



Distance Vector Routing Protocols

Focus → RIP version 1

Jirasak Sittigorn

Internetworking Standards & Technologies

Department of Computer Engineering, Faculty of Engineering
King Mongkut's Institute of Technology Ladkrabang

Dynamic Routing Protocols

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Classifying Routing Protocols

Routing Protocols Metrics

Administrative Distance of a Route

Distance Vector Routing Protocols

Network Discovery

Routing Table Maintenance

Routing Loops

RIP version 1

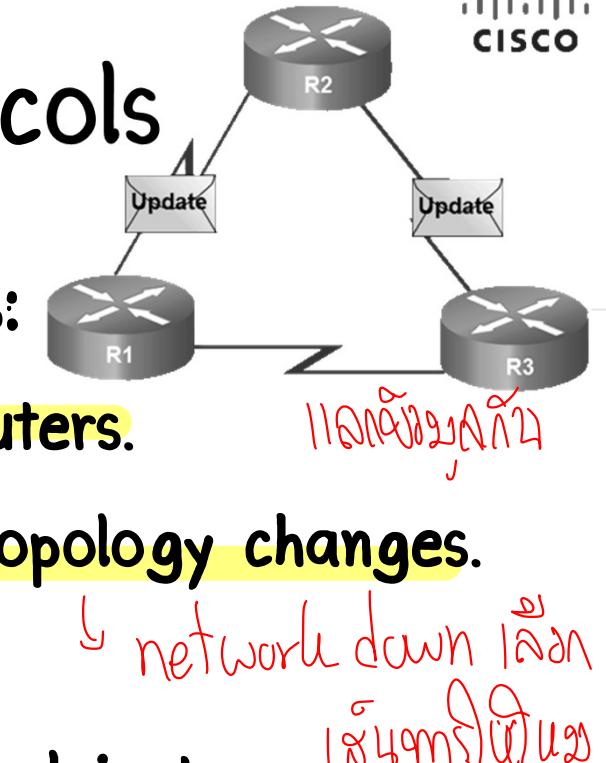
Basic RIPv1 Configuration

Verification and Troubleshooting

Automatic Summarization

Default Route and RIPv1

Dynamic Routing Protocols

- Function(s) of Dynamic Routing Protocols:
 - Dynamically share information between routers.
 - Automatically update routing table when topology changes.
 - Determine best path to a destination.
 - The purpose of a dynamic routing protocol is to:
 - Discover remote networks
 - Maintaining up-to-date routing information
 - Choosing the best path to destination networks
 - Ability to find a new best path if the current path is no longer available
- 
- network down ล้าด
lost connection ลูกูด
- lost connection ลูกูด

Dynamic Routing Protocols

- Components of a routing protocol
 - Algorithm ① → មែនត្រូវពារក្បាល ② → ផ្តល់ជូន routing info
 - In the case of a routing protocol algorithms are used for facilitating routing information and best path determination
 - Routing protocol messages ②
 - These are messages for discovering neighbors and exchange of routing information

Dynamic Routing Protocols

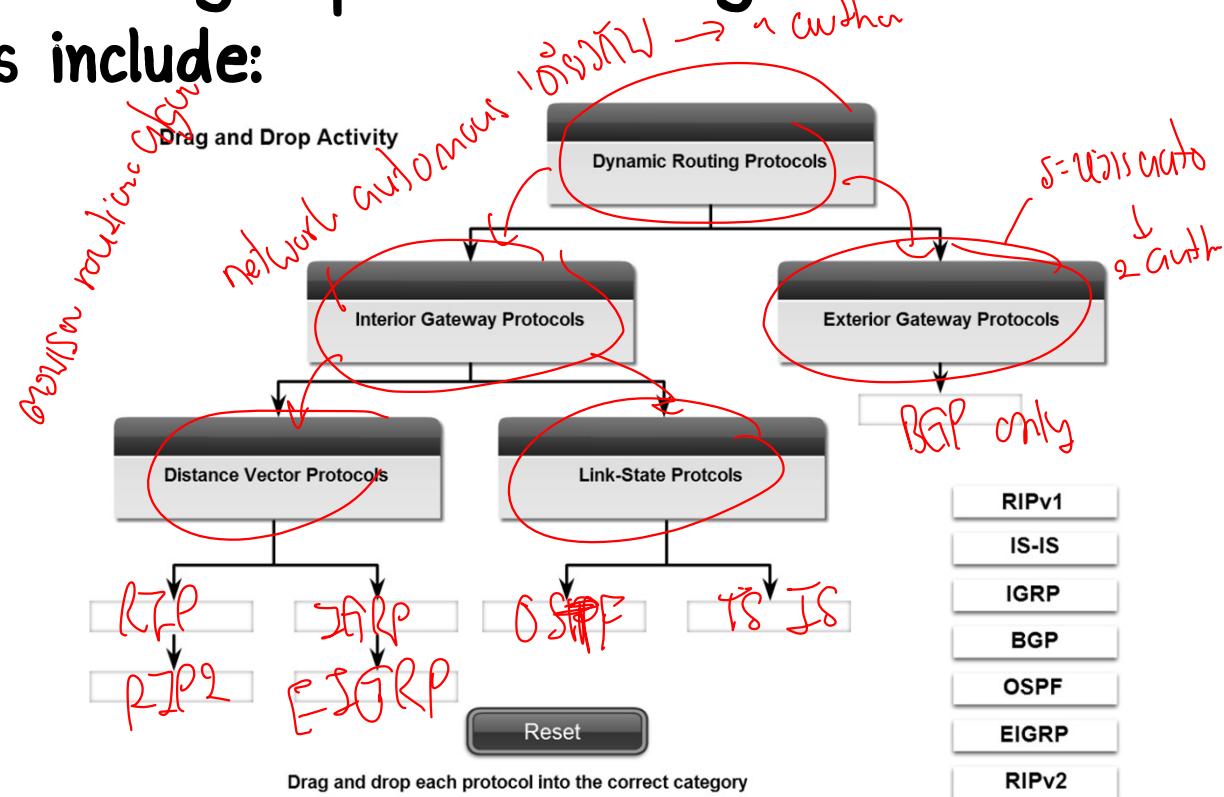
ເຕັກສອນ

	Dynamic routing	Static routing
Configuration Complexity ຄາມຂົ້ນປະຫວັດ	Generally independent of the network size	Increases with network size
Required administrator knowledge	Advanced knowledge required ຕ່າງໆຈະຕໍ່ເຮັດວຽກ	No extra knowledge required admin ເລັກໄສ້ມາກາງ
Topology changes	Automatically adapts to topology changes auto	Administrator intervention required ຕ້ອນຕໍ່ການໃຊ້ມາດ
Scaling	Suitable for simple and complex topologies ແບ່ນທຸລາຍ	Suitable for simple topologies
Security	Less secure	More secure
Resource usage	Uses CPU, memory, link bandwidth ອີເມວິດສິນ	No extra resources needed ຂຶ້ນການໃຊ້ມາດເພື່ອລັດ
Predictability	Route depends on the current topology	Route to destination is always the same

Classifying Routing Protocols

- Dynamic routing protocols are grouped according to characteristics. Examples include:

- RIP
- IGRP
- EIGRP
- OSPF
- IS-IS
- BGP

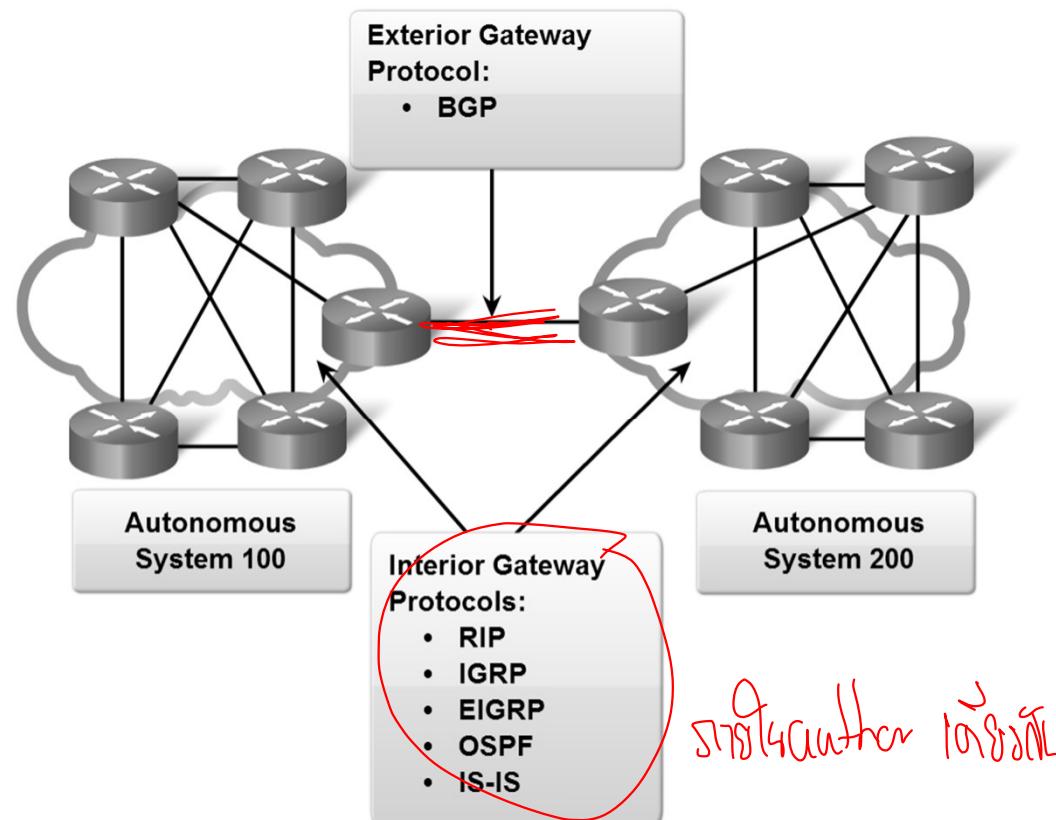


- Autonomous System is a group of routers under the control of a single authority.

Classifying Routing Protocols

- Types of routing protocols:
 - Interior Gateway Protocols (IGP)
 - Exterior Gateway Protocols (EGP)

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Classifying Routing Protocols

- Interior Gateway Protocols (IGP)

- Distance vector

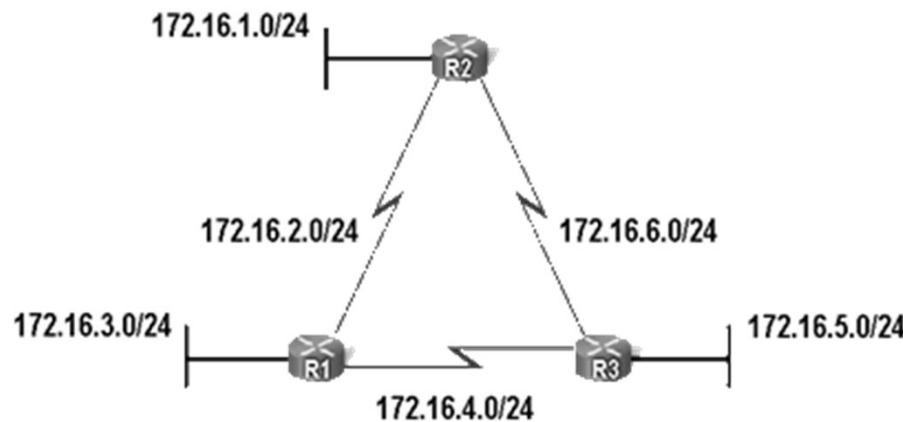
- routes are advertised as vectors of distance & direction.
 - incomplete view of network topology.
 - Generally, periodic updates.

- Link state

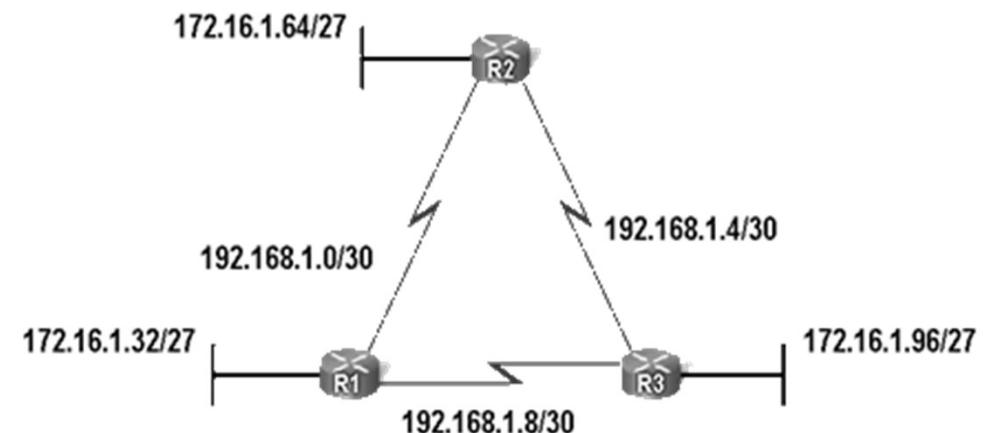
- complete view of network topology is created.
 - updates are not periodic.

Classifying Routing Protocols

- Classifying Routing Protocols *ນັບວິທີ*
 - Classful routing protocols** → sub class also mark(*n*)*H*
 - Do NOT send subnet mask in routing updates
 - Classless routing protocols** *network size ມີມີຫຼາຍ*
 - Do send subnet mask in routing updates.



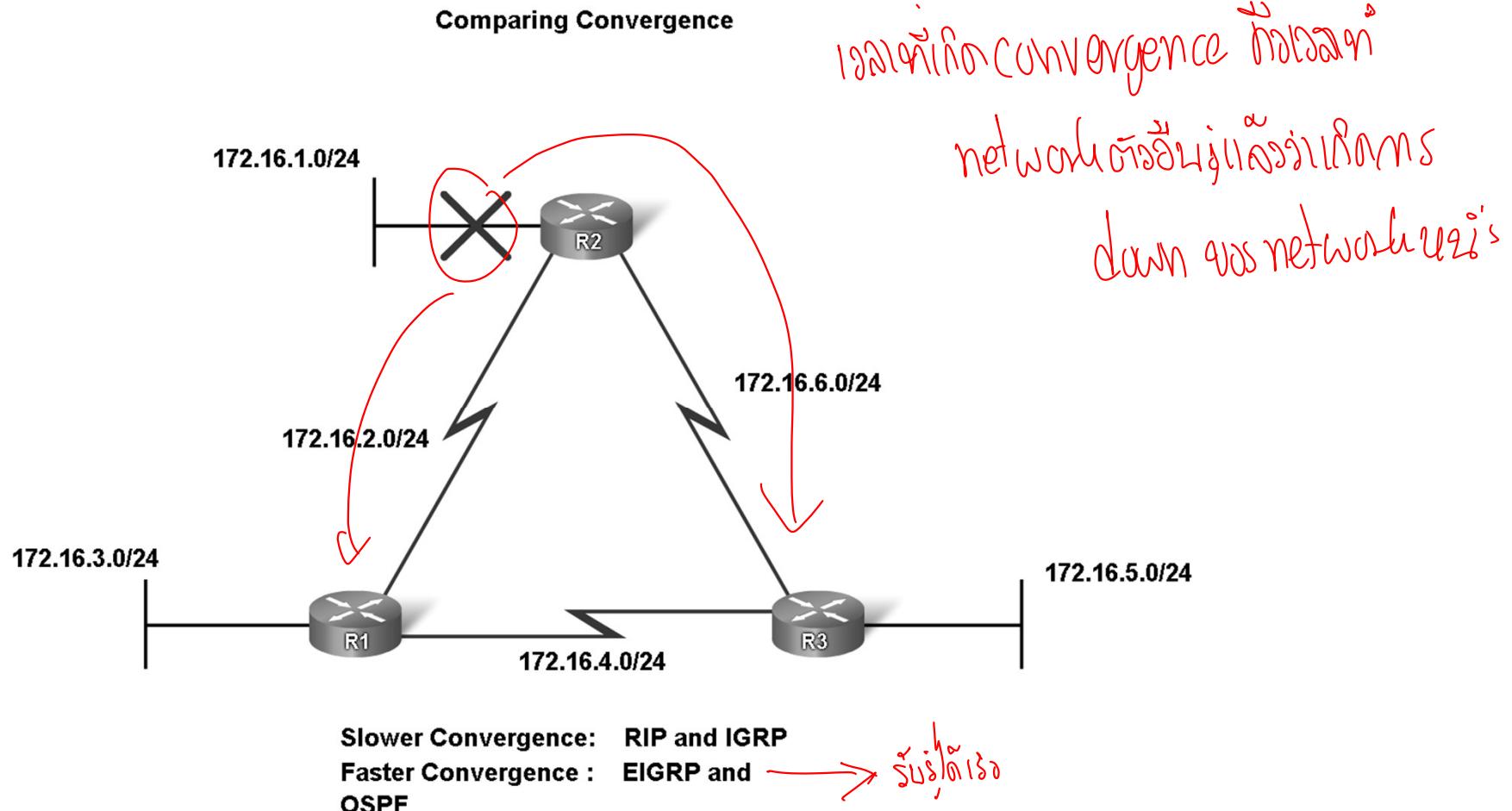
Classful: Subnet mask is the same throughout the topology



