

# Distance Vector Routing with RIP



## Foreword

Distance vector routing protocols are a form of dynamic routing protocol that work on the principle of the **Bellman-Ford** algorithm to define the route that packets should take to reach other network destinations. The application of the Routing Information Protocol (RIP) is often applied in many small networks and therefore remains a valid and popular protocol even though the protocol itself has been in existence much longer than other dynamic routing protocols in use today. The characteristics of such distance vector protocols are represented in this section through the Routing Information Protocol.



## Objectives

Upon completion of this section, trainees will be able to:

- Describe the behavior of the Routing Information Protocol.
- Successfully configure RIP routing and associated attributes.



# Routing

I routers possono popolare le tabelle di routing in tre modi:

- Rotte direttamente connesse;
- Rotte statiche;
- Rotte apprese con protocolli di routing dinamico.



# Terminologia

## **Protocollo di routing:**

è un insieme di messaggi, di regole e di algoritmi che sono utilizzati dai router con lo scopo di apprendere delle rotte. Il processo include lo scambio di informazioni di routing. Ogni router sceglie la migliore rotta verso ogni sottorete e poi inserisce le rotte migliori nella routing table.

Esempio: RIP – OSPF – ISIS – EIGRP – IGRP – RIPv2 – OSPFv3



# Terminologia

## **Protocollo instradabile (routed protocol):**

è un protocollo che definisce un indirizzamento logico,  
consentendo ai router di inoltrare il pacchetto fino a destinazione.

Esempio: IPv4 – IPv6



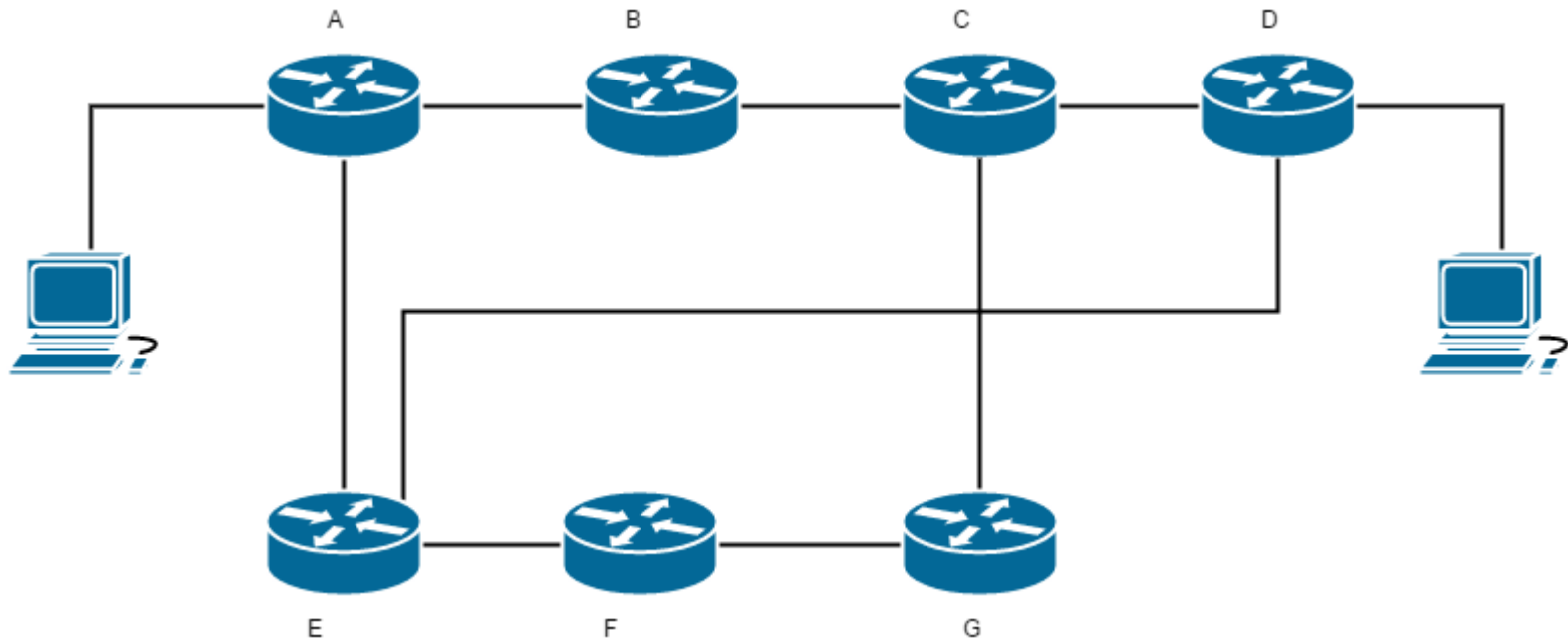
# Terminologia

## **Funzioni di un protocollo di routing:**

- Apprendere le informazioni di routing sulle sottoreti IP da altri router vicini;
- Annunciare le informazioni di routing sulle sottoreti IP ad altri router vicini;
- Se esistono percorsi multipli verso una destinazione, scegliere il migliore in base ad una metrica stabilita;
- Se la topologia della rete cambia, reagire al cambiamento trovando nuovi percorsi per raggiungere le sottoreti.



# Terminologia







# Terminologia

## **IGP (Internal gateway protocol)**

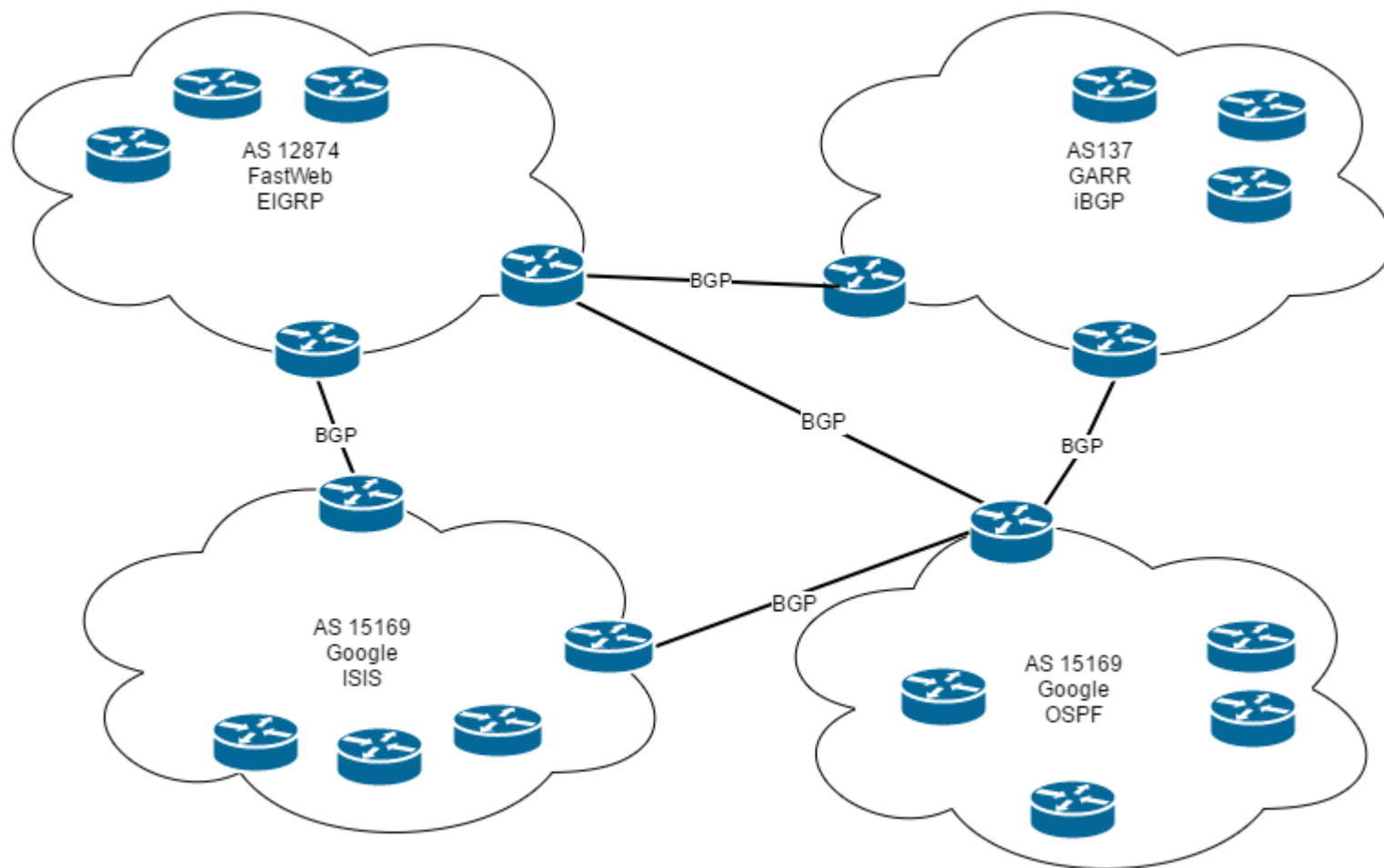
Protocollo di routing studiato per essere utilizzato all'interno di un singolo autonomous system.

