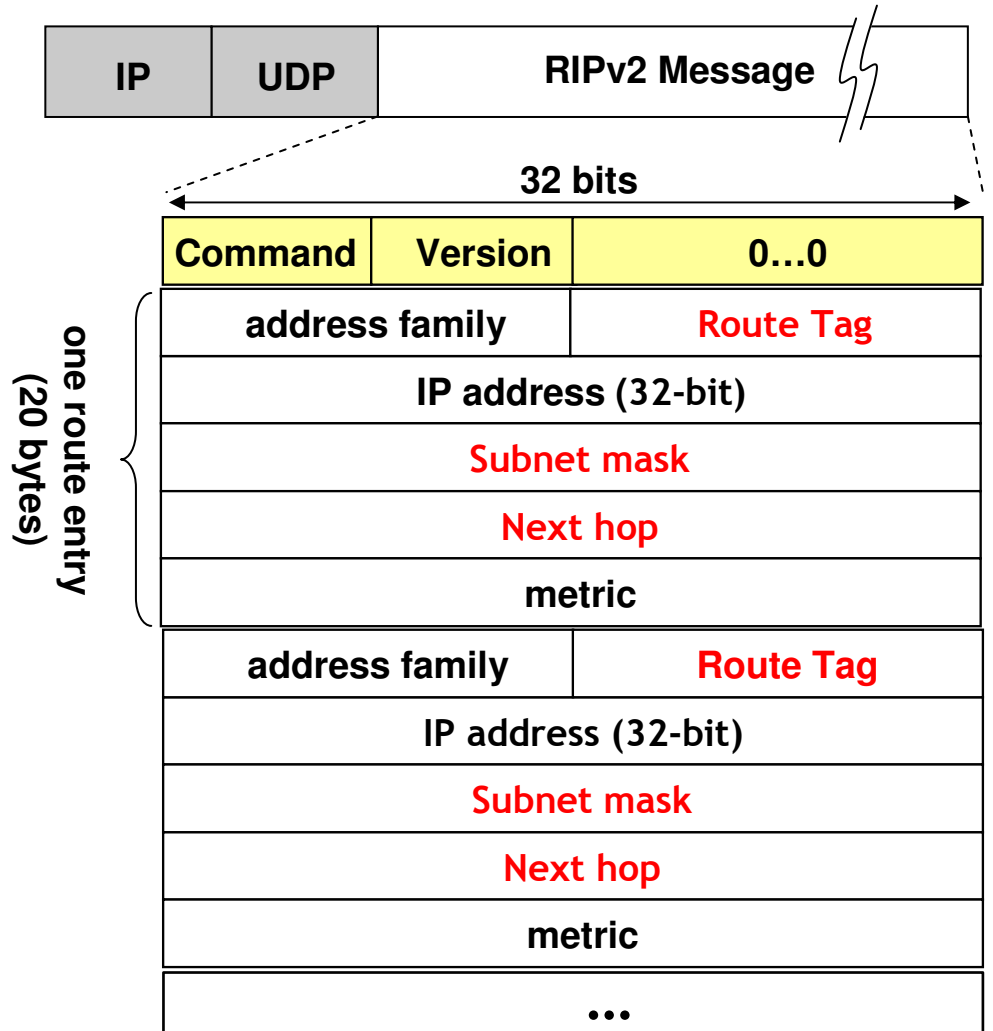
❑ Action: the router generates the messages according to the commands received

- the messages contain entries from the routing table

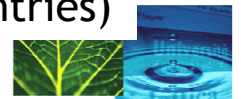


RIPv2: Message Format

- Version: 2
- Route Tag: used to carry information from other routing protocols
 - e.g., autonomous system number
- Subnet mask for IP address
- Next hop
 - identifies a better next-hop address on the same subnet than the advertising router, if one exists (otherwise 0...0)