Classless: Subnet mask can vary in the topology

Classifying Routing Protocols

- Convergence is defined as when all routers' routing tables are at a state of consistency

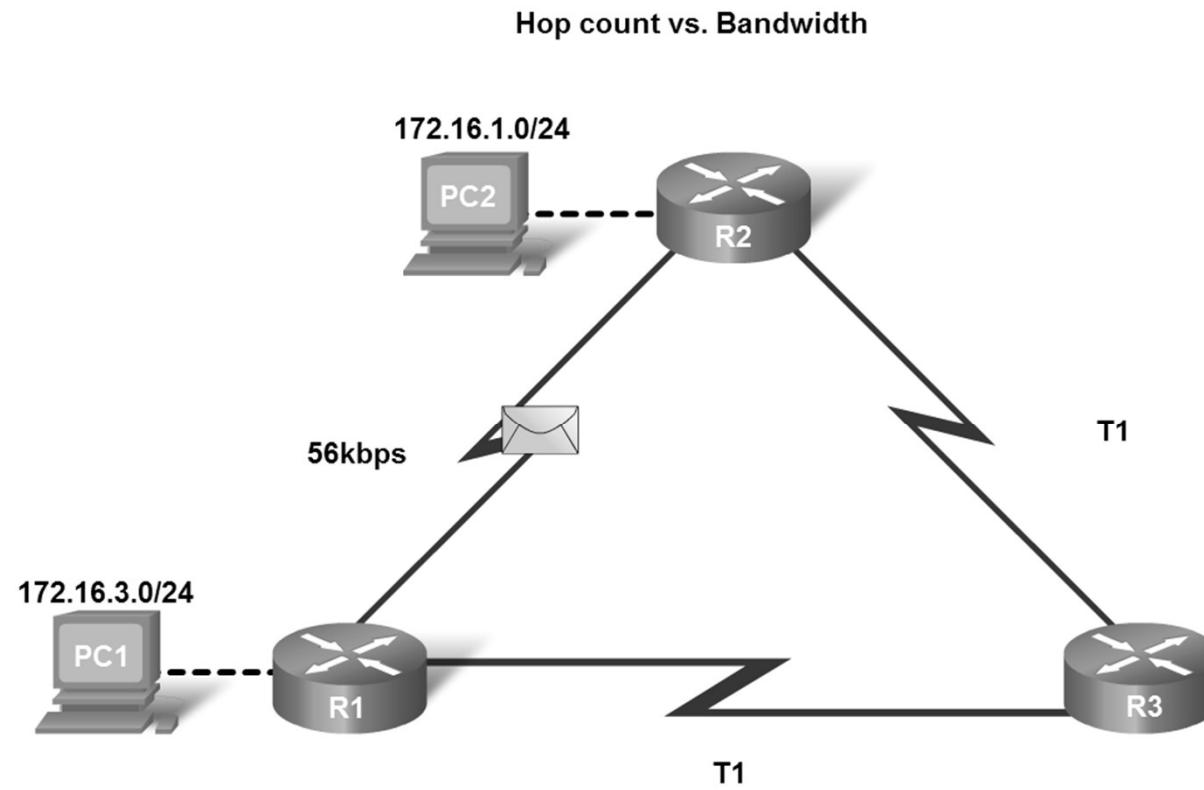


Routing Protocols Metrics

→ თუ მისამართი დენეტ გვამსჭროვი → რი მატრიკი ისწავლა პროტოკოლი

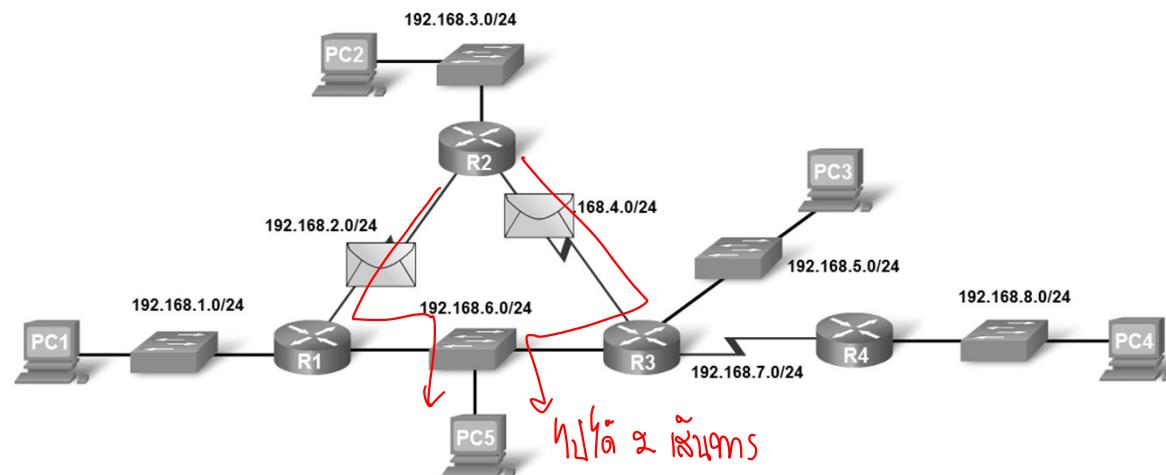
- Metric : A value used by a routing protocol to determine which routes are better than others.

- Hop count
- Bandwidth
- Cost
- Delay
- Load
- Reliability



Routing Protocols Metrics

- Load balancing
 - This is the ability of a router to distribute packets among multiple same cost paths
- Load Balancing Across Equal Cost Paths

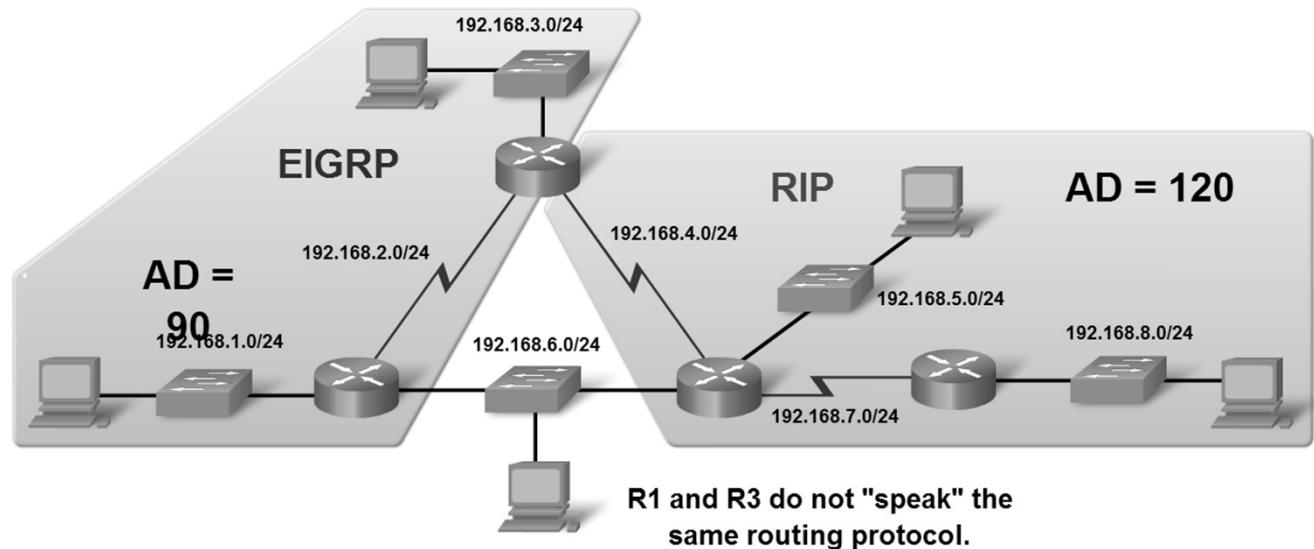


```
R2#show ip route
<output omitted>
R    192.168.6.0/24 [120/1] via 192.168.2.1, 00:00:24, Serial0/0/0
      [120/1] via 192.168.4.1, 00:00:26, Serial0/0/1
} main load balanced
เท่ากัน 2 ms
```

Administrative Distance of a Route

(AD) → តើរបស់ព្រឹកណានា នឹងរួចរាល់

- Purpose of a metric
 - It's a calculated value used to determine the best path to a destination
- Purpose of Administrative Distance
 - It's a numeric value that specifies the preference of a particular route



Administrative Distance of a Route

Default Administrative Distances

Route Source	Administrative Distance
Connected	0
Static	1
EIGRP summary route	5
External BGP	20
Internal EIGRP	90
IGRP	100
OSPF	110
IS-IS	115
External EIGRP	170
Internal BGP	200

Distance Vector Routing Protocols

- Examples of Distance Vector routing protocols:
 - Routing Information Protocol (RIP)
 - Interior Gateway Routing Protocol (IGRP) 
 - Enhanced Interior Gateway Routing Protocol (EIGRP)
- Distance Vector Technology
 - The Meaning of **Distance Vector**:
 - A router using distance vector routing protocols knows 2 things:
 - **Distance to final destination**
 - **Vector, or direction**, traffic should be directed

Distance Vector Routing Protocols

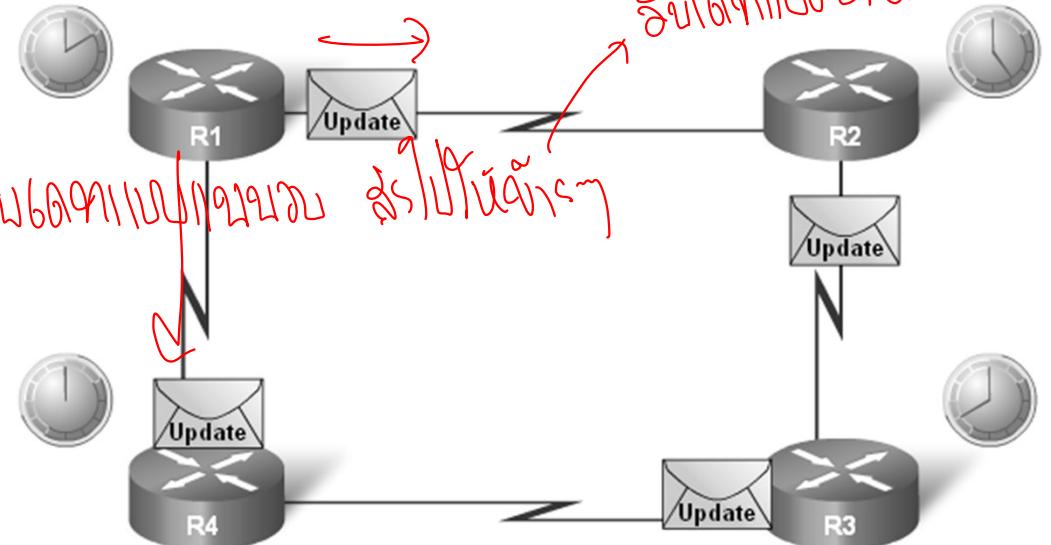
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- Characteristics of Distance Vector routing

- protocols:

- Periodic updates
- Neighbors
- Broadcast updates
- Entire routing table is included with routing update



Distance Vector Routing Protocols

- Routing Protocol Characteristics

- Criteria used to compare routing protocols includes

- Time to convergence เวลาที่โปรแกรมเปลี่ยนแปลง

- Scalability ความสามารถในการขยายตัว

- Resource usage การใช้ทรัพยากรесурс

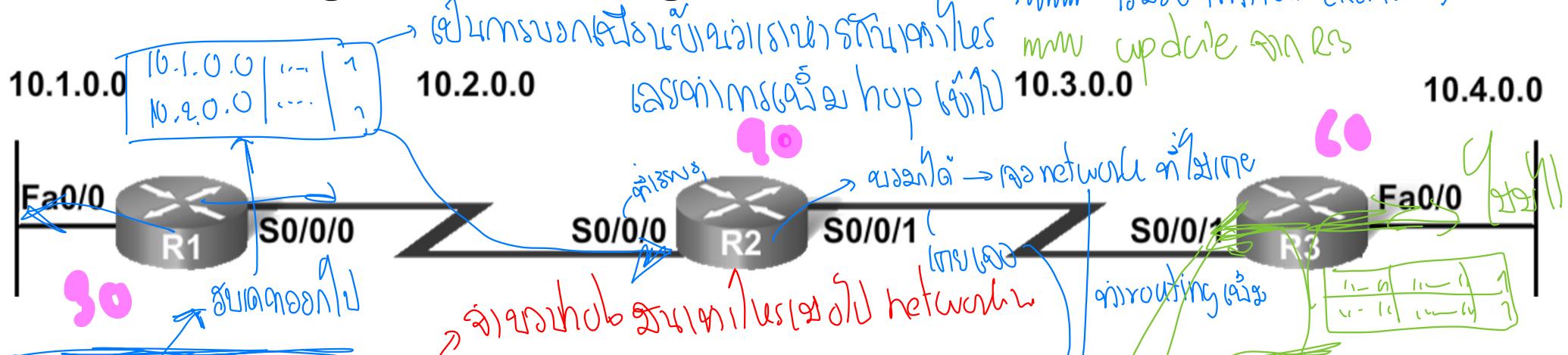
- Implementation & maintenance ง่ายต่อการติดตั้งและบำรุงรักษา

Network Discovery

⑤ stage 팀

မြန်မာစာ အကျဉ်းပို့

- Cold Starts : Router Initial Start Up
 - Initial Exchange of Routing Information
 - Exchange of Routing Information