## **EGP (External gateway protocol)**

Protocollo di routing studiato per essere utilizzato tra differenti autonomous systems.



# Terminologia



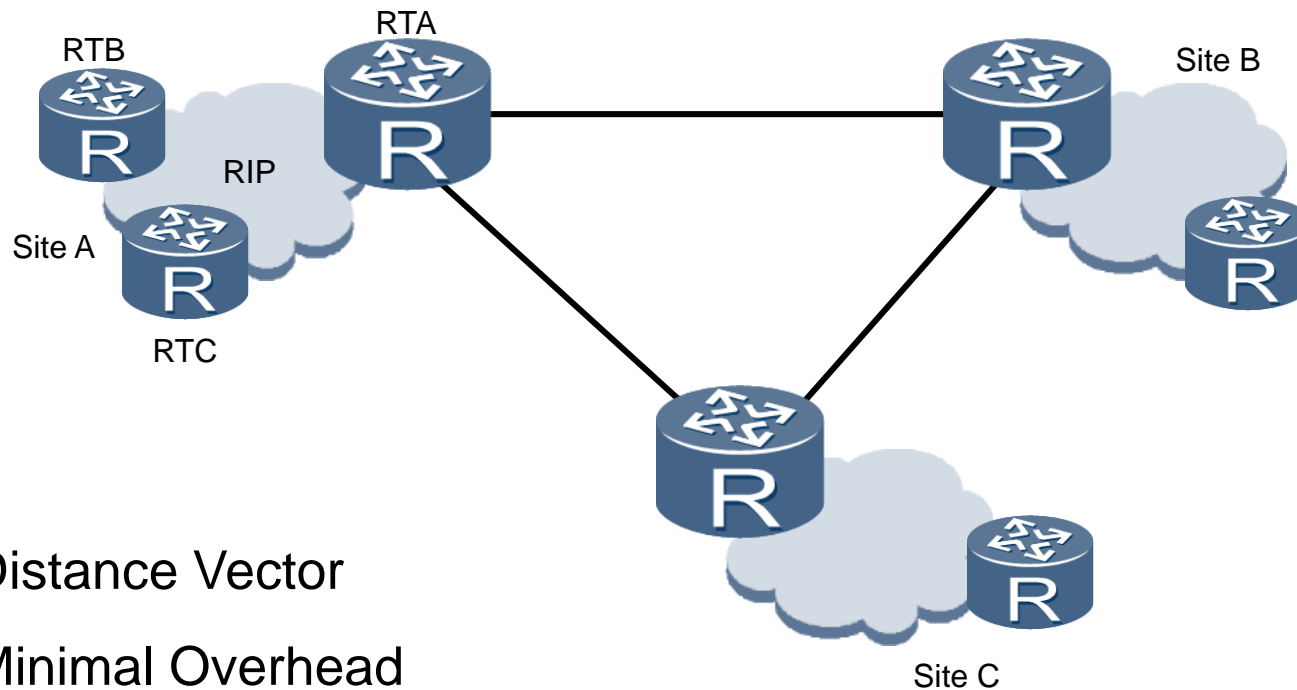


# Terminologia

L'algoritmo alla base di un protocollo di routing determina la logica con la quale le rotte vengono apprese ed inserite nella tabella di routing.

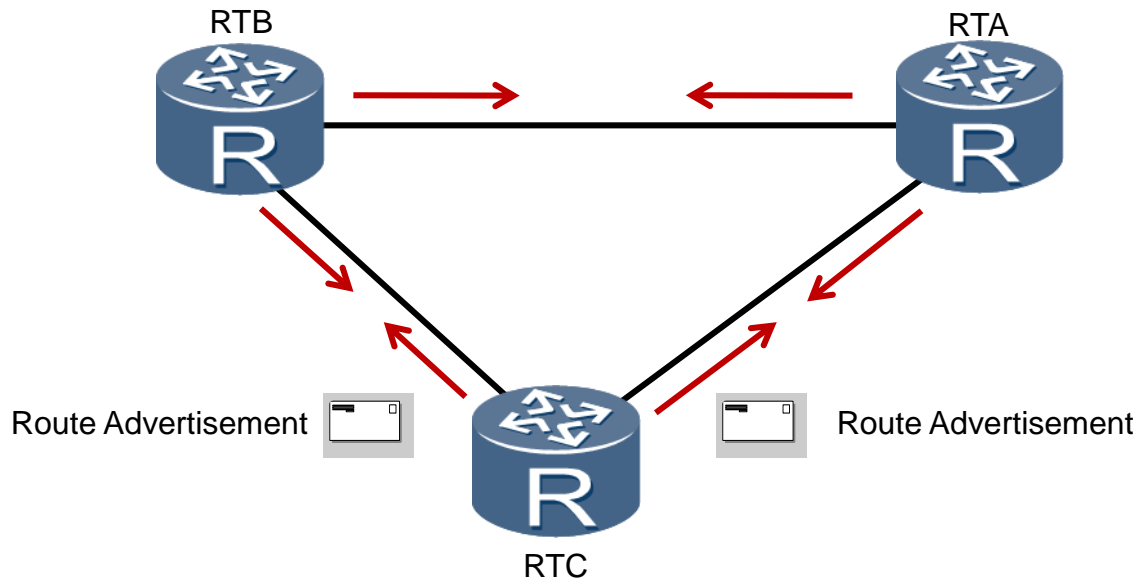
- DISTANCE VECTOR
- LINK-STATE

# Routing Information Protocol



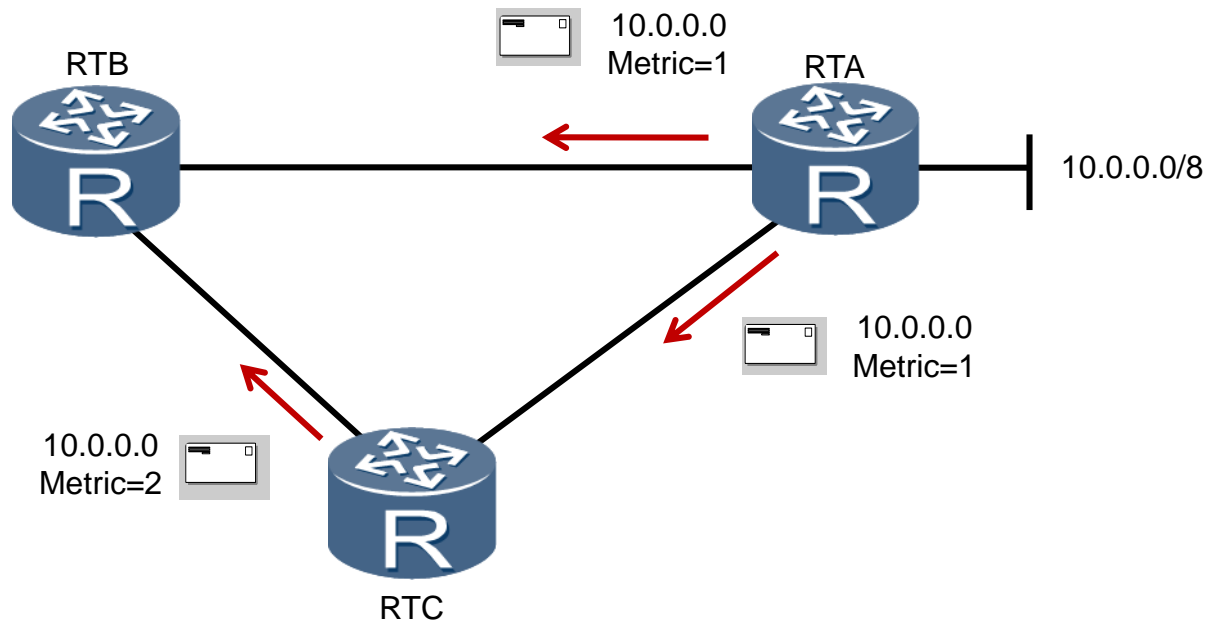
- Distance Vector
- Minimal Overhead
- Suited to Small Networks
- Simple implementation