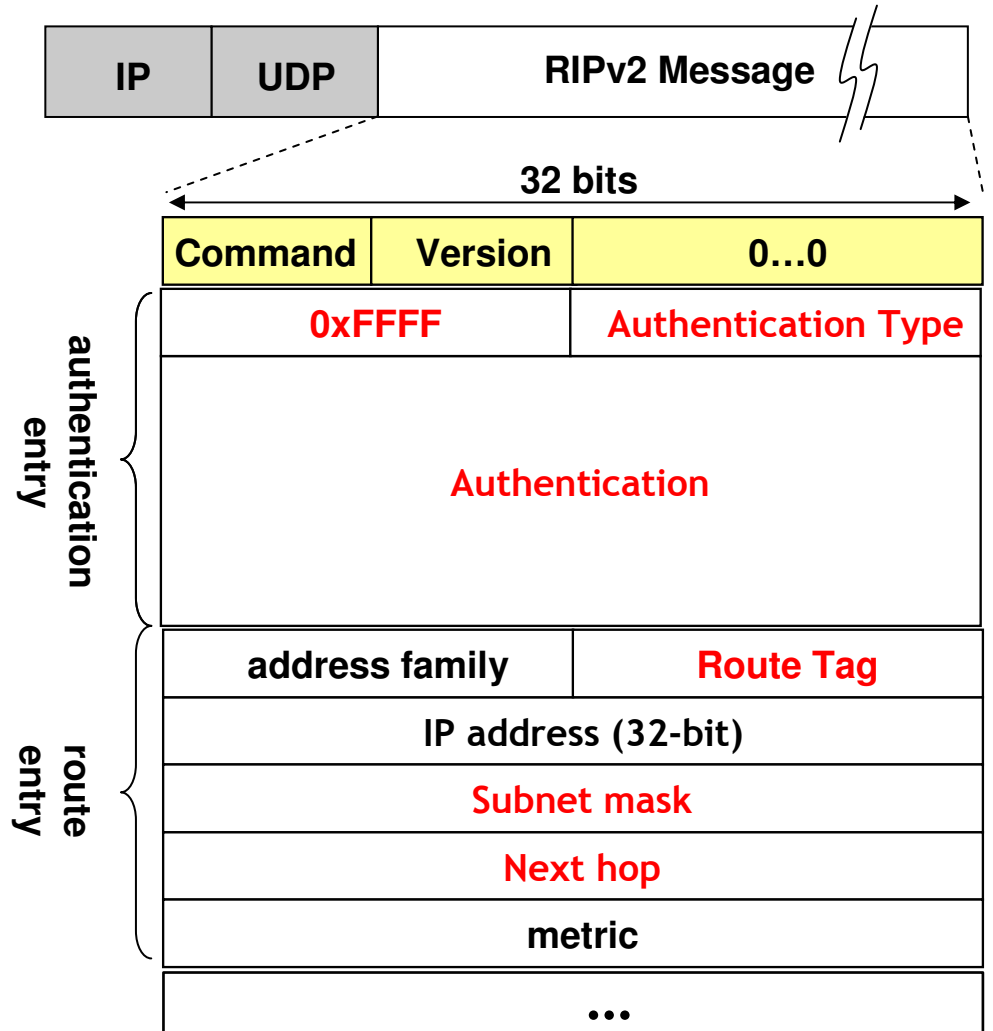


(up to 25 total route entries)



RIPv2: authentication

- ❑ Any host sending packets on UDP port 520 would be considered a router
- ❑ Malicious users can inject fake routing entries
- ❑ With authentication, only authorized router can send Rip packets
 - Authentication type
 - password
 - MD5
 - Authentication
 - plain text password
 - MD5 hash



(up to 24 total route entries)

RIPv2: other aspects

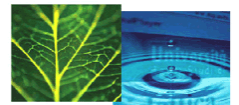
Explicit use of subnets

Interoperability

- RIPv1 and RIPv2 can be present in the same network since RIPv1 simply ignores fields not known
 - RIPv2 responds to RIPv1 Request with a RIPv1 Response

Multicast

- instead of broadcasting RIP messages, RIPv2 uses multicast address 224.0.0.9



RIP limitations: the cost of simplicity

- ❑ Destinations with metric more than 15 are unreachable
 - If larger metric allowed, convergence becomes lengthy
- ❑ Simple metric leads to sub-optimal routing tables
 - Packets sent over slower links
- ❑ Accept RIP updates from any device (if no security is implemented)
 - Misconfigured device can disrupt entire configuration