Network	Interface	Hop
10.1.0.0	Fa0/0	0
10.2.0.0	so1/0/0	0

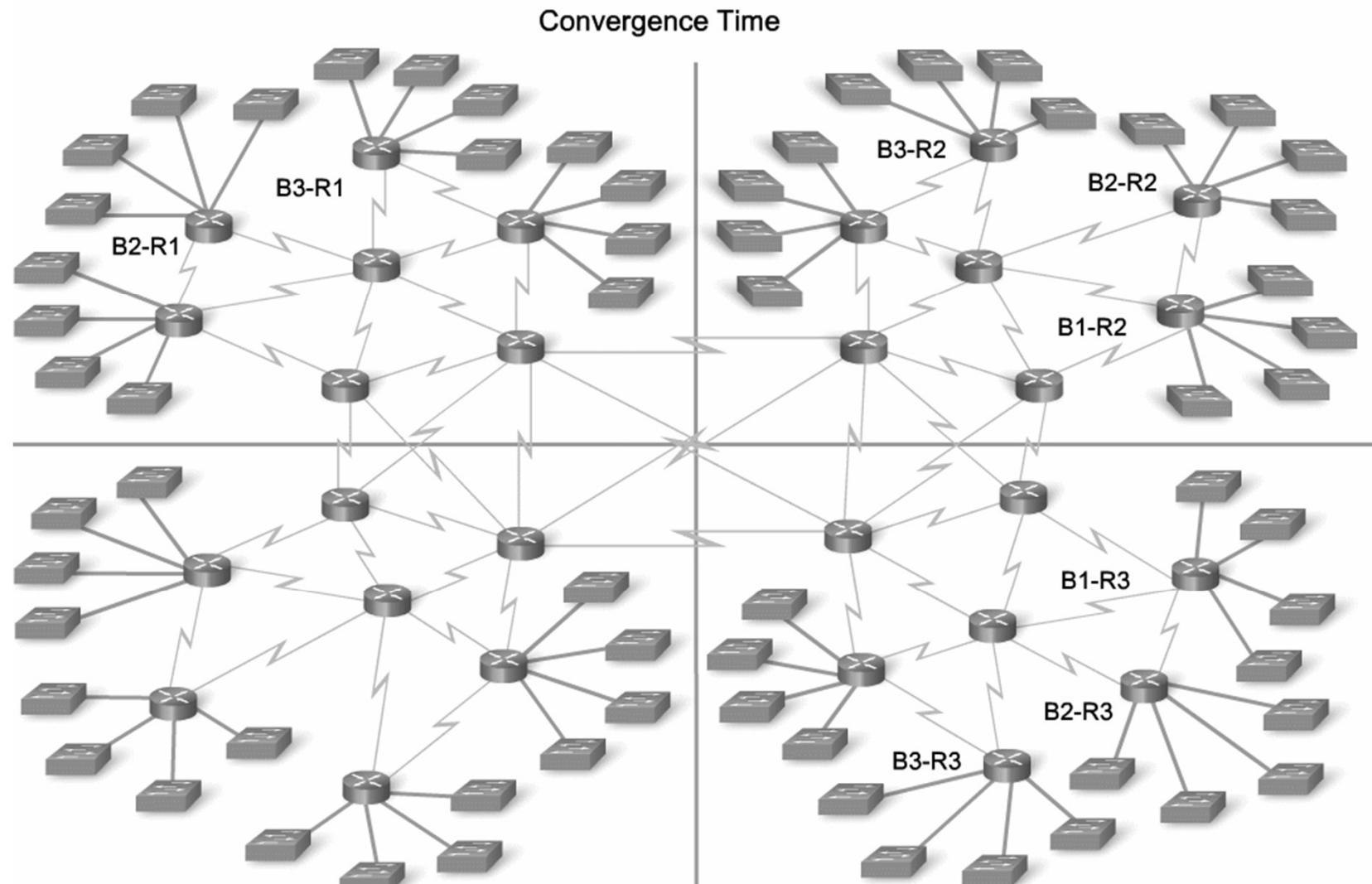
Network	Interface	Hop
10.9.0.0	So1/0/0	0
10.8.0.0	So1/0/1	0
10.1.0.0	So1/0/0	1
10.4.0.0	So1/0/1	1

Network	Interface	Hop
10.9.0.0	E0/0/1	0
10.4.0.0	Fa 0/0	0

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Network Discovery

- Convergence → Time system all network converge



Routing Table Maintenance

on 30 等於 routes info an

- Periodic Updates : **RIP Update timer (default 30)**

— RIP Timers : In addition to the update timer, the IOS implements three additional timers for RIP:

- **Invalid timer (default 180)**
- **Holddown timer (default 180)**
- **Flush timer (default 240)**

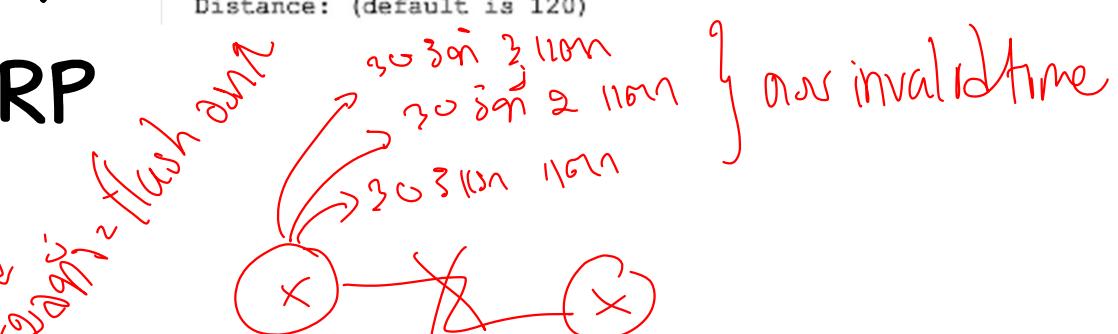
```
R1#show ip protocols
Routing Protocol is "rip"
  Sending updates every 30 seconds, next due in 13 seconds
  Invalid after 180 seconds, hold down 180, flushed after 240
  <output omitted>
  Routing for Networks:
    10.0.0.0
  Routing Information Sources:
    Gateway          Distance      Last Update
    10.3.0.1           120          00:00:27
  Distance: (default is 120)
```

- **Bounded Update : EIGRP**

- Triggered Update

- Random Jitter

update on ←
multiple access
periodic time transmission
→



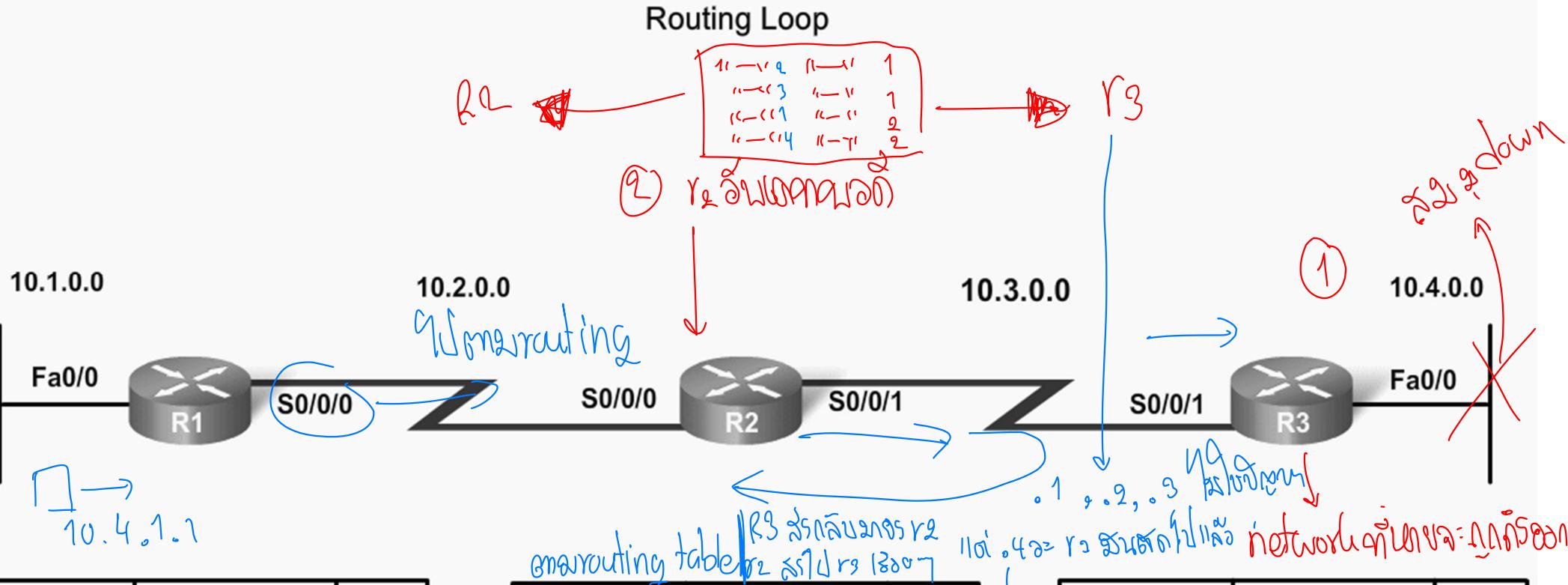
random lamp

Routing Loops

ရန်ကုန်မြို့နယ်၊ ရန်ကုန်မြို့

rum
protozoa

• Definition and Implications



Network	Interface	Hop
10.1.0.0	Fa0/0	0
10.2.0.0	S0/0/0	0
10.3.0.0	S0/0/0	1
10.4.0.0	S0/0/0	2

Network	Interface	Hop
10.2.0.0	S0/0/0	0
10.3.0.0	S0/0/1	0
10.1.0.0	S0/0/0	1
10.4.0.0	S0/0/1	1

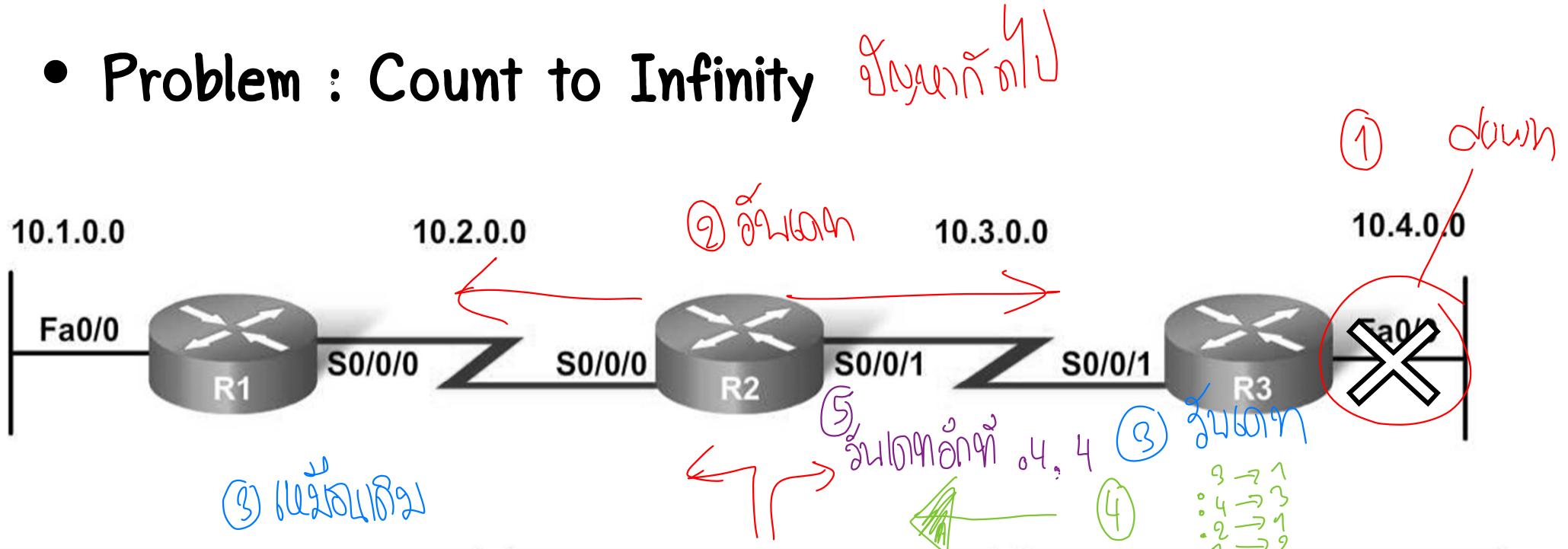
Network	Interface	Hop
10.3.0.0	S0/0/1	0
10.4.0.0	Fa0/0	0
10.2.0.0	S0/0/1	1
10.1.0.0	S0/0/1	2

Routing Loops

- The loop may be a result of:
- A routing loop can create the following conditions:

Routing Loops

- ## • Problem : Count to Infinity



Network	Interface	Hop
10.1.0.0	Fa0/0	0
10.2.0.0	S0/0/0	0
10.3.0.0	S0/0/0	1
10.4.0.0	S0/0/0	2

Network	Interface	Hop
10.2.0.0	S0/0/0	0
10.3.0.0	S0/0/1	0
10.1.0.0	S0/0/0	1
10.4.0.0	S0/0/1	1

Network	Interface	Hop
10.3.0.0	S0/0/1	0
10.4.0.0	Fa/0/1	1
10.2.0.0	S0/0/1	1
10.1.0.0	S0/0/1	2

ବାଗକୁଳରୁଷିଯା=ଭାରତୀୟଙ୍କୁ ପରେଣ୍ଟ ଦିନ inf

↓
ជាមួយ 4 នៃ hop = 3 ទីបាន=ម៉ោងចុះត្រូវក្នុង ms update
នៃ នាក់ interface តើខ្លួន

Routing Loops

ରୋସିଙ୍ ଲୁପ୍ସ

- Setting a Maximum ୧୫ହେମ୍ୟୁମ୍ପୁର୍ବୁନ୍ଦୁ କୁଟ୍ଟିଏଇ୍ଫ୍ଫୁନ୍ଦୁ ନେଟ୍ୱୁର୍କୁନ୍ଦୁ ଡାଉନ୍ଗ୍ରାନ୍ତିକ୍ଷମାନ୍ଦୁ
- RIP defines infinity as 16 hops - an "unreachable" metric.
Once the routers "count to infinity," they mark the route as unreachable.



Network	Interface	Hop
10.1.0.0	Fa0/0	0
10.2.0.0	S0/0/0	0
10.3.0.0	S0/0/0	1
10.4.0.0	S0/0/0	16

Network	Interface	Hop
10.2.0.0	S0/0/0	0
10.3.0.0	S0/0/1	0
10.1.0.0	S0/0/0	1
10.4.0.0	S0/0/1	16

Network	Interface	Hop
10.3.0.0	S0/0/1	0
10.4.0.0	S0/0/1	16
10.2.0.0	S0/0/1	1
10.1.0.0	S0/0/1	2

Routing Loops

လျှပ်စီးနည်းလမ်းကြောင်း

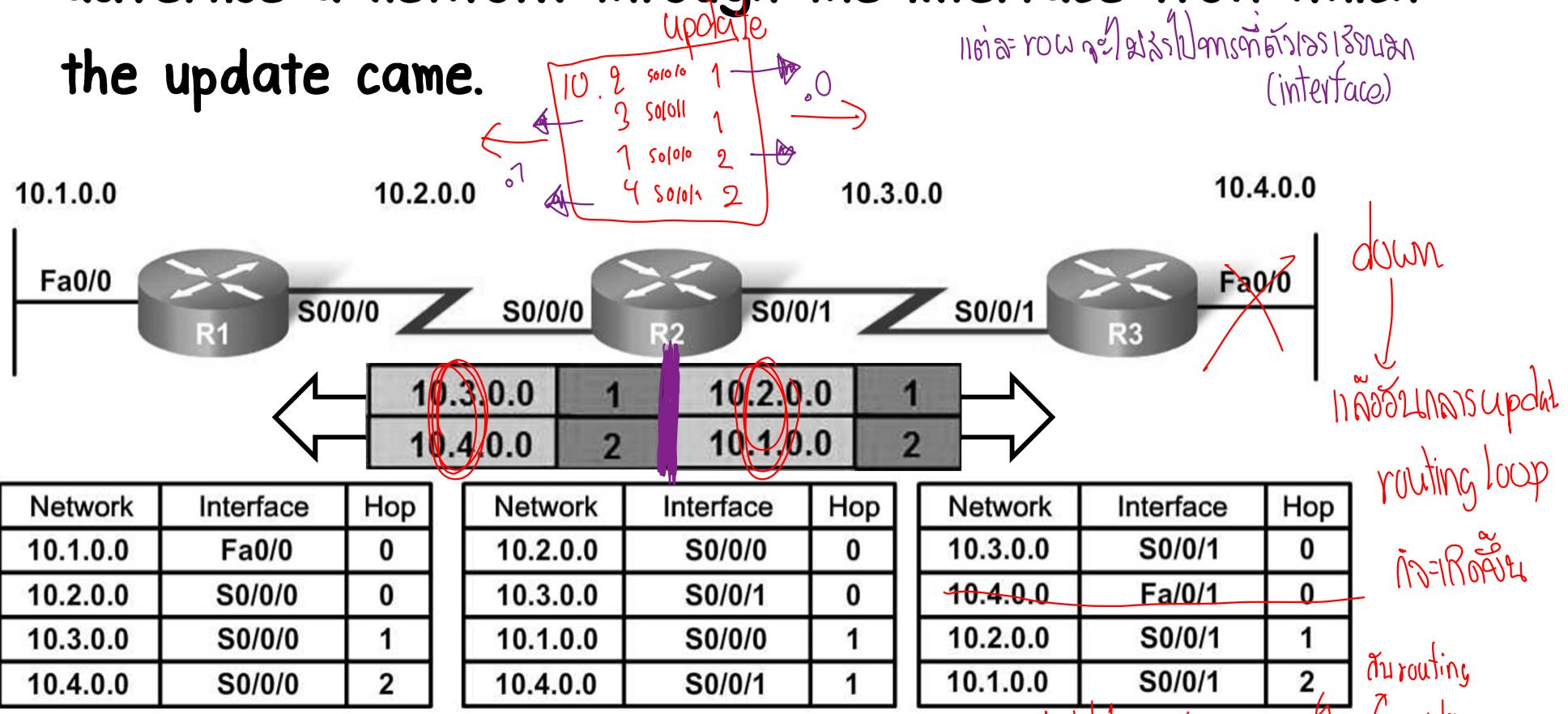
ပုံစံအသိပေါ်

- Preventing Routing Loop with Holddown Timers
 - Holddown timers instruct routers to hold any changes that might affect routes for a specified period of time. If a route is identified as down or possibly down, any other information for that route containing the same status, or worse, is ignored for a predetermined amount of time (the holddown period).