# Principle Behavior



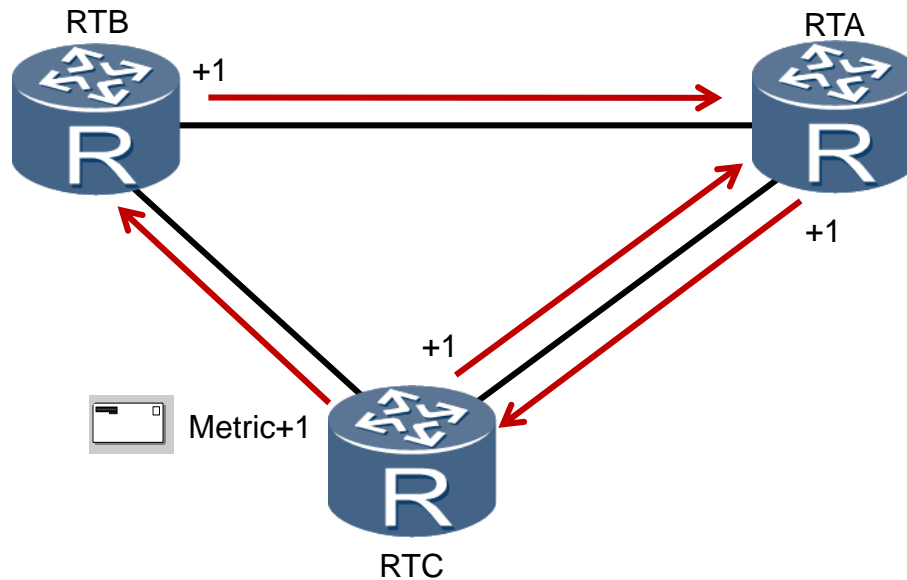
- Route Advertisements are sent periodically.
- Advertised information is used to discover the best routes.

# Metrics



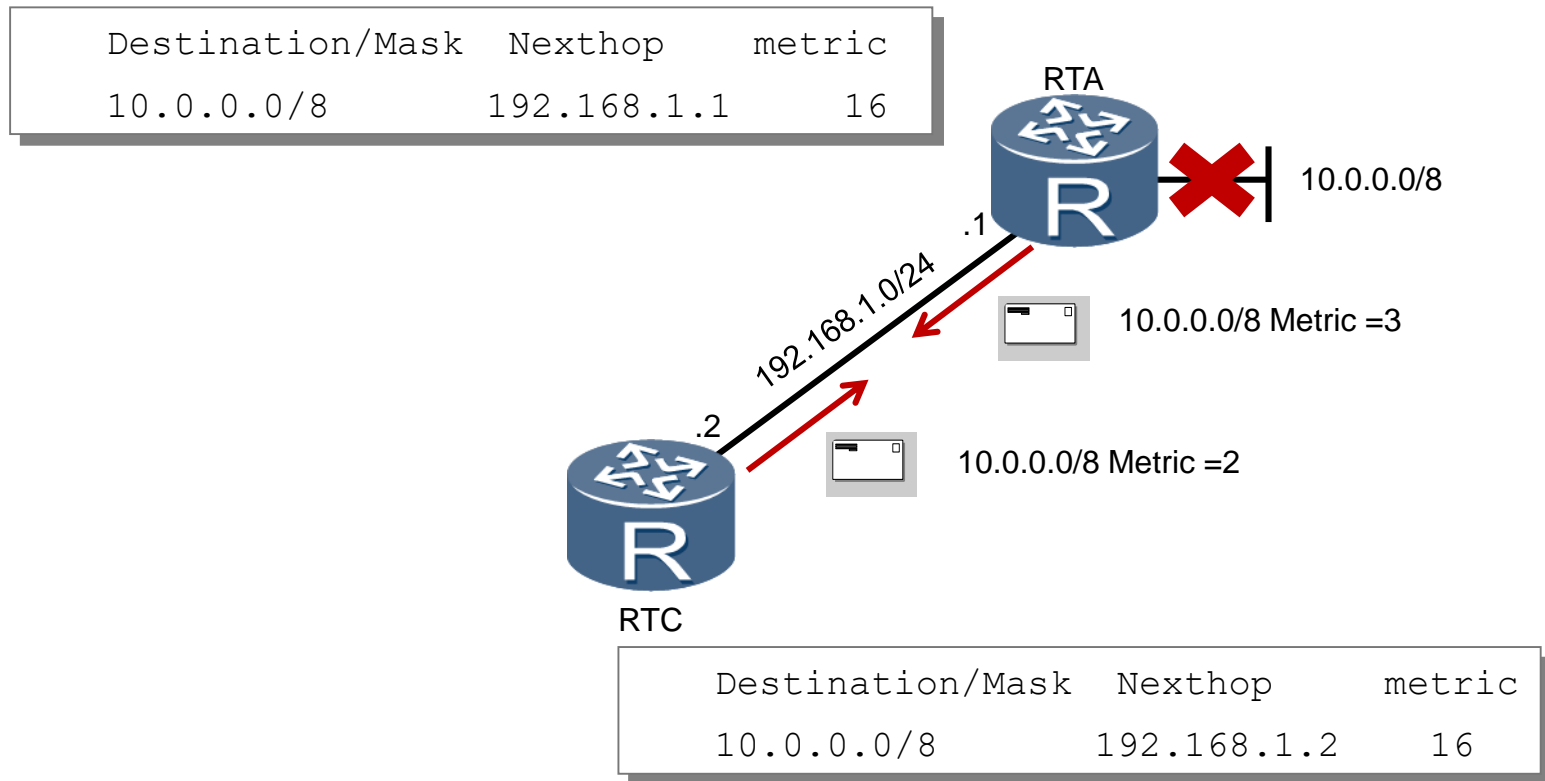
- Metric is used to measure the distance to a given network.
- Calculation is based on hops representing a metric of 1.

# Routing Loops and Hop Limits



- Metric is incremented by 1 before advertisement is forwarded.
- A limit of 15 hops is defined to prevent infinite forwarding.

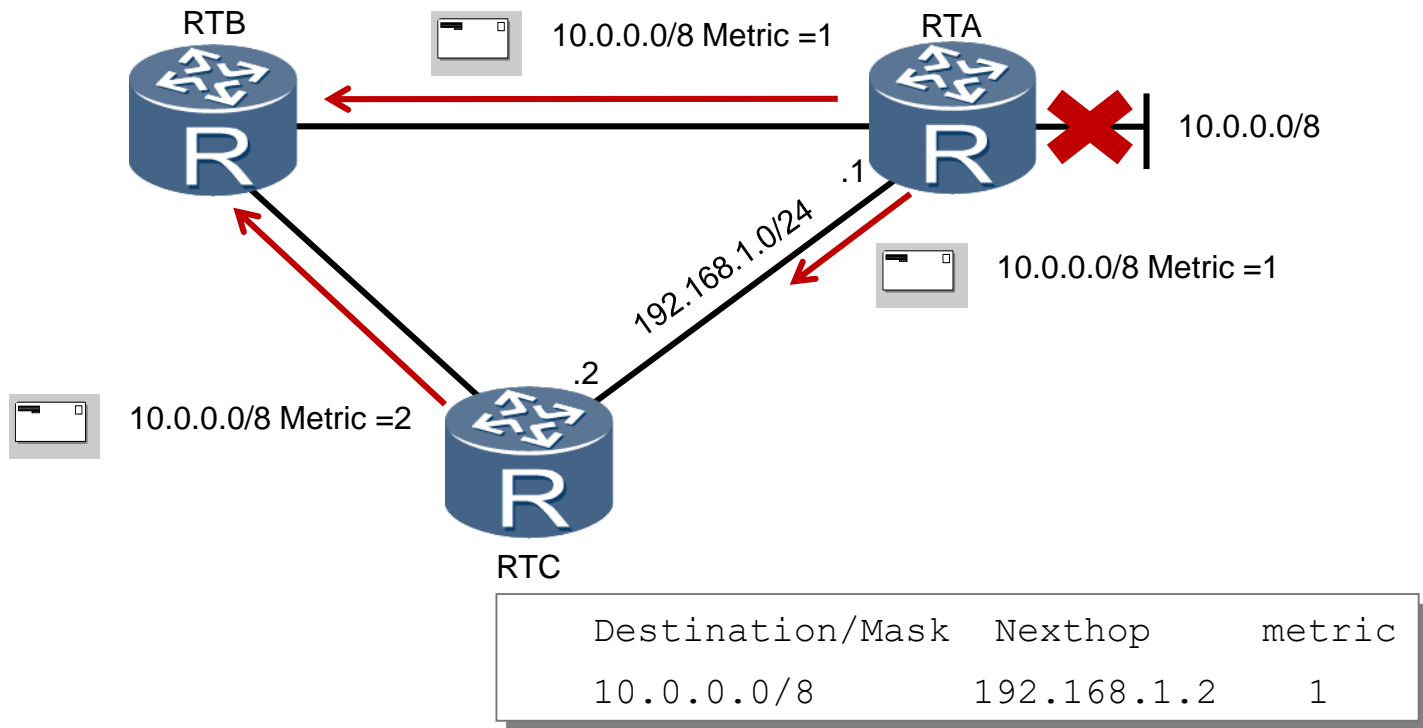
# Loop Formation



- When a network fails, the next best route may generate a loop.
- A metric of 16 represents an unreachable route.

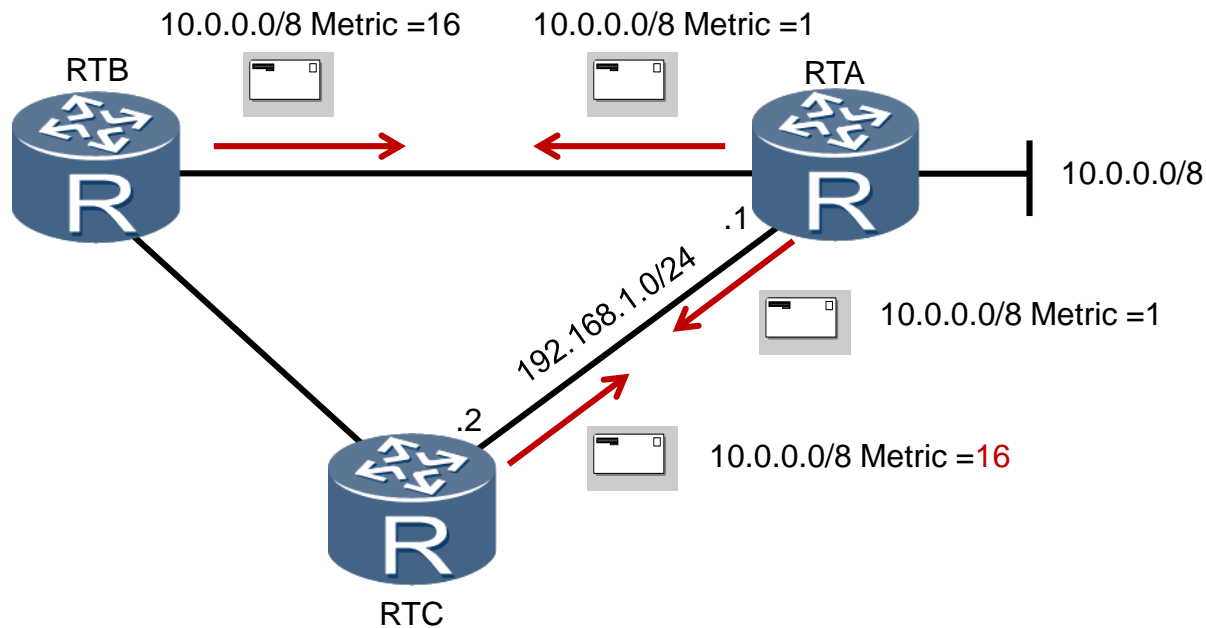


# Loop Prevention-Split Horizon



- A route cannot be advertised on the interface via which it was learned.

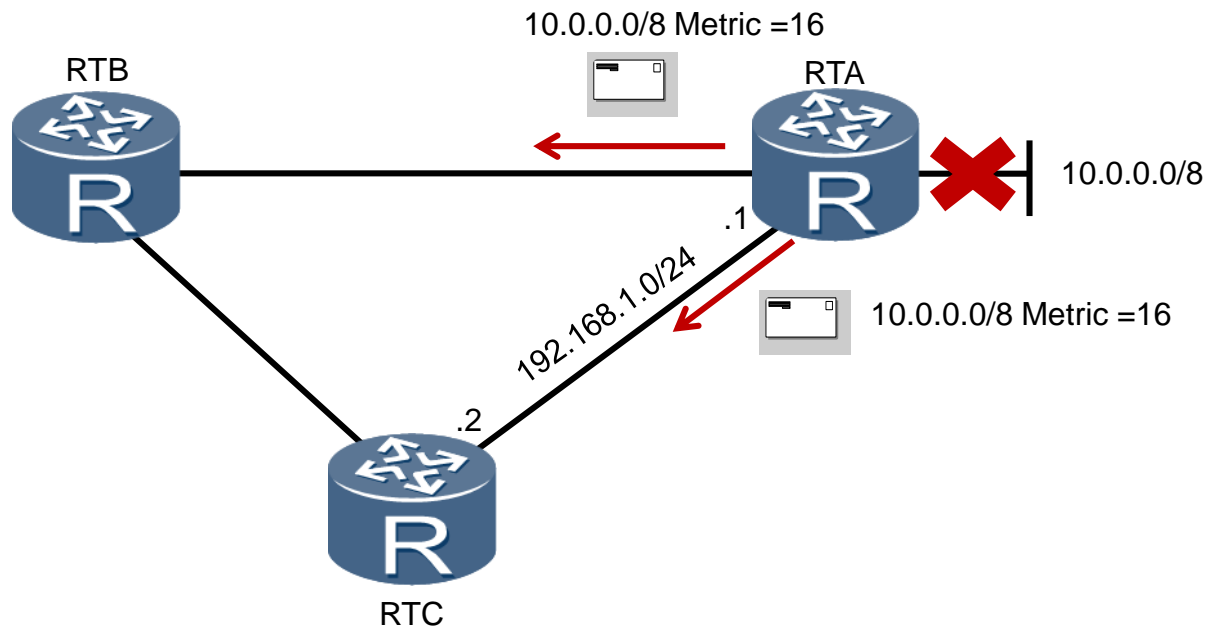
# Loop Prevention-Poisoned Reverse



Destination/Mask	Nexthop	metric
10.0.0.0/8	192.168.1.1	16

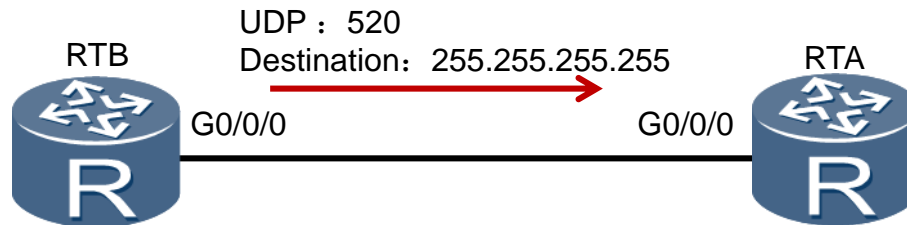
- Poisoned Reverse improves convergence time, however generates additional overhead due to extra route information.

# Loop Prevention-Triggered Updates



- Updates are sent by default approximately every 30 seconds.
- Triggered updates allow updates to be sent almost instantly.