Routing Loops

- Split Horizon Rule

— The split horizon rule says that a router should not advertise a network through the interface from which the update came.



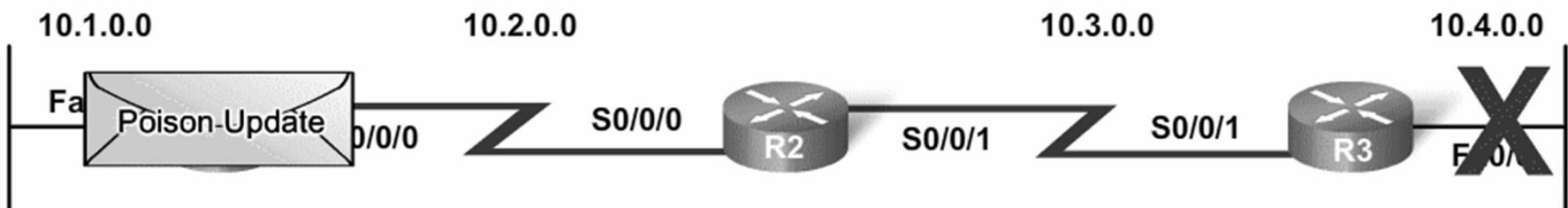
Routing Loops

- Route Poisoning

ក្រឡិន down តាម set នឹង unreachable នៃផែន router

- Route poisoning is used to mark the route as unreachable in a routing update that is sent to other routers.

Network is converged on “poisoned” route.



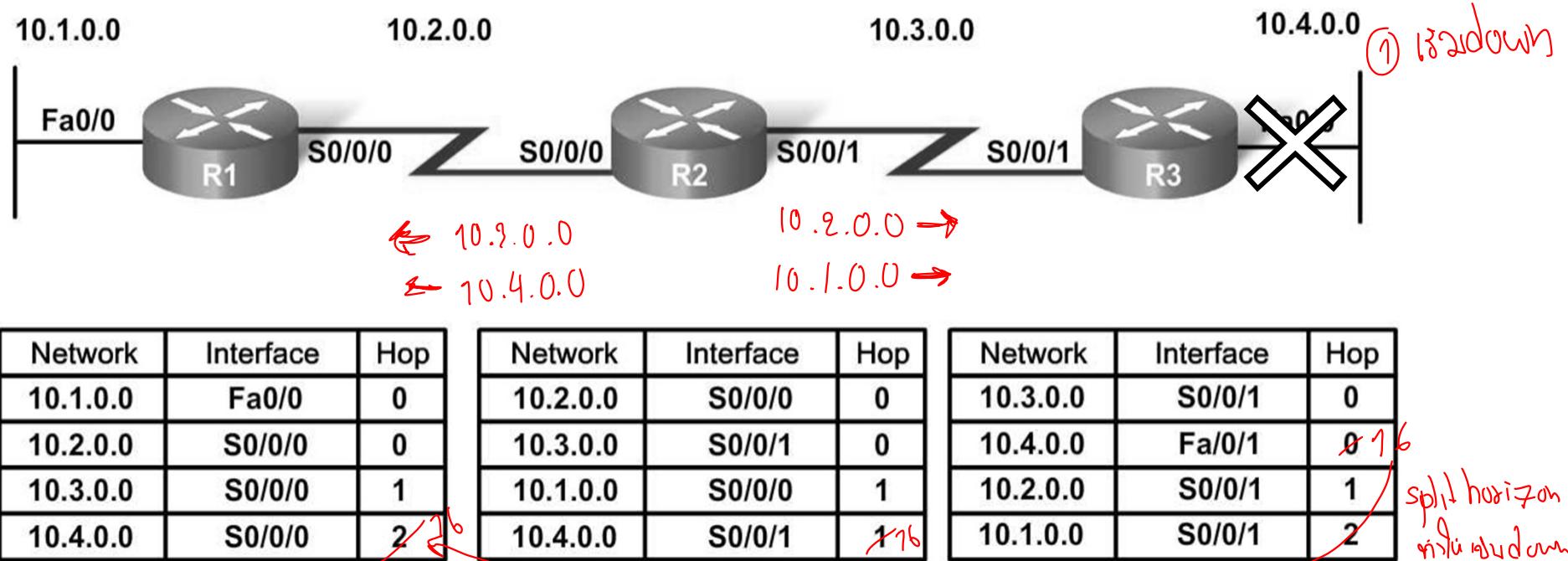
Network	Interface	Hop
10.1.0.0	Fa0/0	0
10.2.0.0	S0/0/0	0
10.3.0.0	S0/0/0	1
10.4.0.0	S0/0/0	16

Network	Interface	Hop
10.2.0.0	S0/0/0	0
10.3.0.0	S0/0/1	0
10.1.0.0	S0/0/0	1
10.4.0.0	S0/0/1	16

Network	Interface	Hop
10.3.0.0	S0/0/1	0
10.4.0.0	Fa0/0	16
10.2.0.0	S0/0/1	1
10.1.0.0	S0/0/1	2

Routing Loops

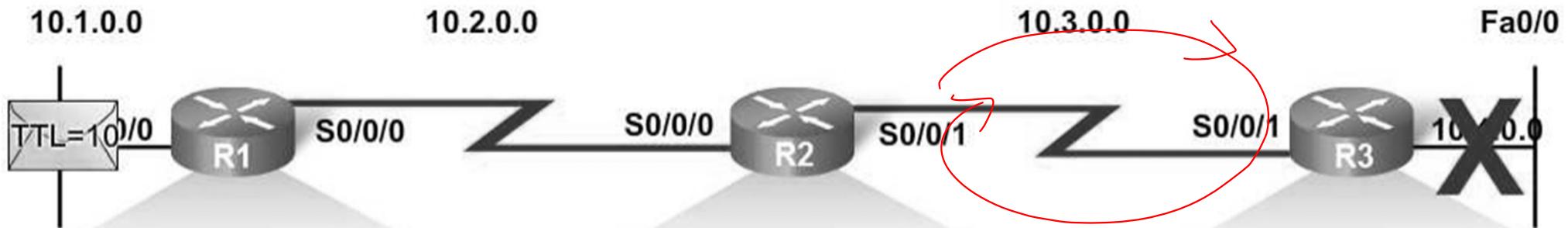
- Split horizon with poison reverse ມີຄະດີກົດໝາຍ
 - The rule for split horizon with poison reverse states when sending updates out a specific interface, designate any networks that were learned on that interface as unreachable.



Routing Loops

- IP & TTL

- Time to Live (TTL) is an 8-bit field in the IP header that limits the number of hops a packet can traverse through the network before it is discarded.



Network	Interface	Hop
10.1.0.0	Fa0/0	0
10.2.0.0	S0/0/0	0
10.3.0.0	S0/0/0	1
10.4.0.0	S0/0/0	4

Network	Interface	Hop
10.2.0.0	S0/0/0	0
10.3.0.0	S0/0/1	0
10.4.0.0	S0/0/0	1
10.1.0.0	S0/0/1	3

Network	Interface	Hop
10.3.0.0	S0/0/1	0
10.4.0.0	S0/0/1	2
10.2.0.0	S0/0/1	1
10.1.0.0	S0/0/1	2

RIP & IGRP & EIGRP

Distance Vector Routing Protocols Compared

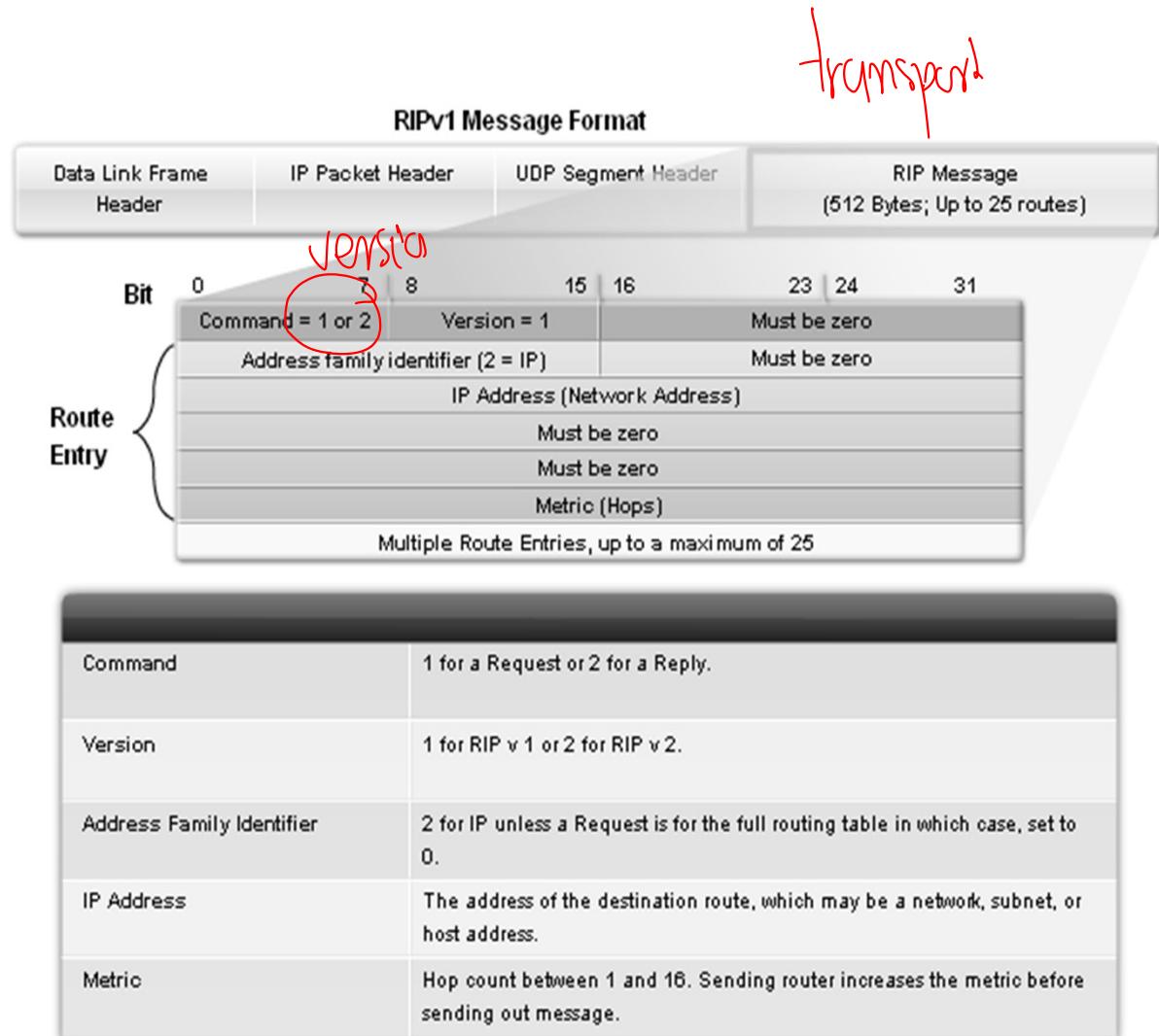
	RIPv1	RIPv2	IGRP	EIGRP
Speed of Convergence				
Scalability - size of network				
Use of VLSM	?	Y	?	Y
Resource usage				
Implementation and maintenance				
Slow				
Fast				
Low				
Medium				
High				
Small				
Large				
Simple				
Complex				
Yes				
No				

RIP version 1

- RIP Characteristics
 - A classful, Distance Vector (DV) routing protocol
 - Metric = hop count
 - Routes with a hop count > 15 are unreachable
 - Updates are broadcast every 30 seconds

RIP version 1

- RIP Message Format
- RIP header - divided into 3 fields
 - Command field
 - Version field
 - Must be zero
- Route Entry - composed of 3 fields
 - Address family identifier
 - IP address
 - Metric



RIP version 1

- RIP Operation
 - RIP uses 2 message types: *ডোবল*
 - Request message
 - This is sent out on startup by each RIP enabled interface
 - Requests all RIP enabled neighbors to send routing table
 - Response message
 - Message sent to requesting router containing routing table

RIP version 1

- IP addresses initially divided into classes
 - Class A
 - Class B
 - Class C
- RIP is a classful routing protocol
 - Does not send subnet masks in routing updates

Default Subnet Masks for Address Classes

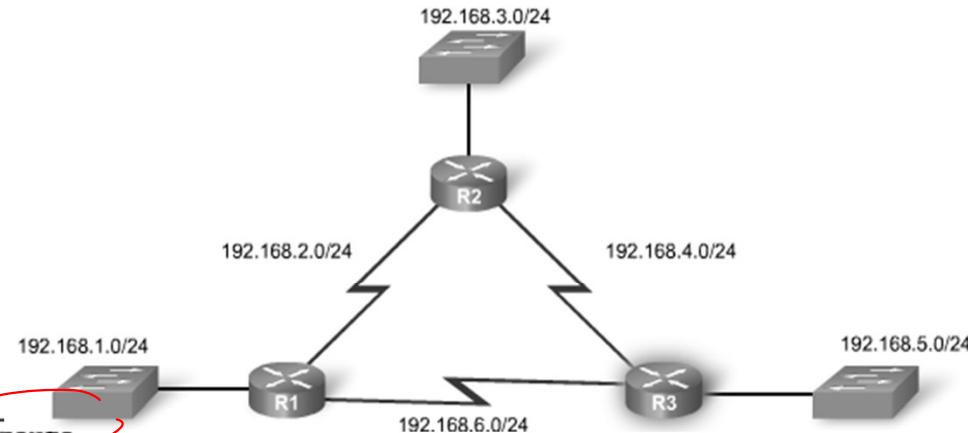
	8 bits	8 bits	8 bits	8 bits
Class A:	Network	Host	Host	Host
	255 . 0 . 0 . 0			
Class B:	Network	Network	Host	Host
	255 . 255 . 0 . 0			
Class C:	Network	Network	Network	Host
	255 . 255 . 255 . 0			

Class A Address Range: 1.0.0.0 to 126.255.255.255
 Class B Address Range: 128.0.0.0 to 191.255.255.255
 Class C Address Range: 192.0.0.0 to 223.255.255.255