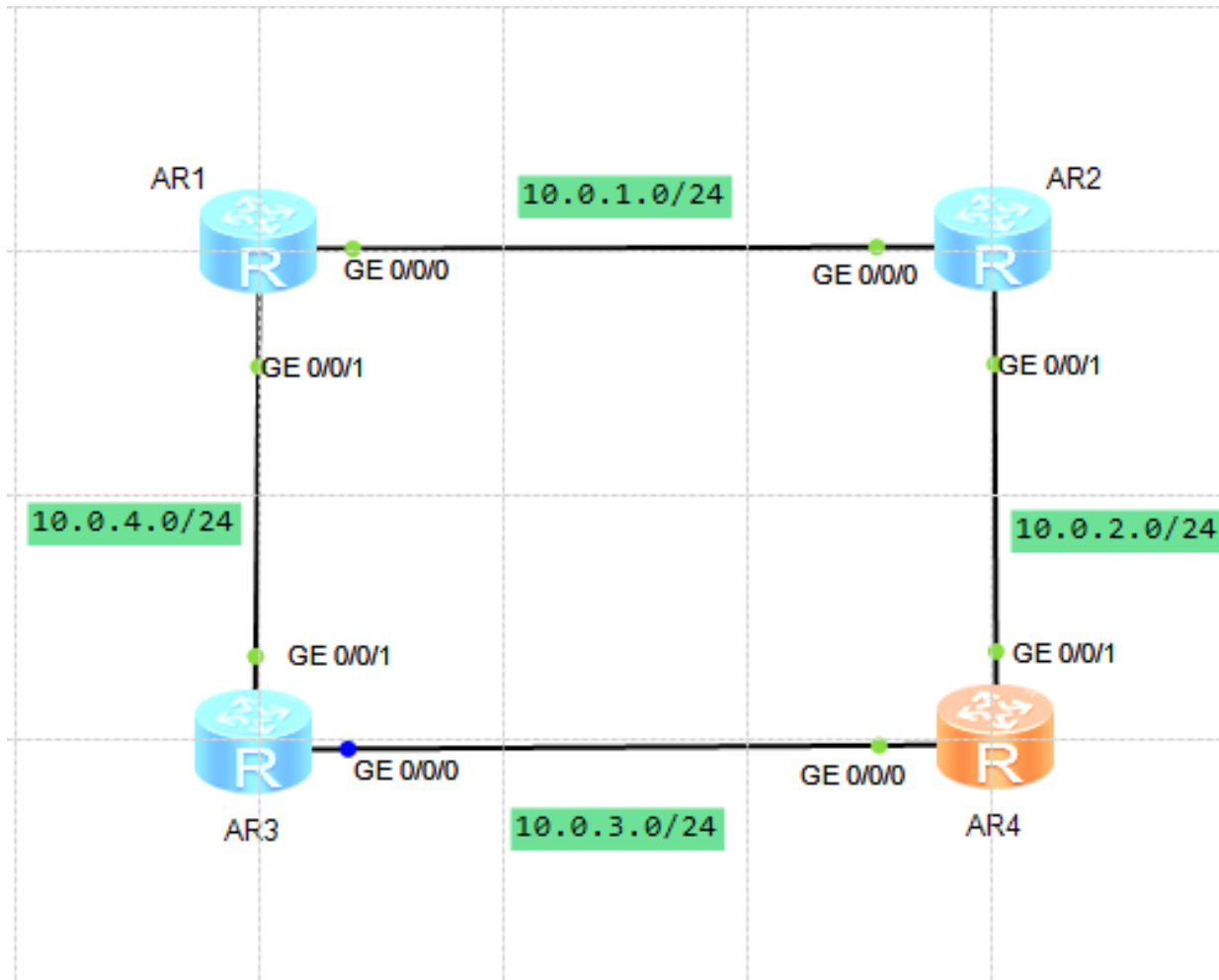
# RIP Messaging



Command	Version	Must be Zero
Address Family Identifier		Must be Zero
IP Address		
Must be Zero		
Must be Zero		
Metric		

# RIP Messaging

Mini-Lab\_basic:09-rip\_01



# RIP Messaging R1 and R2

## ▼ User Datagram Protocol, Src Port: 520, Dst Port: 520

Source Port: 520  
Destination Port: 520  
Length: 52  
Checksum: 0xd55f [unverified]  
[Checksum Status: Unverified]  
[Stream index: 0]

## ▼ Routing Information Protocol

Command: Response (2)  
Version: RIPv1 (1)

### ▼ IP Address: 10.0.1.0, Metric: 16

Address Family: IP (2)  
IP Address: 10.0.1.0  
Metric: 16

### ▼ IP Address: 10.0.4.0, Metric: 1

Address Family: IP (2)  
IP Address: 10.0.4.0  
Metric: 1

## ▼ User Datagram Protocol, Src Port: 520, Dst Port: 520

Source Port: 520  
Destination Port: 520  
Length: 32  
Checksum: 0xef8b [unverified]  
[Checksum Status: Unverified]  
[Stream index: 1]

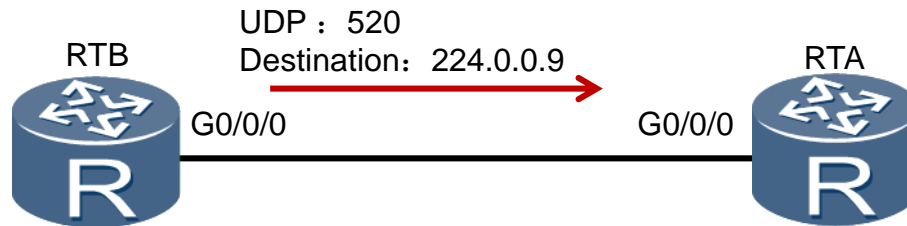
## ▼ Routing Information Protocol

Command: Request (1)  
Version: RIPv1 (1)

### ▼ Address not specified, Metric: 16

Address Family: Unspecified (0)  
Metric: 16

# RIP Extensions



Command	Version	Unused
Address Family Identifier		Route Tag
IP Address		
Subnet Mask		
Next Hop		
Metric		

# RIP Messaging R3 R4 (version 2)

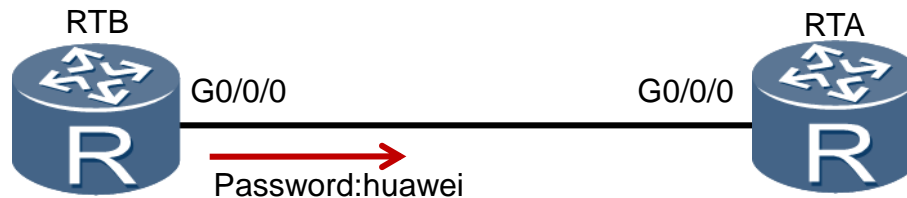
- > Internet Protocol Version 4, Src: 10.0.3.3, Dst: 224.0.0.9
- ▼ User Datagram Protocol, Src Port: 520, Dst Port: 520
  - Source Port: 520
  - Destination Port: 520
  - Length: 52
  - Checksum: 0xf350 [unverified]
  - [Checksum Status: Unverified]
  - [Stream index: 0]
- ▼ Routing Information Protocol
  - Command: Response (2)
  - Version: RIPv2 (2)
  - ▼ IP Address: 10.0.3.0, Metric: 16
    - Address Family: IP (2)
    - Route Tag: 0
    - IP Address: 10.0.3.0
    - Netmask: 255.255.255.0
    - Next Hop: 0.0.0.0
    - Metric: 16
  - ▼ IP Address: 10.0.4.0, Metric: 1
    - Address Family: IP (2)
    - Route Tag: 0
    - IP Address: 10.0.4.0
    - Netmask: 255.255.255.0
    - Next Hop: 0.0.0.0
    - Metric: 1



# RIP Messaging R3 R4 (version 2)

- > Internet Protocol Version 4, Src: 10.0.3.4, Dst: 224.0.0.9
- ▼ User Datagram Protocol, Src Port: 520, Dst Port: 520
  - Source Port: 520
  - Destination Port: 520
  - Length: 52
  - Checksum: 0xf75d [unverified]
  - [Checksum Status: Unverified]
  - [Stream index: 1]
- ▼ Routing Information Protocol
  - Command: Response (2)
  - Version: RIPv2 (2)
  - ▼ IP Address: 10.0.1.0, Metric: 2
    - Address Family: IP (2)
    - Route Tag: 0
    - IP Address: 10.0.1.0
    - Netmask: 255.255.255.0
    - Next Hop: 0.0.0.0
    - Metric: 2
  - ▼ IP Address: 10.0.2.0, Metric: 1
    - Address Family: IP (2)
    - Route Tag: 0
    - IP Address: 10.0.2.0
    - Netmask: 255.255.255.0
    - Next Hop: 0.0.0.0
    - Metric: 1