RIP version 1

- Administrative Distance
 - RIP's default administrative distance is 120

Verifying Administrative Distance



```
R3#show ip route
Codes: C - connected, S - static, I - IGRP, R - RIP, M - mobile, B - BGP
        D - EIGRP, EX - EIGRP external, O - OSPF, IA - OSPF inter area
        N1 - OSPF NSSA external type 1, N2 - OSPF NSSA external type 2
        E1 - OSPF external type 1, E2 - OSPF external type 2, E - EGP
        i - IS-IS, L1 - IS-IS level-1, L2 - IS-IS level-2, ia - IS-IS inter
        * - candidate default, U - per-user static route, o - ODR
        P - periodic downloaded static route

Gateway of last resort is not set

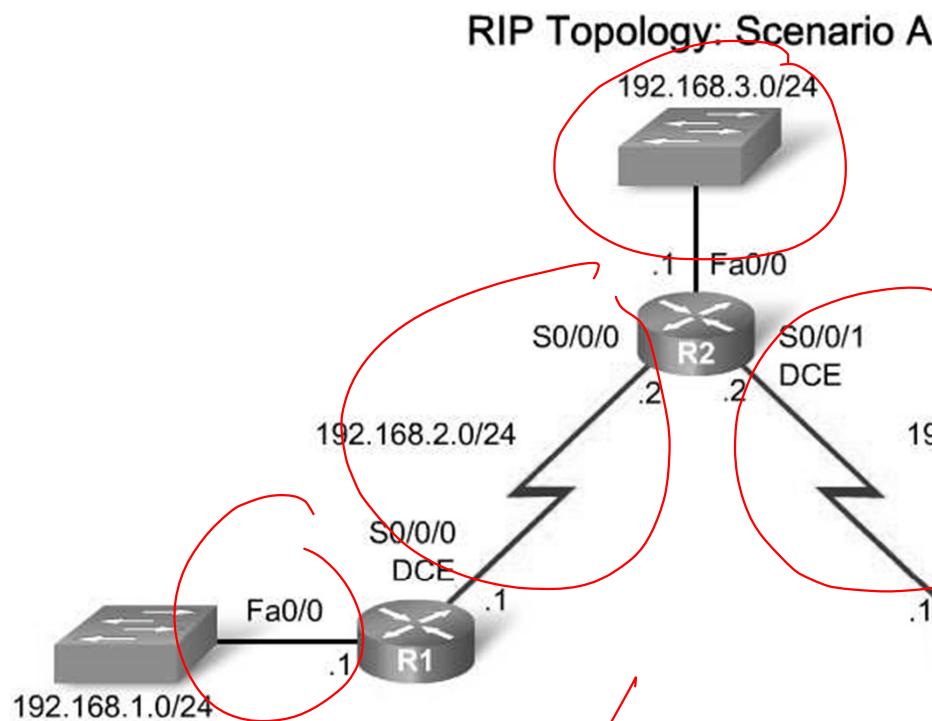
R  192.168.1.0/24 [120/1] via 192.168.6.2, 00:00:05, Serial0/0/0
R  192.168.2.0/24 [120/1] via 192.168.6.2, 00:00:05, Serial0/0/0
R  192.168.3.0/24 [120/1] via 192.168.4.2, 00:00:05, Serial0/0/1
C  192.168.4.0/24 is directly connected, Serial0/0/1
C  192.168.5.0/24 is directly connected, FastEthernet0/0
C  192.168.6.0/24 is directly connected, Serial0/0/0
```

road to a banan

```
R3#show ip protocols
Routing Protocol is "rip"
<output omitted>
Redistributing: rip
Default version control: send version 1, receive any version
  Interface          Send  Recv  Triggered RIP  Key-chain
    FastEthernet0/0      1      1 2
    Serial0/0/0         1      1 2
    Serial0/0/1         1      1 2
Automatic network summarization is in effect
Routing for Networks:
  192.168.4.0
  192.168.5.0
  192.168.6.0
Routing Information Sources:
  Gateway          Distance      Last Update
  192.168.6.2          120          00:00:10
  192.168.4.2          120          00:00:18
Distance: (default is 120)
```

Basic RIPv1 Configuration

- A typical topology suitable for use by RIPv1 :



subnet mask (on)

① on basic configure

Addressing Table: Scenario A

Device	Interface	IP Address	Subnet Mask
R1	Fa0/0	192.168.1.1	255.255.255.0
	S0/0/0	192.168.2.1	255.255.255.0
R2	Fa0/0	192.168.3.1	255.255.255.0
	S0/0/1	192.168.4.2	255.255.255.0
R3	Fa0/0	192.168.5.1	255.255.255.0
	S0/0/1	192.168.4.1	255.255.255.0

Basic RIPv1 Configuration

- Basic Settings on a Router
- Router RIP Command

— Specifying Networks

```
R1(config)#router rip
R1(config-router)#network 192.168.1.0
R1(config-router)#network 192.168.2.0
```

network

```
R2(config)#router rip
R2(config-router)#network 192.168.2.0
R2(config-router)#network 192.168.3.0
R2(config-router)#network 192.168.4.0
```

```
R3(config)#router rip
R3(config-router)#network 192.168.4.0
R3(config-router)#network 192.168.5.0
```

```
R1#conf t
Enter configuration commands, one per line. End with CTRI-D or Ctrl-Z.
R1(config)#router ?
      bgp          Border Gateway Protocol (BGP)
      egp          Exterior Gateway Protocol (EGP)
      eigrp         Enhanced Interior Gateway Protocol (EIGRP)
      igrp          Interior Gateway Routing Protocol (IGRP)
      isis          ISO IS-IS
      iso-igrp     IGRP for OSI networks
      mobile        Mobile routes
      odr           On Demand stub Routes
      ospf          Open Shortest Path First (OSPF)
      rip           Routing Information Protocol (RIP)
```

```
R1(config)#router rip
R1(config-router)#

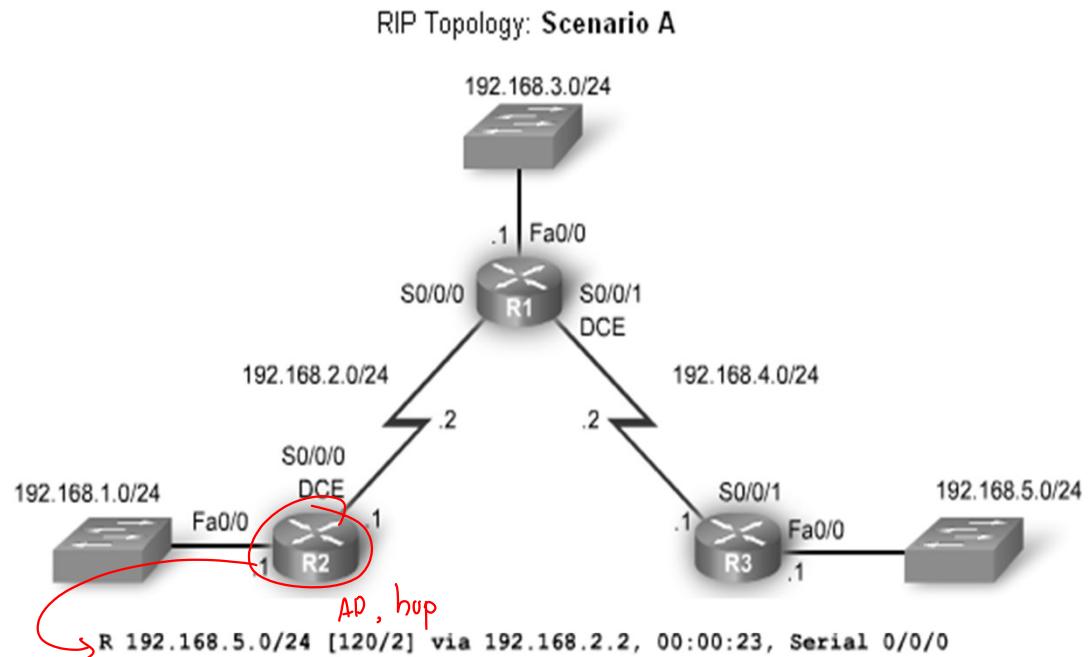
```

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Verification and Troubleshooting

- Use the following commands:

show running-config
show ip route
show ip protocols
debug ip rip



Interpreting a RIP Route in the Routing Table	
R	Identifies the source of the route as RIP.
192.168.5.0	Indicates the address of the remote network.
/24	The subnet mask used for this network
[120/2]	The administrative distance (120) and the metric (2 hops)
via 192.168.2.2	Specifies the address of the next-hop router (R2) to send traffic to for the remote network.
00:00:23	Specifies the amount of time since the route was updated (here, 23 seconds). Another update is due in 7 seconds.
Serial0/0/0	192.168.4.2

Verification and Troubleshooting

- Use the following commands:

show running-config

show ip route

show ip protocols

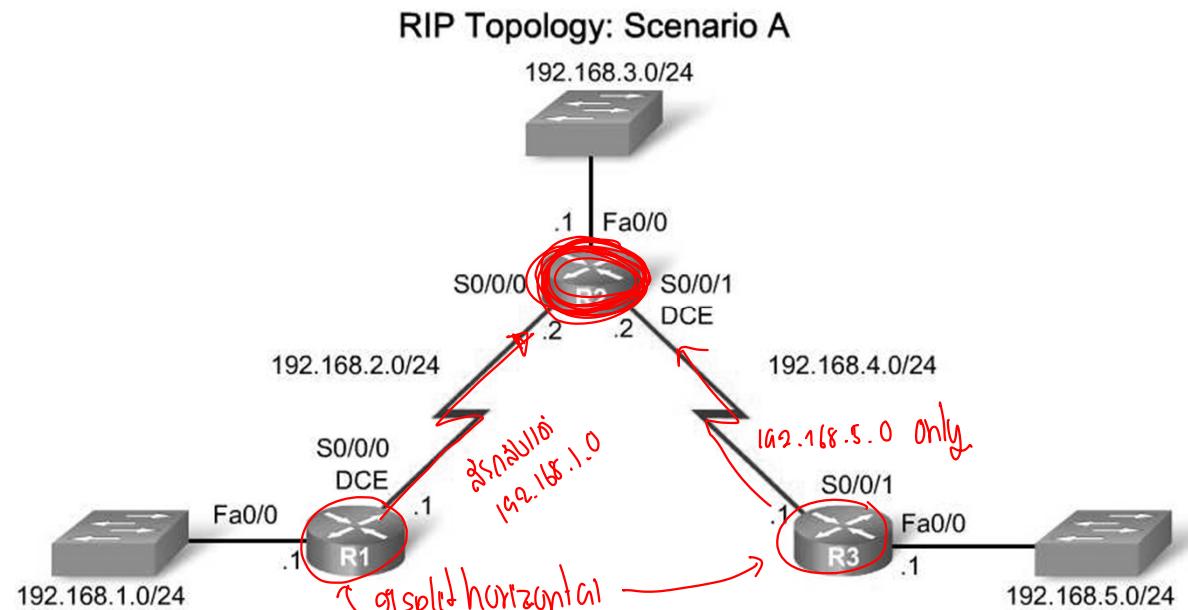
debug ip rip

```
R2#show ip protocols
Routing Protocol is "rip"
  Sending updates every 30 seconds, next due in 23 seconds
  Invalid after 180 seconds, hold down 180, flushed after 240
  Outgoing update filter list for all interfaces is not set
  Incoming update filter list for all interfaces is not set
  Redistributing: rip
  Default version control: send version 1, receive any version
    Interface          Send   Recv   Triggered RIP  Key-chain
    FastEthernet0/0     1       1 2
    Serial0/0/0         1       1 2
    Serial0/0/1         1       1 2
  Automatic network summarization is in effect
  Maximum path: 4
  Routing for Networks:
    192.168.2.0
    192.168.3.0
    192.168.4.0
  Routing Information Sources:
    Gateway          Distance      Last Update
    192.168.2.1        120          00:00:18
    192.168.4.1        120          00:00:22
    Distance: (default is 120)
  Shows which routing processes are enabled
  Timers currently in use including when the next
  update will be sent out by this router (23 seconds)
  CCRIP-level topics include:
    - Filtering what updates this router will send and receive
    - Redistributing: rip means that this router is sending and receiving only RIP.
  Shows which interfaces are currently sending and receiving
  RIP updates as well as which RIP version.
  - Automatic summarization in effect means this router is summarizing to the classful network boundary.
  - Maximum paths specifies how many equal-cost routes RIP will use to send traffic to the same destination.
  Routing for Networks displays the classful network address configured in RIP
  router configuration mode.
  - Routing Information Sources are the RIP neighbors this router is currently receiving updates from.
  - Includes next-hop IP address, the AD, and when the last update was received.
  - Last line shows the AD for this router.
```

} command in config

Verification and Troubleshooting

- Use the following commands:
- show running-config**
show ip route
show ip protocols
debug ip rip



```

R2#debug ip rip
RIP protocol debugging is on
RIP: received v1 update from 192.168.2.1 on Serial0/0/0 - R2 receives an update from R1 advertising the R1's directly connected LAN.
      192.168.1.0 in 1 hops
RIP: received v1 update from 192.168.4.1 on Serial0/0/1 - R2 receives an update from R3 advertising the R3's directly connected LAN.
      192.168.5.0 in 1 hops
RIP: sending v1 update to 255.255.255.255 via FastEthernet0/0 (192.168.3.1)
RIP: build update entries                                broadcast - R2 sends an update out Fa0/0 to all networks in the routing table except the network attached
      network 192.168.1.0 metric 2
      network 192.168.2.0 metric 1
      network 192.168.4.0 metric 1
      network 192.168.5.0 metric 2
      →ส่งเฉพาะท้องที่ only
RIP: sending v1 update to 255.255.255.255 via Serial0/0/1 (192.168.4.2)
RIP: build update entries
      network 192.168.1.0 metric 2
      network 192.168.2.0 metric 1
      network 192.168.3.0 metric 1
      →ส่งเฉพาะท้องที่ only
      - R2 sends an update out S0/0/1 to R3. Included in the update are R1's LAN, the WAN between R1 and R2, and R2's LAN.
      - Note that split horizon is in effect. R2 does not advertise the R3 LAN back to R3.
RIP: sending v1 update to 255.255.255.255 via Serial0/0/0 (192.168.2.2)
RIP: build update entries
  
```

Verification and Troubleshooting

- Passive interface command

- Used to prevent a router from sending updates through an interface

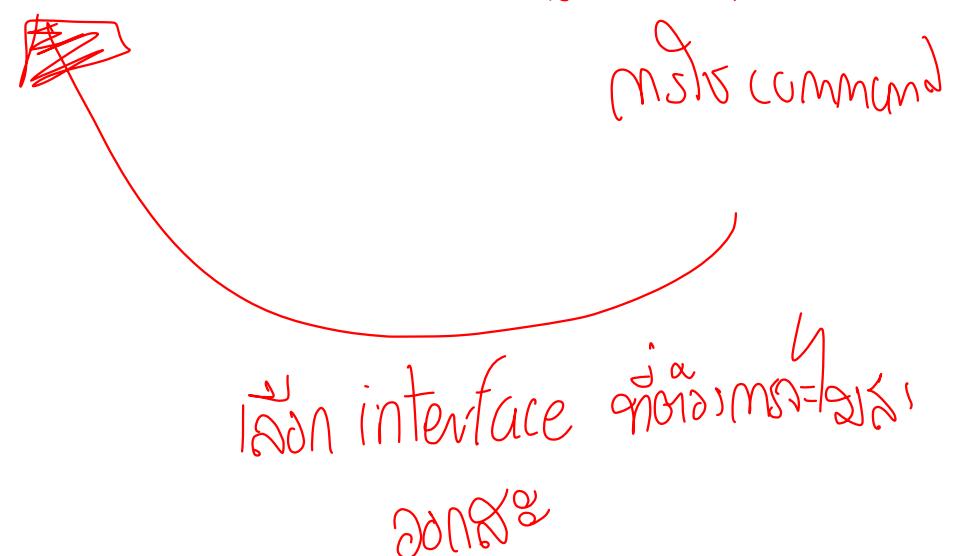
```
Router(config-router)#passive-interface  
interface-type interface-number
```