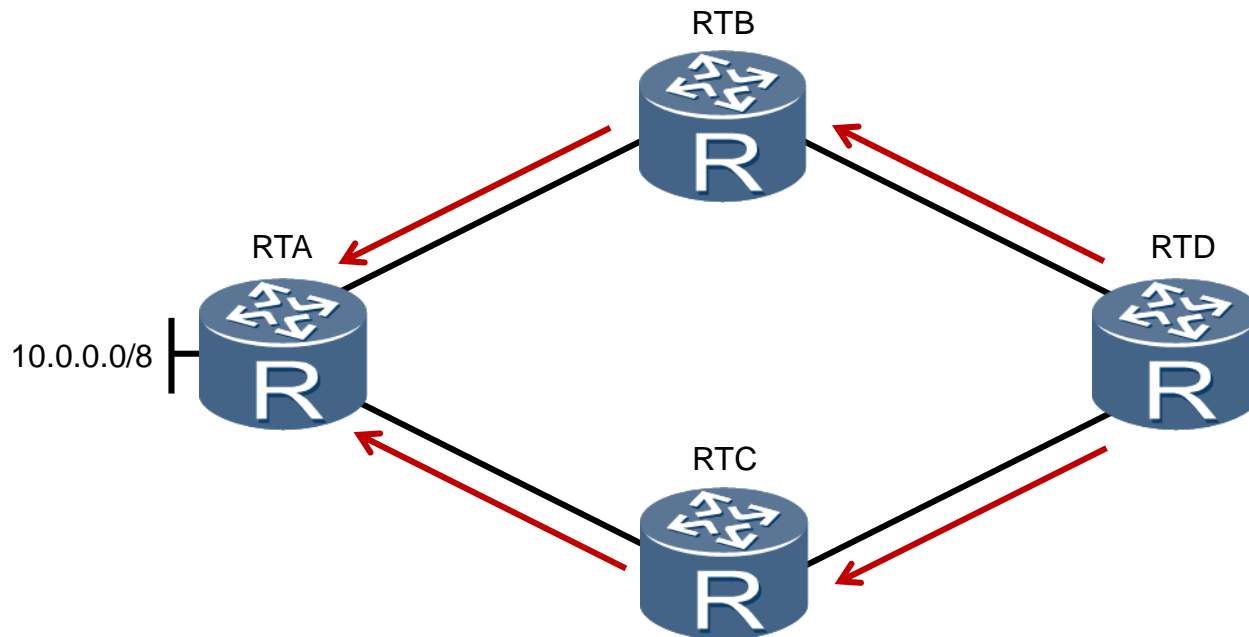
# RIP Extensions – Authentication



Command	Version	Unused
0XFFFF		Authentication Type
Authentication		

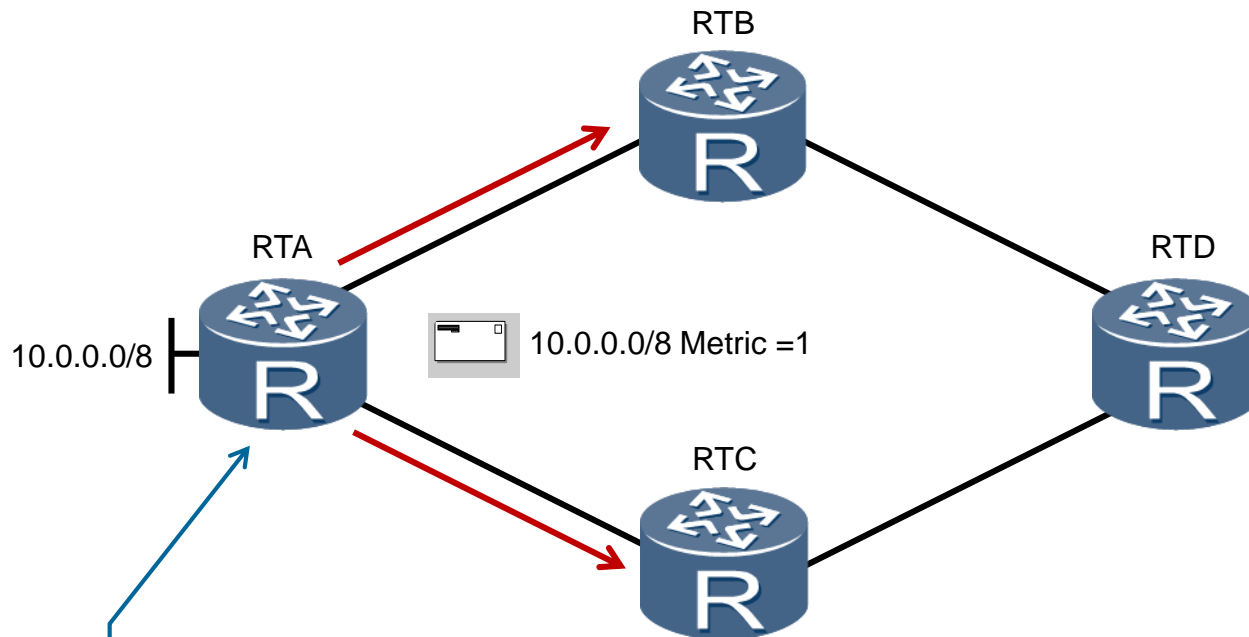
- RIP version 2 allows for authentication between peers.
- Supports plaintext and cryptographic authentication.

# RIP Load Balancing



- Load balancing can be used in RIP to utilize redundant links.
- AR2200 supports up to 8 equal cost routes by default.

# RIP Network Advertisement

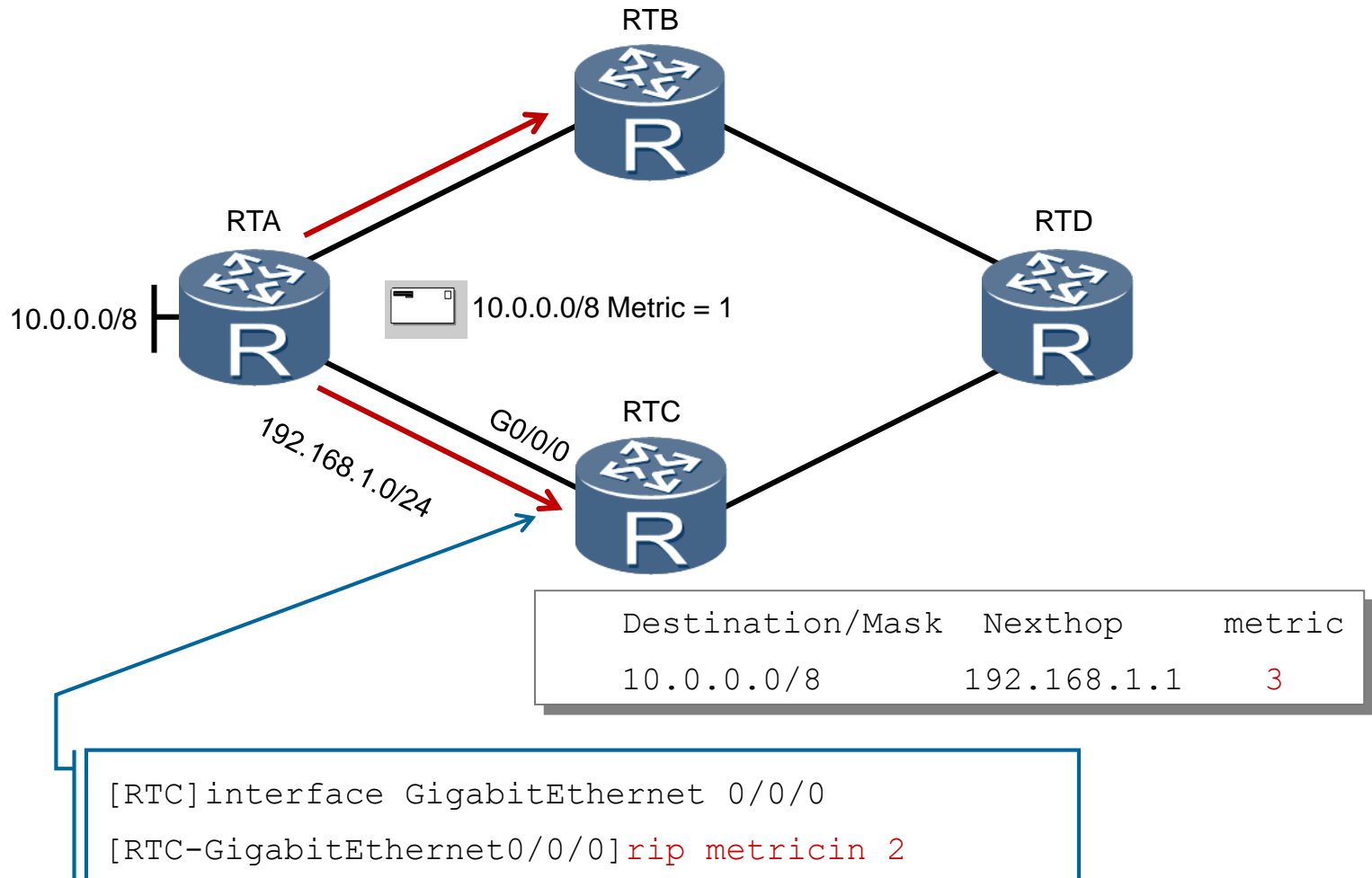


```
[RTA]rip
[RTA-rip-1]version 2
[RTA-rip-1]network 10.0.0.0
```