ក្នុងព័ត៌មានលក្ខណនា Router នេះ Update ចិញ្ចាត់ទៀត
នូវការប្រគល់ព័ត៌មាន នៃវិសោធន៍យោង

តើវាមានឯកសារពី IP នៃ
Update នេះ

រាយការណាន់របស់
ក្រសួង (Ministry)

ក្រសួង (Ministry)



Verification and Troubleshooting

• Passive interface command

ଓড়োসি

```
R2(config)#router rip
R2(config-router)#passive-interface FastEthernet 0/0
R2(config-router)#end
R2#show ip protocols → ৭৮০৫৮০৯
Routing Protocol is "rip"
  Sending updates every 30 seconds, next due in 14 seconds
  Invalid after 180 seconds, hold down 180, flushed after 240
  Outgoing update filter list for all interfaces is
  Incoming update filter list for all interfaces is
  Redistributing: rip
  Default version control: send version 1, receive any version
    Interface      Send   Recv   Triggered RIP  Key-chain
      Serial0/0/0     1       1  2
      Serial0/0/1     1       1  2
  Automatic network summarization is in effect
  Routing for Networks:
    192.168.2.0
    192.168.3.0
    192.168.3.0
    192.168.4.0
  Passive Interface(s):
    FastEthernet0/0
  Routing Information Sources:
    Gateway        Distance      Last Update
      192.168.2.1        120      00:00:27
      192.168.4.1        120      00:00:23
  Distance: (default is 120)
```

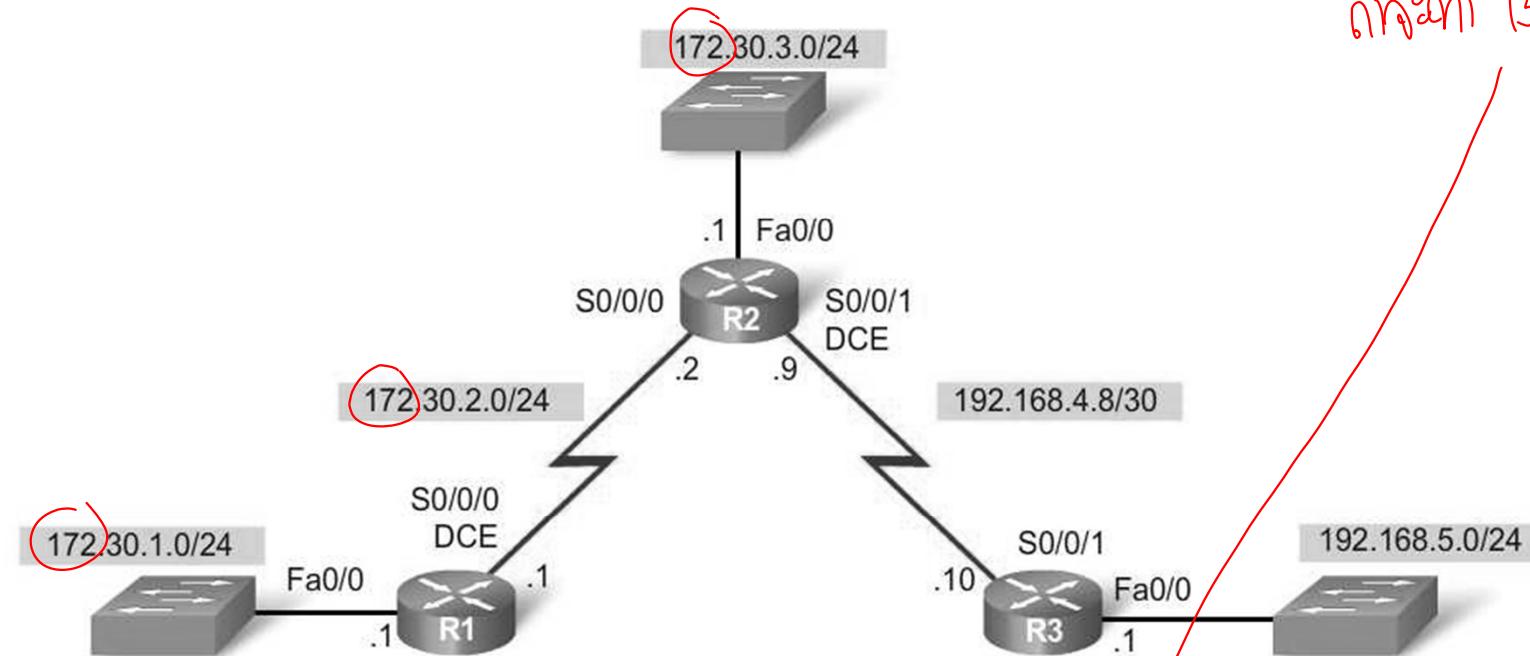
Notice FastEthernet 0/0 is no longer listed under “Default version control.”

However, R2 is still routing for 192.168.3.0 and now lists FastEthernet under “Passive Interfaces.”

Automatic Summarization

- Modified Topology : Scenario B

RIP Topology: Scenario B



ip តិចបន្ទាយលើនា

កំណត់ B ព័ត៌មានទាំងអេ A នា

RIP Topology: Scenario B

	Subnet Mask	Subnet Mask	Subnet Mask	Subnet Mask
R1	Fa0/0	172.30.1.1	255.255.255.0	
	S0/0/0	172.30.2.1	255.255.255.0	
R2	Fa0/0	172.30.3.1	255.255.255.0	
	S0/0/1	192.168.4.9	255.255.255.252	
R3	Fa0/0	192.168.5.1	255.255.255.0	
	S0/0/1	192.168.4.10	255.255.255.252	

Automatic Summarization

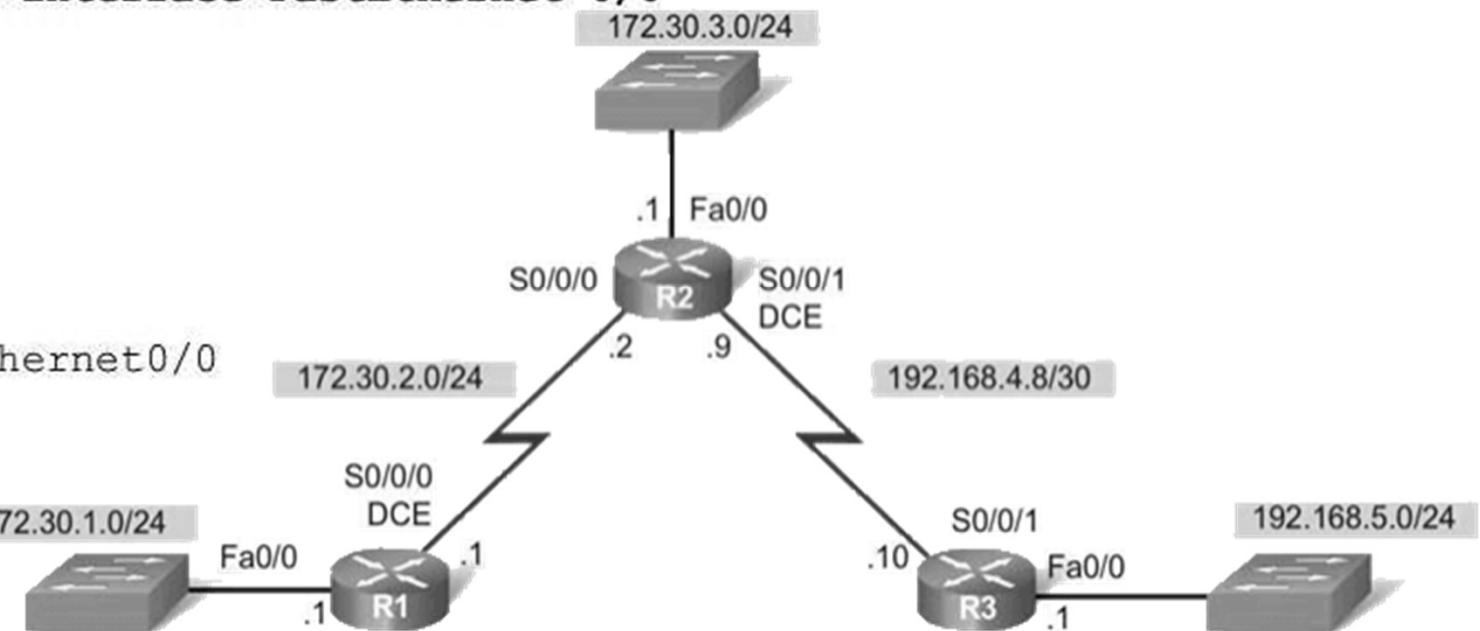
```

R1(config)#interface fa0/0
R1(config-if)#ip address 172.30.1.1 255.255.255.0
R1(config-if)#interface S0/0/0
R1(config-if)#ip address 172.30.2.1 255.255.255.0
R1(config-ROUTER)#no router rip #กัน network 162
R1(config)#router rip
R1(config-router)#network 172.30.1.0
R1(config-router)#network 172.30.2.0
R1(config-router)#passive-interface FastEthernet0/0
R1(config-router)#end
R1#show run
(**output omitted**)

!
router rip
    passive-interface FastEthernet0/0
    network 172.30.0.0
!
(**output omitted**)

```

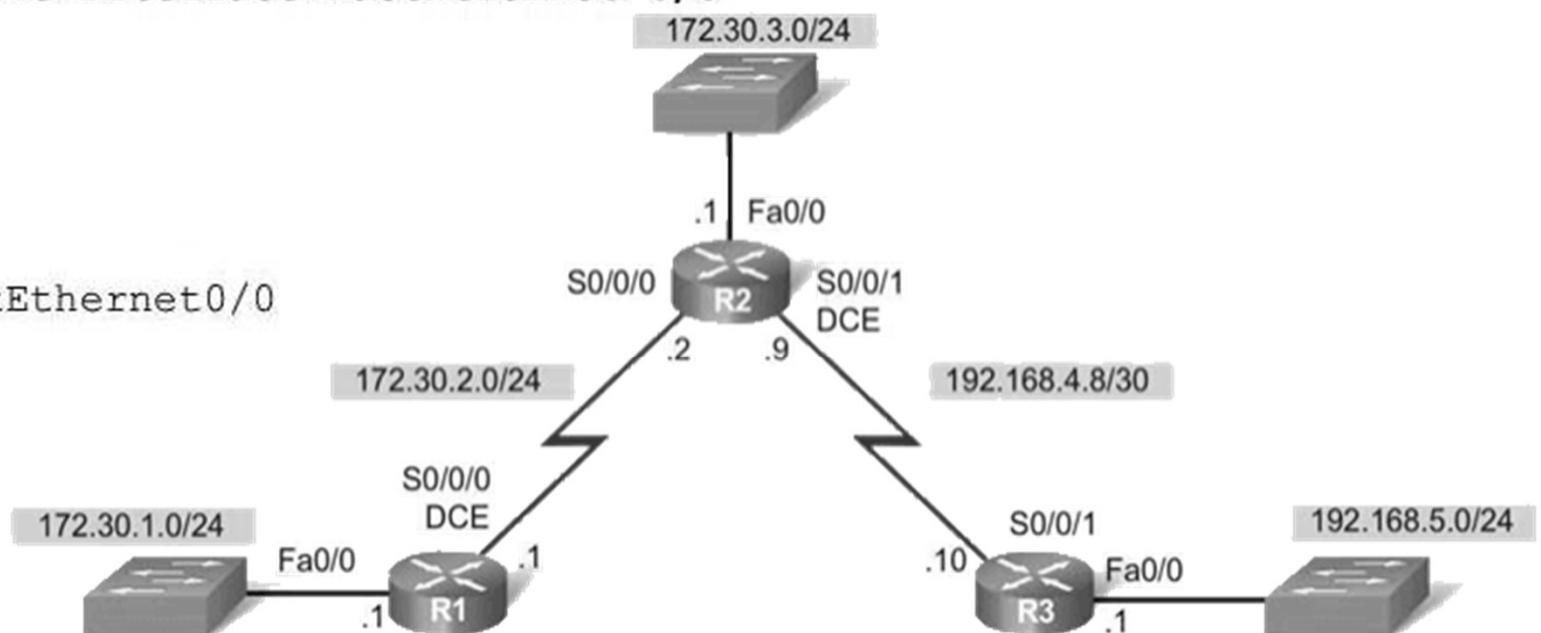
The diagram illustrates Router R1's connection to the network. It has two interfaces: Fa0/0, which is connected to a switch (labeled 172.30.1.0/24), and S0/0/0, which is connected to another router (labeled 172.30.2.0/24). The S0/0/0 interface is specifically labeled as 'DCE'.



Automatic Summarization

```
R2(config)#interface s0/0/0
R2(config-if)#ip address 172.30.2.2 255.255.255.0
R2(config-if)#interface fa0/0
R2(config-if)#ip address 172.30.3.1 255.255.255.0
R2(config-if)#interface S0/0/1
R2(config-if)#ip address 192.168.4.9 255.255.255.252
R2(config-if)#no router rip
R2(config)#router rip
R2(config-router)#network 172.30.0.0
R2(config-router)#network 192.168.4.8
R2(config-router)#passive-interface FastEthernet 0/0
R2(config-router)#end
R2#show run
(**output omitted**)
!
router rip
  passive-interface FastEthernet0/0
  network 172.30.0.0
  network 192.168.4.0
!
(**output omitted**)
R2#
```

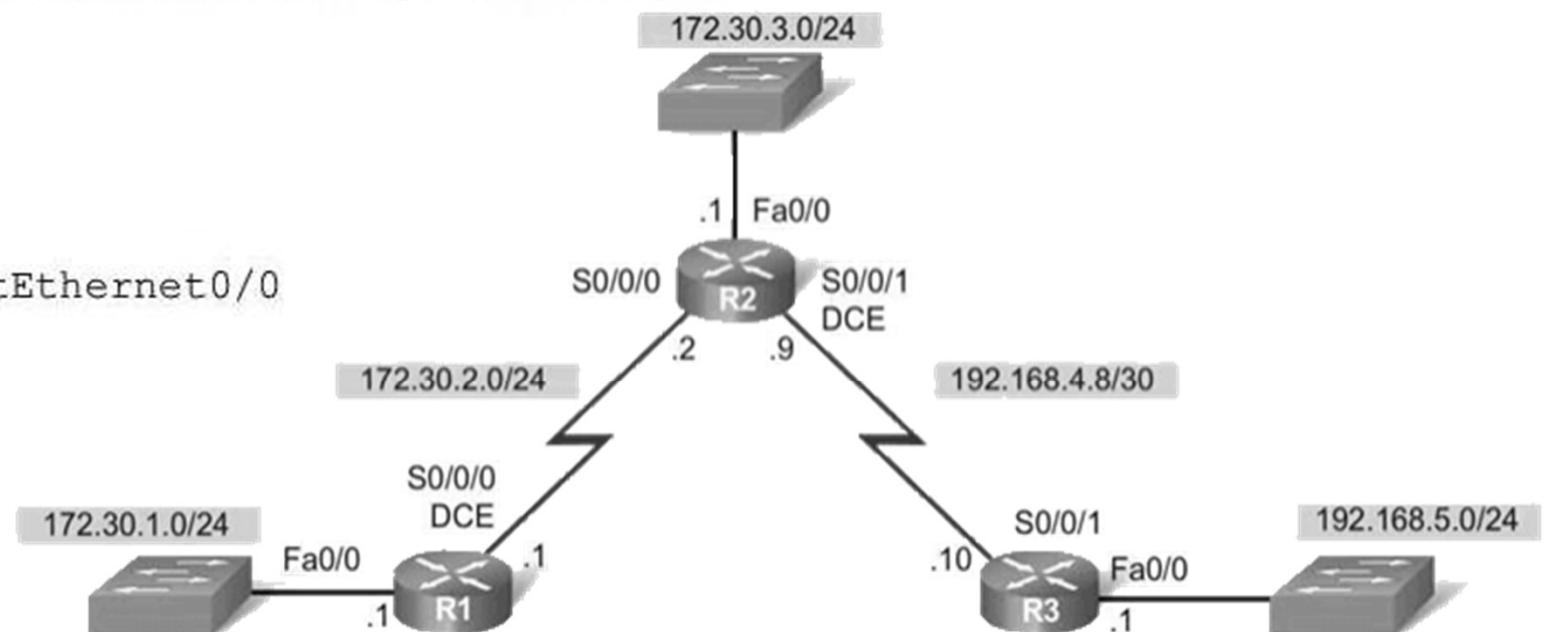
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Automatic Summarization

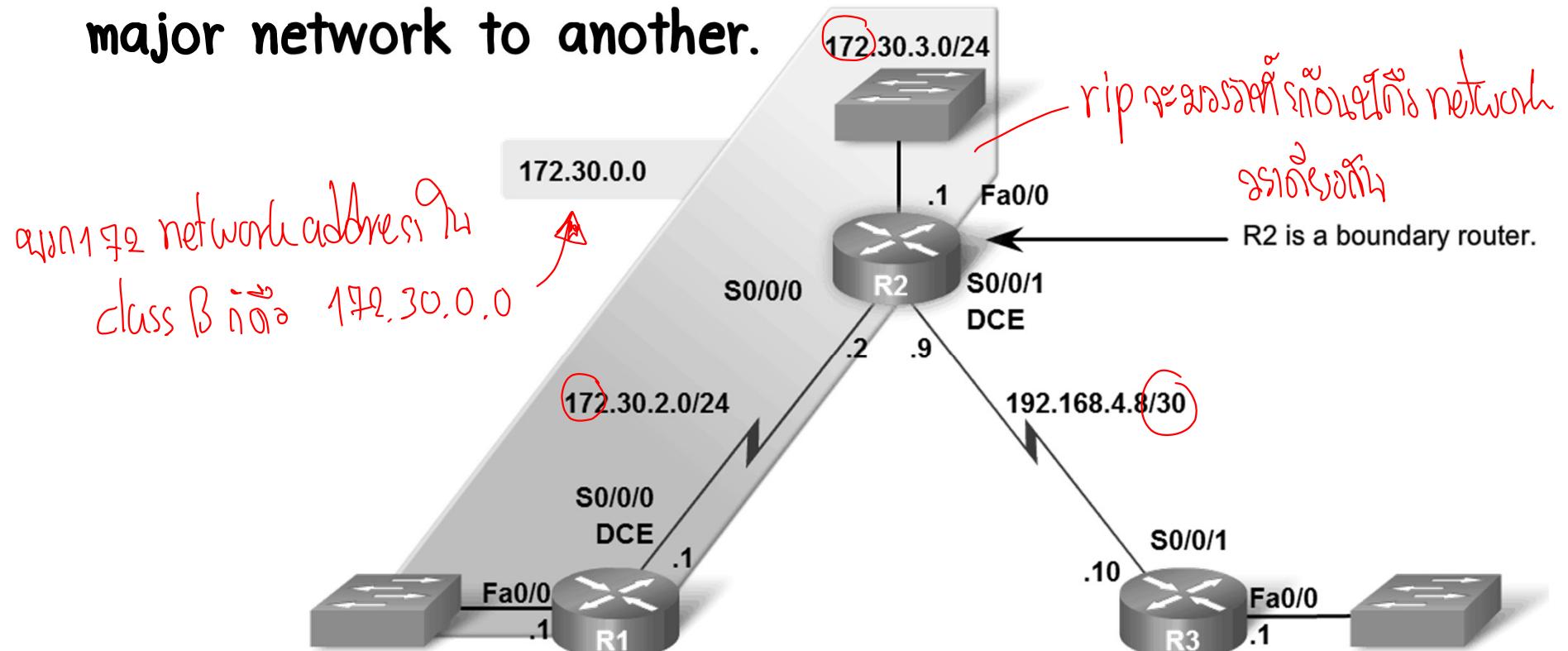
```
R3(config)#interface fa0/0
R3(config-if)#ip address 192.168.5.1 255.255.255.0
R3(config-if)#interface S0/0/1
R3(config-if)#ip address 192.168.4.10 255.255.255.252
R3(config-if)#no router rip
R3(config)#router rip
R3(config-router)#network 192.168.4.0
R3(config-router)#network 192.168.5.0
R3(config-router)#passive-interface FastEthernet 0/0
R3(config-router)#end
R3#show run
(**output omitted**)
!
router rip
  passive-interface FastEthernet0/0
  network 192.168.4.0
  network 192.168.5.0
!
(**output omitted**)
R3#
```

01161202(0)91996
O/B



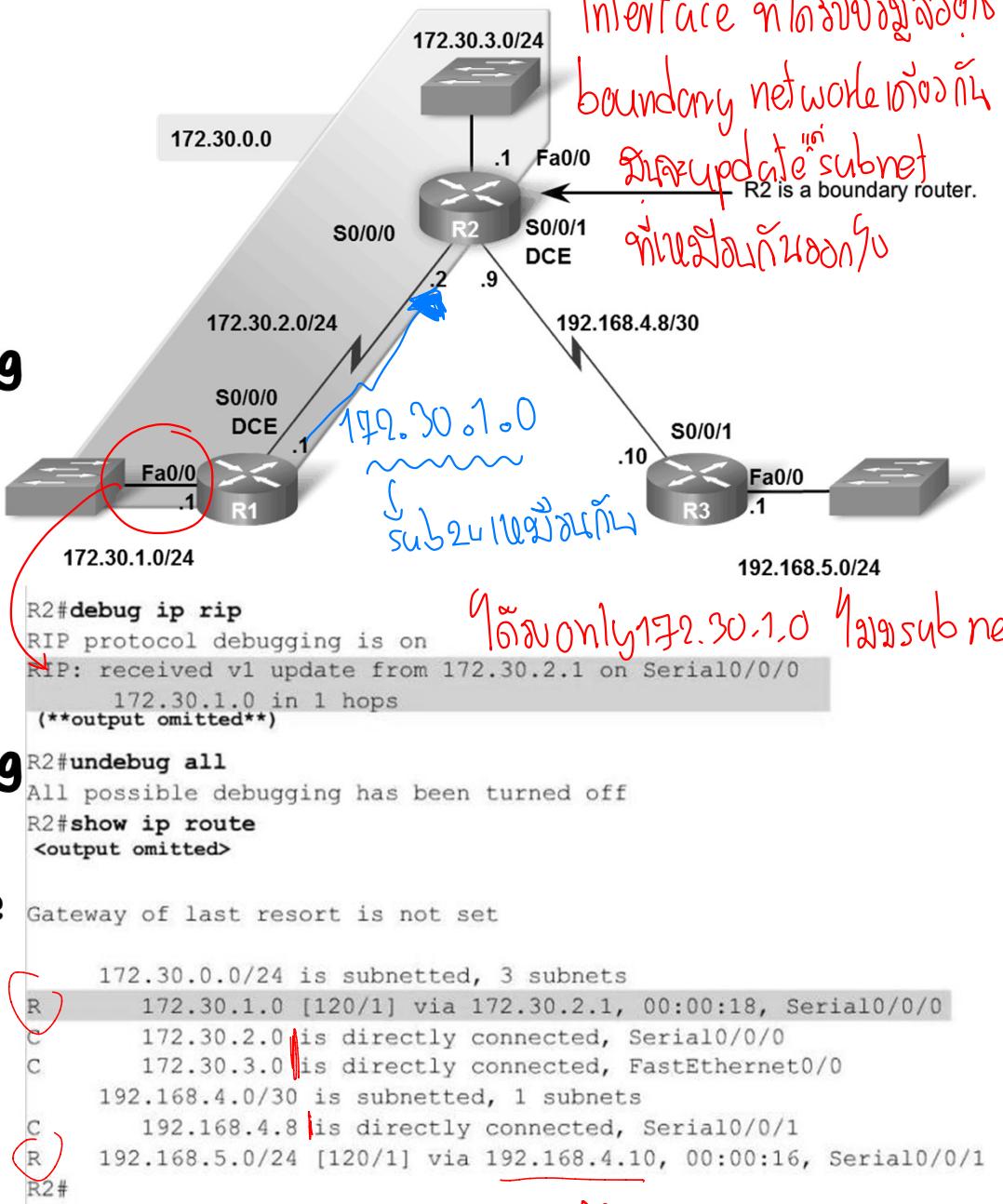
Automatic Summarization

- Boundary Routers
 - RIP automatically summarizes classful networks
 - Boundary routers summarize RIP subnets from one major network to another.



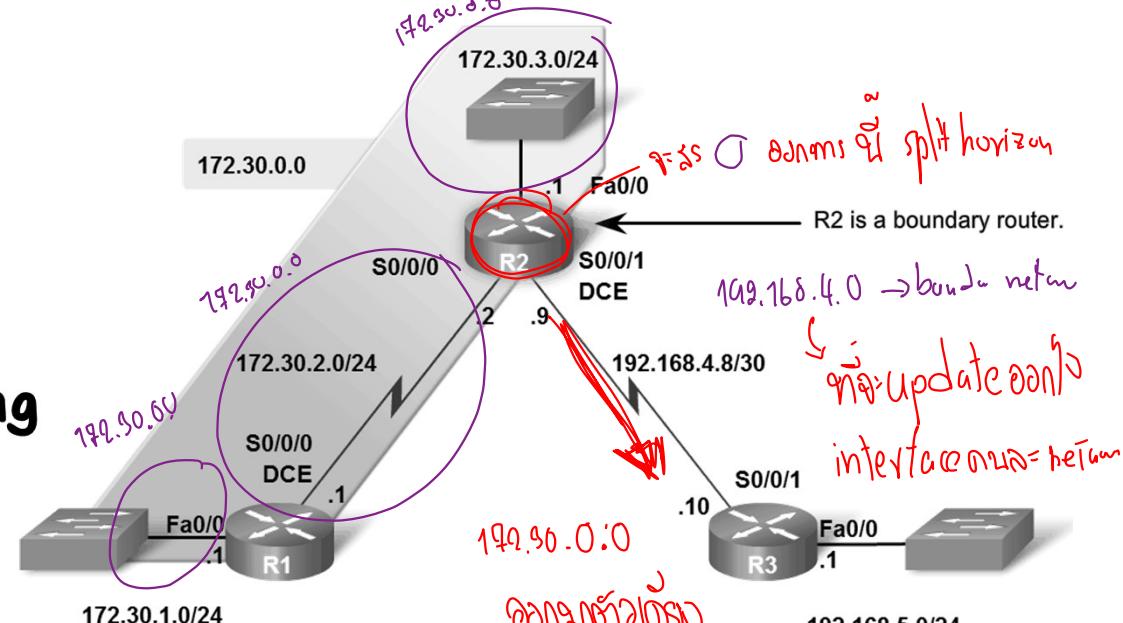
Automatic Summarization

- Processing RIP Updates
- 2 rules govern RIPv1 updates:
 - If a routing update and the interface it's received on belong to the same network then
 - The subnet mask of the interface is applied to the network in the routing update
 - If a routing update and the interface it's received on belong to a different network then
 - The classful subnet mask of the network is applied to the network in the routing update.



Automatic Summarization

- Processing RIP Updates
- 2 rules govern RIPv1 updates:
 - If a routing update and the interface it's received on belong to the same network then
 - The subnet mask of the interface is applied to the network in the routing update
 - If a routing update and the interface it's received on belong to a different network then
 - The classful subnet mask of the network is applied to the network in the routing update.



```
R2#debug ip rip
RIP protocol debugging is on
RIP: received v1 update from 172.30.2.1 on Serial0/0/0
  172.30.1.0 in 1 hops
(**output omitted**)

R2#undbg all
All possible debugging has been turned off
R2#show ip route
<output omitted>

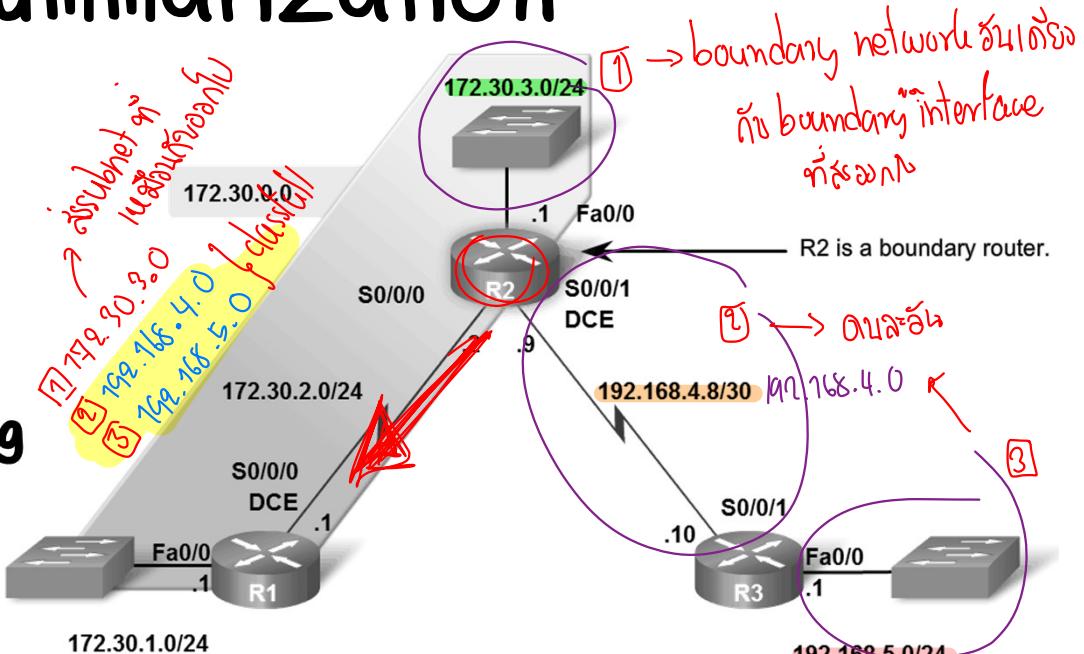
Gateway of last resort is not set
172.30.0.0/24 is subnetted, 3 subnets
R  172.30.1.0 [120/1] via 172.30.2.1, 00:00:18, Serial0/0/0
C  172.30.2.0 is directly connected, Serial0/0/0
C  172.30.3.0 is directly connected, FastEthernet0/0
  192.168.4.0/30 is subnetted, 1 subnets
C  192.168.4.8 is directly connected, Serial0/0/1
R  192.168.5.0/24 [120/1] via 192.168.4.10, 00:00:16, Serial0/0/1
```

Gateway of last resort is not set
 172.30.0.0/24 is subnetted, 3 subnets
 R 172.30.1.0 [120/1] via 172.30.2.1, 00:00:18, Serial0/0/0
 C 172.30.2.0 is directly connected, Serial0/0/0
 C 172.30.3.0 is directly connected, FastEthernet0/0
 192.168.4.0/30 is subnetted, 1 subnets
 C 192.168.4.8 is directly connected, Serial0/0/1
 R 192.168.5.0/24 [120/1] via 192.168.4.10, 00:00:16, Serial0/0/1

↑ မြန်မာစာမျက်နှာ
 ↑ ပုဂ္ဂန်း update ခေါ်၏ R2
 ↑ အဲ 172.30.0.0 ပေါ်လေ့မယ်။
 ↑ မြန်မာစာမျက်နှာ