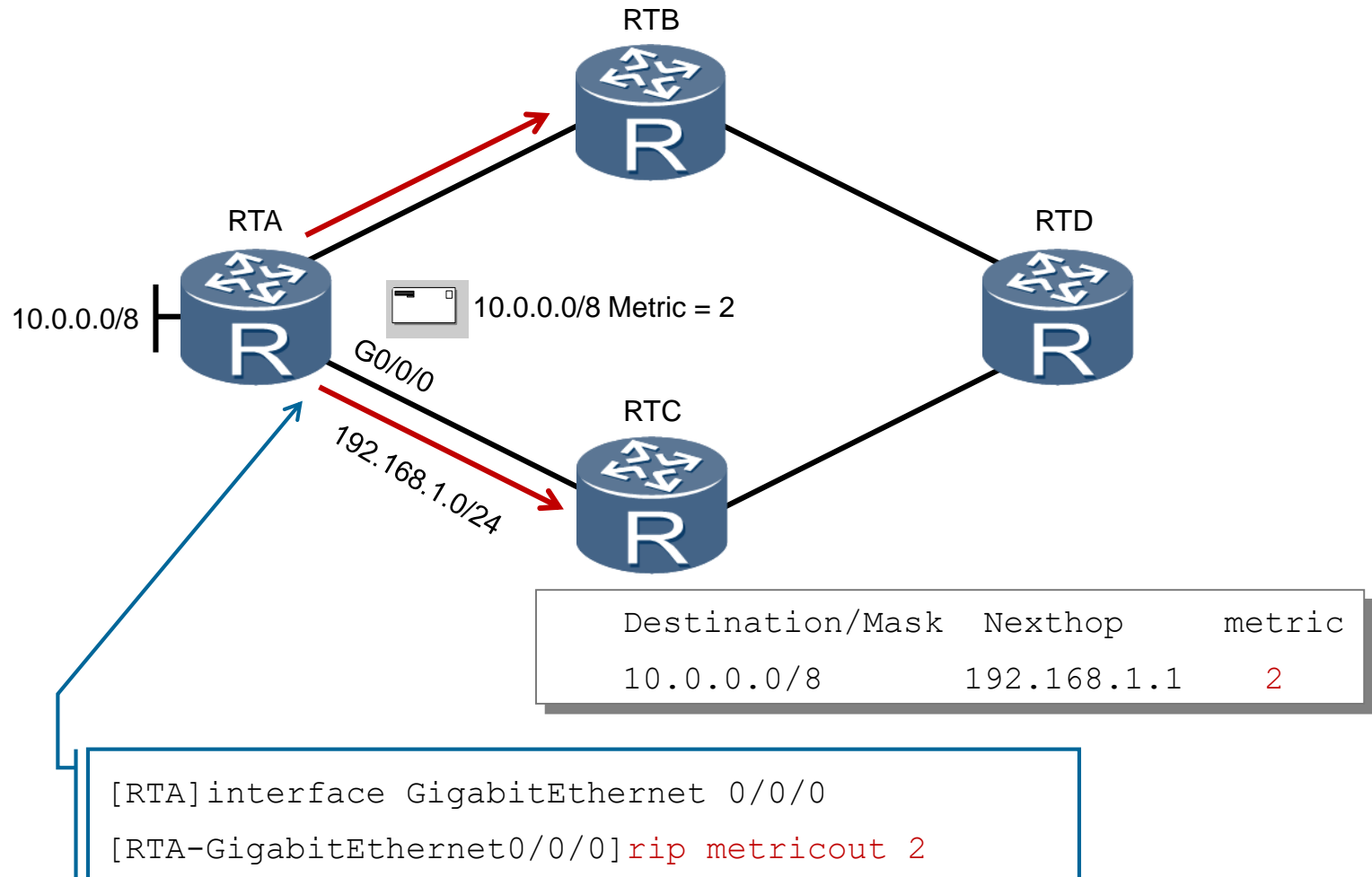
# RIP Network Advertisement

- Attenzione al comando NETWORK!  
“The network command enables RIP for the interface on the specified network segment.”
- E' un modo per “selezionare le interfacce” che partecipano al RIP.
- Attenzione a come viene usato!

# RIP Metricin



# RIP Metricout



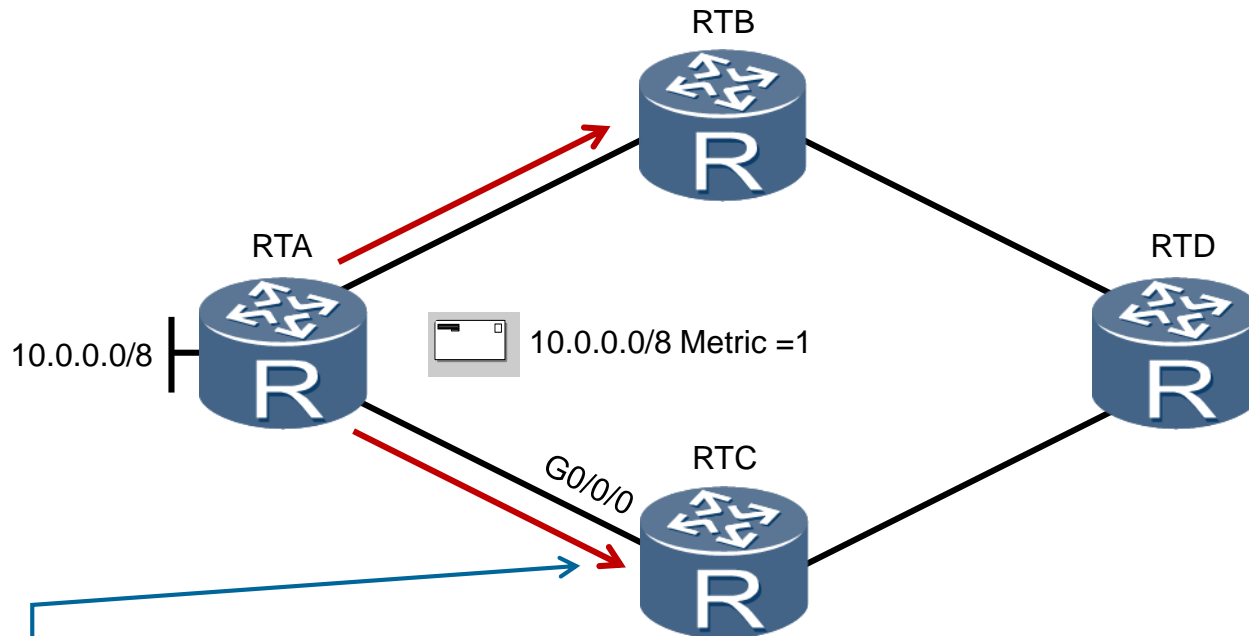
# RIP Metricout

The additional metric is added to the original metric of the RIP route.

- The **rip metricin** command is used to add an additional metric to an incoming route. After this route is added to the routing table, its metric in the routing table changes. Running this command affects route selection on the local device and other devices on the network.
- The **rip metricout** command is used to add an additional metric to an outgoing route. When this route is advertised, an additional metric is added to this route, but the metric of the route in the routing table does not change. Running this command does not affect route selection on the local device or other devices on the network.



# Split Horizon & Poisoned Reverse



```
[RTC]interface GigabitEthernet 0/0/0  
[RTC-GigabitEthernet0/0/0]rip split-horizon  
[RTC-GigabitEthernet0/0/0]rip poison-reverse
```

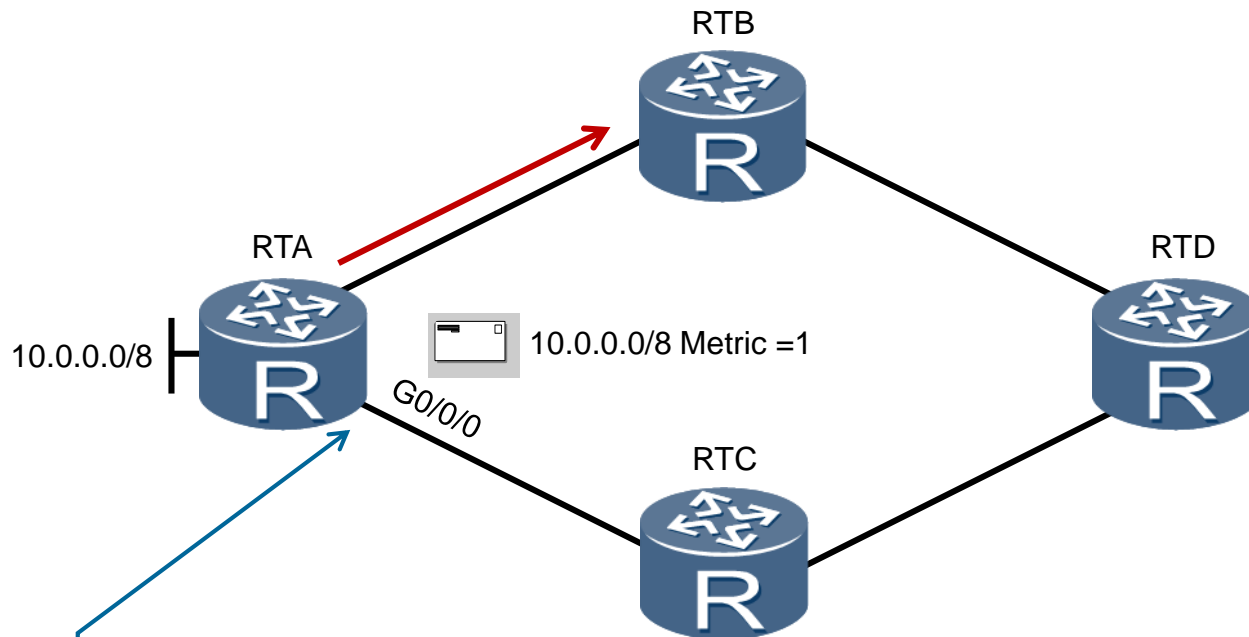
- If both are enabled, only *rip poison-reverse* will take effect.

# Configuration Validation

```
[RTC] display rip 1 interface GigabitEthernet0/0/0 verbose
GigabitEthernet0/0/0(192.168.1.2)
  State                : UP                MTU      : 500
  Metricin             : 2
  Metricout            : 1
  Input                : Enabled           Output   : Enabled
  Protocol             : RIPv2 Multicast
  Send version         : RIPv2 Multicast Packets
  Receive version      : RIPv2 Multicast and Broadcast Packets
  Poison-reverse       : Enabled
  Split-Horizon        : Enabled
  Authentication type  : None
  Replay Protection    : Disabled
```

- Both show as enabled but only “*Poison-reverse*” will take effect.

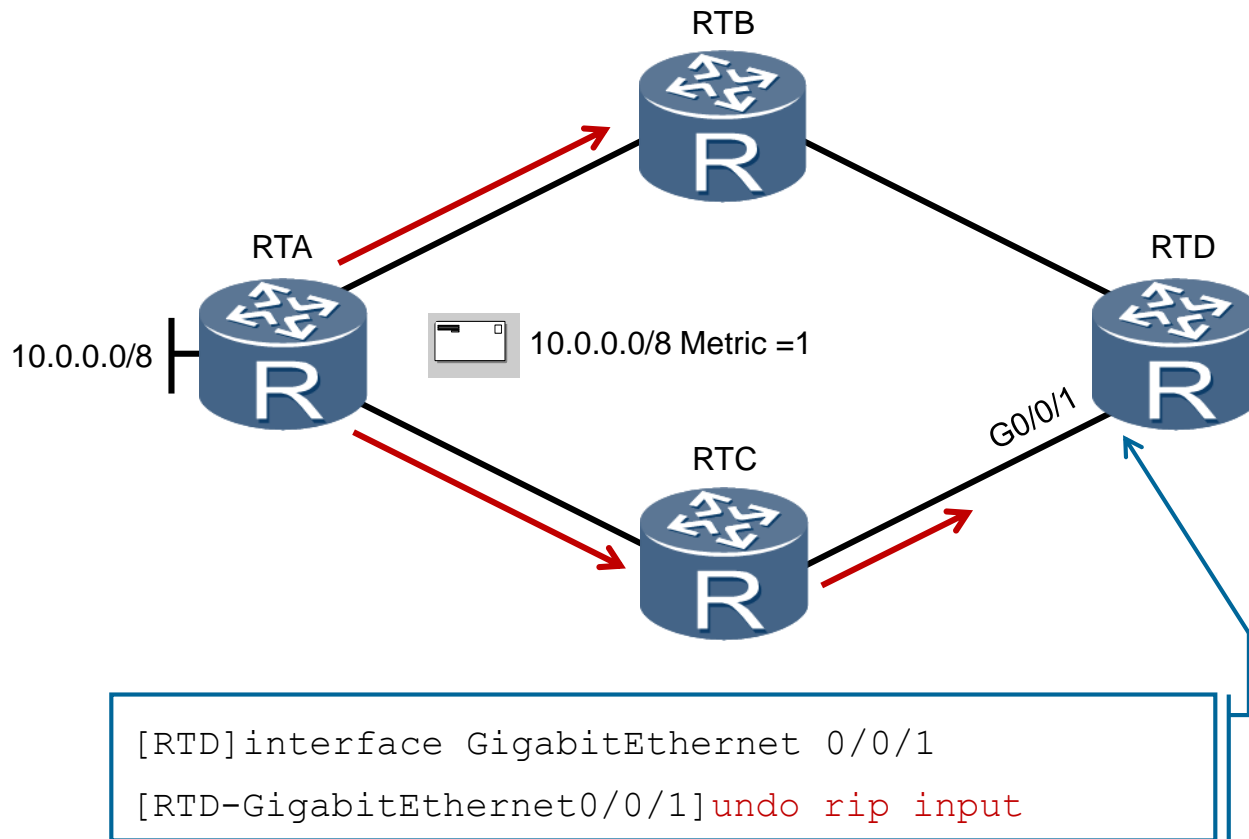
# RIP Output



```
[RTA]interface GigabitEthernet 0/0/0  
[RTA-GigabitEthernet0/0/0]undo rip output
```

- Outbound RIP advertisements restricted on the G0/0/0 interface.

# RIP Input

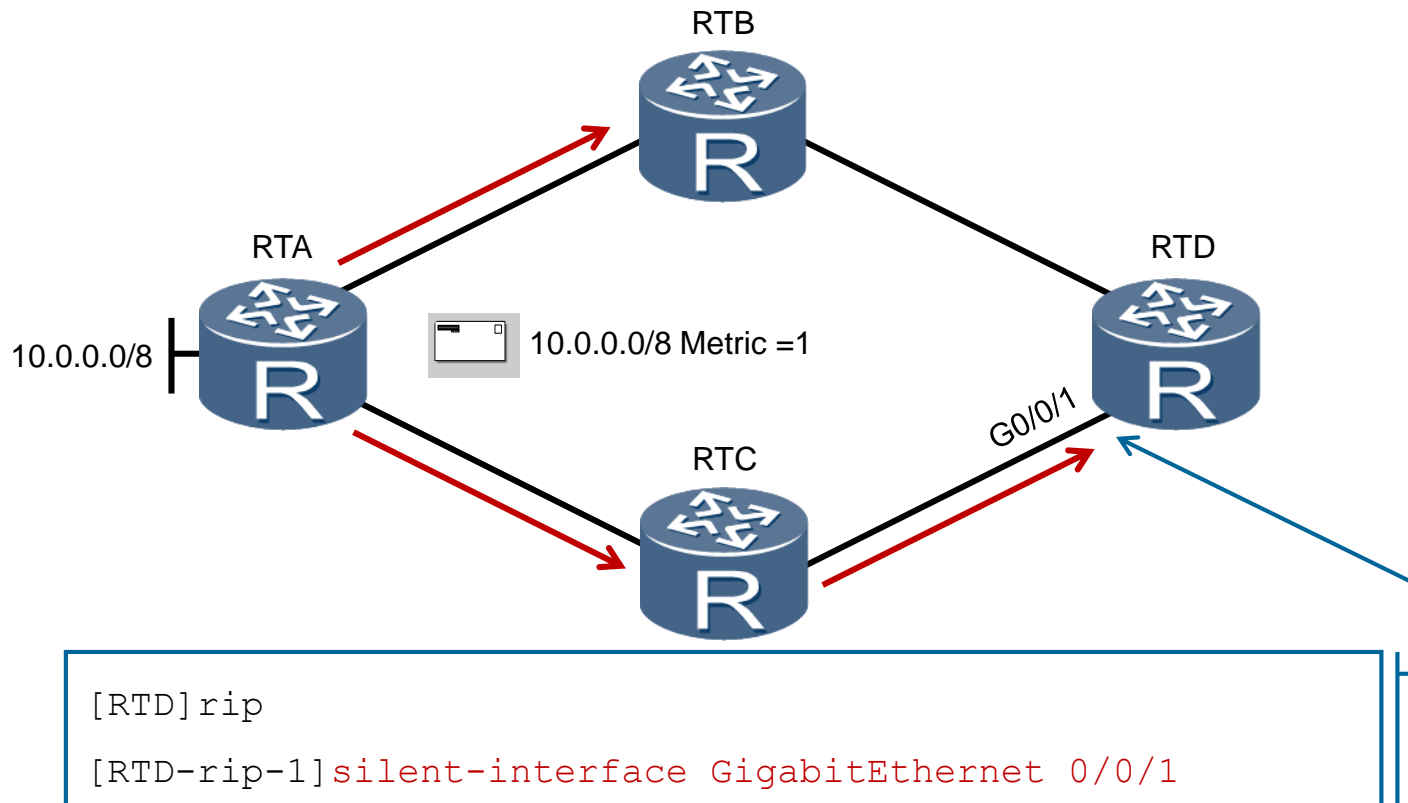


- Inbound RIP advertisements restricted on the G0/0/1 interface.

# Configuration Validation

```
[RTD] display rip 1 interface GigabitEthernet0/0/1 verbose
GigabitEthernet0/0/1(192.168.1.2)
  State           : UP           MTU       : 500
  Metricin        : 1
  Metricout       : 1
  Input           : Disabled      Output   : Enabled
  Protocol        : RIPv2 Multicast
  Send version    : RIPv2 Multicast Packets
  Receive version : RIPv2 Multicast and Broadcast Packets
  Poison-reverse  : Enabled
  Split-Horizon   : Enabled
  Authentication type : None
  Replay Protection : Disabled
```

# Silent Interface



- Interface will not participate in RIP, but will receive RIP routes.
- Takes precedence over *rip input* and *rip output* commands.

# Configuration Validation

```
[RTD] display rip
Public VPN-instance
  RIP process : 1
    RIP version      : 2
    Preference       : 100
    Checkzero        : Enabled
    Default-cost     : 0
    Summary          : Enabled
    Host-route       : Enabled
    Maximum number of balanced paths : 8
    Update time      : 30 sec           Age time : 180 sec
    Garbage-collect time : 120 sec
    Graceful restart : Disabled
    BFD              : Disabled
    Silent-interfaces : GigabitEthernet0/0/1
```



## Summary

- At which point is the metric incremented for advertised routes?
- What configuration is required in order to advertise RIP routes?





**Thank you**  
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