Automatic Summarization

- Processing RIP Updates
- 2 rules govern RIPv1 updates:
 - If a routing update and the interface it's received on belong to the same network then
 - The subnet mask of the interface is applied to the network in the routing update
 - If a routing update and the interface it's received on belong to a different network then
 - The **classful subnet mask** of the network is applied to the network in the routing update.



```
R2#debug ip rip
RIP protocol debugging is on
RIP: received v1 update from 172.30.2.1 on Serial0/0/0
  172.30.1.0 in 1 hops
(**output omitted**)

R2#undbg all
All possible debugging has been turned off
R2#show ip route
<output omitted>

Gateway of last resort is not set

  172.30.0.0/24 is subnetted, 3 subnets
R  172.30.1.0 [120/1] via 172.30.2.1, 00:00:18, Serial0/0/0
C  172.30.2.0 is directly connected, Serial0/0/0
C  172.30.3.0 is directly connected, FastEthernet0/0/0
① 192.168.4.0/30 is subnetted, 1 subnets
C  192.168.4.8 is directly connected, Serial0/0/1
R  192.168.5.0/24 [120/1] via 192.168.4.10, 00:00:16, Serial0/0/1
R2#
```

Automatic Summarization

- Sending RIP Updates
 - RIP uses automatic summarization to reduce the size of a routing table.

```
R2#debug ip rip
RIP protocol debugging is on
RIP: sending v1 update to 255.255.255.255 via Serial0/0/0 (172.30.2.2)
RIP: build update entries
    network 172.30.3.0 metric 1
    network 192.168.4.0 metric 1
    network 192.168.5.0 metric 2
RIP: sending v1 update to 255.255.255.255 via Serial0/0/1 (192.168.4.9)
RIP: build update entries
    network 172.30.0.0 metric 1
R2#undebug all
All possible debugging has been turned off
R2#
```

network កំណត់នៃ update ដែលបានរួចរាល់

```
R1#show ip route
Codes: C - connected, S - static, I - IGRP, R - RIP, M - mobile, B - BGP
(**output omitted**)

Gateway of last resort is not set

      172.30.0.0/24 is subnetted, 3 subnets
C        172.30.1.0 is directly connected, FastEthernet0/0
C        172.30.2.0 is directly connected, Serial0/0/0
R        172.30.3.0 [120/1] via 172.30.2.2, 00:00:17, Serial0/0/0
R        192.168.4.0/24 [120/1] via 172.30.2.2, 00:00:17, Serial0/0/0
R        192.168.5.0/24 [120/2] via 172.30.2.2, 00:00:17, Serial0/0/0
```

ភ្លាមៗ 4.0/30 → ពារកំណត់នៃ

```
R3#show ip route
Codes: C - connected, S - static, I - IGRP, R - RIP, M - mobile, B - B
(**output omitted**)

Gateway of last resort is not set

R        172.30.0.0/16 [120/1] via 192.168.4.9, 00:00:15, Serial0/0/1
          192.168.4.0/30 is subnetted, 1 subnets
C            192.168.4.8 is directly connected, Serial0/0/1
C            192.168.5.0/24 is directly connected, FastEthernet0/0
```

Automatic Summarization

- Advantages of automatic summarization:
 - The size of routing updates is reduced → ගැඹුණු ✓
 - Single routes are used to represent multiple routes which results in faster lookup in the routing table.

```
R3#show ip route
```

Codes: C - connected, S - static, I -IGRP, R - RIP, M - mobile, B - BGP
D - EIGRP, EX - EIGRP external, O - OSPF, IA - OSFP inter area
N1 - OSPF NSSA external type 1, N2 - OSPF NSSA external type2
E1 - OSPF external type 1, E2 - OSPF external type 2, E - EGP
i - IS-IS, II - IS-IS level-1, L2 - IS-IS level-2, ia - IS-IS inter area
* - candidate default, U - per-user static route, o - ODR
P - periodic downloaded static route

Gateway of last resort is not set

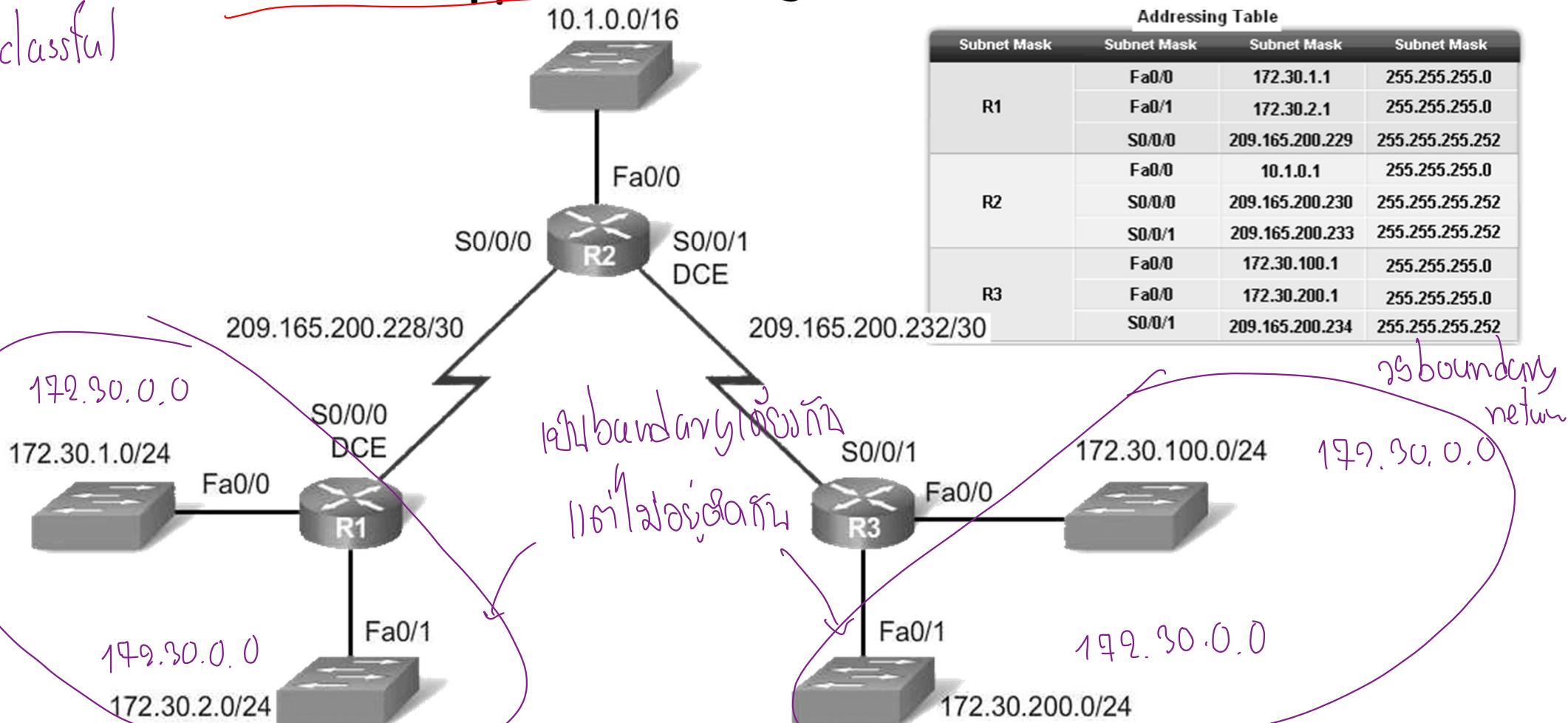
R	172.30.0.0/16 [120/1] via 192.168.4.9, 00:00:15, Serial0/0/1 192.168.4.0/30 is subnetted, 1 subnets
C	192.168.4.8 is directly connected, Serial0/0/1
C	192.168.5.0/24 is directly connected, FastEthernet0/0

Automatic Summarization

Scenarios ဆိတ်များ

- Disadvantage of Automatic Summarization:
 - Does not support discontiguous networks

classful



ជូនមានការពិនិត្យ ?

Automatic Summarization

៩) $10.1.1.1 \rightarrow 172.30.1.1$ ត្រូវបានចូលទៅក្នុង

- **Discontiguous**

$172.30.1.1 \rightarrow 172.30.100.1$ ក្រឡាតាំង
ចូលទៅក្នុង

Topologies do not converge with RIPv1

- A router will only advertise major network addresses out interfaces that do not belong to the advertised route.

ផ្លូវការ update នៃ R3

172.30.0.0 ភែមុន

នៅពេលដែលរាយការក្លាត់ខ្លួន

នៅពេល R1 ចាប់រាយការ

មិនមែនអាជីវកម្ម

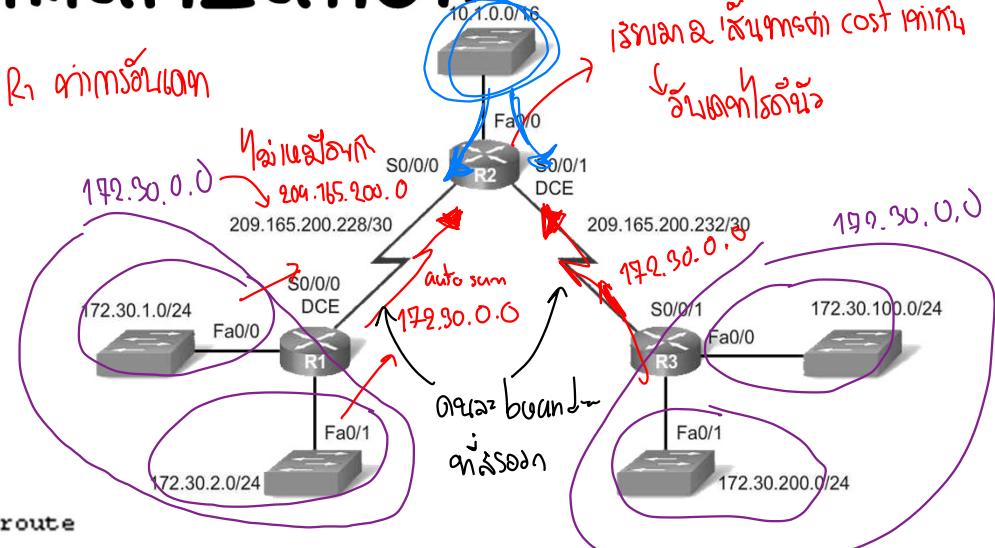
209.165.200.228/30

auto sum

172.30.0.0

09/02 buand

ក្រឡាតាំង



```
R1#sh ip route
Gateway of last resort is not set
R  10.0.0.0/8 [120/1] via 209.165.200.230, 00:00:03, Serial0/0
    172.30.0.0/24 is subnetted, 2 subnets
C      172.30.1.0 is directly connected, FastEthernet0/0
C      172.30.2.0 is directly connected, FastEthernet0/1
    209.165.200.0/30 is subnetted, 2 subnets
C          209.165.200.228 is directly connected, Serial0/0
R      209.165.200.232 [120/1] via 209.165.200.230, 00:00:03, Serial0/0
R2#sh ip route
Gateway of last resort is not set
    10.0.0.0/16 is subnetted, 1 subnets
C          10.1.0.0 is directly connected, FastEthernet0/0
R  172.30.0.0/16 [120/1] via 209.165.200.229, 00:00:26, Serial0/0
    [120/1] via 209.165.200.234, 00:00:16, Serial0/1
    209.165.200.0/30 is subnetted, 2 subnets
C          209.165.200.228 is directly connected, Serial0/0
C          209.165.200.232 is directly connected, Serial0/1
R3#show ip route
Gateway of last resort is not set
R  10.0.0.0/8 [120/1] via 209.165.200.233, 00:00:10, Serial0/1
    172.30.0.0/24 is subnetted, 2 subnets
C          172.30.100.0 is directly connected, FastEthernet0/0
C          172.30.200.0 is directly connected, FastEthernet0/1
    209.165.200.0/30 is subnetted, 2 subnets
C          209.165.200.228 [120/1] via 209.165.200.233, 00:00:10, Serial0/1
C          209.165.200.232 is directly connected, Serial0/1
```

គឺ cost ធានាក្នុង
ភែមុន loud
} balance

172

មិនមែន
100 %
-200

0.0

100 %

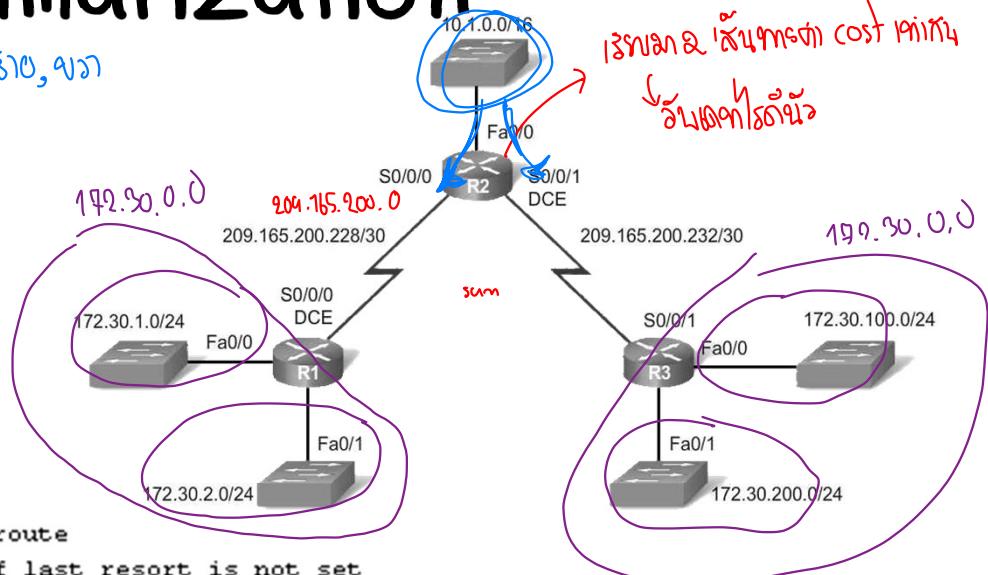
20.0.0

Automatic Summarization

ផែល 172.30.0.0 ខ្លួនការងារ 10, នៅ

មិនសរស់ស្តី 2.9ms

- Discontiguous Topologies do not converge with RIPv1
- A router will only advertise major network addresses out interfaces that do not belong to the advertised route.



```
R1#sh ip route
Gateway of last resort is not set
R    10.0.0.0/8 [120/1] via 209.165.200.230, 00:00:03, Serial0/0
      172.30.0.0/24 is subnetted, 2 subnets
C        172.30.1.0 is directly connected, FastEthernet0/0
C        172.30.2.0 is directly connected, FastEthernet0/1
      209.165.200.0/30 is subnetted, 2 subnets
C          209.165.200.228 is directly connected, Serial0/0
R    209.165.200.232 [120/1] via 209.165.200.230, 00:00:03, Serial0/0
R2#sh ip route
Gateway of last resort is not set
      10.0.0.0/16 is subnetted, 1 subnets
C        10.1.0.0 is directly connected, FastEthernet0/0
R    172.30.0.0/16 [120/1] via 209.165.200.229, 00:00:26, Serial0/0
      [120/1] via 209.165.200.234, 00:00:16, Serial0/1
      209.165.200.0/30 is subnetted, 2 subnets
C        209.165.200.228 is directly connected, Serial0/0
C        209.165.200.232 is directly connected, Serial0/1
R3#show ip route
Gateway of last resort is not set
R    10.0.0.0/8 [120/1] via 209.165.200.233, 00:00:10, Serial0/1
      172.30.0.0/24 is subnetted, 2 subnets
C        172.30.100.0 is directly connected, FastEthernet0/0
C        172.30.200.0 is directly connected, FastEthernet0/1
      209.165.200.0/30 is subnetted, 2 subnets
C          209.165.200.228 [120/1] via 209.165.200.233, 00:00:10, Serial0/1
C          209.165.200.232 is directly connected, Serial0/1
```

Default Route and RIPv1

- Modified Topology : Scenario C
- Default routes
 - Packets that are not defined specifically in a routing table will go to the specified interface for the default route
 - Example: Customer routers use default routes to connect to an ISP router.
 - Command used to configure a default route is
`ip route 0.0.0.0 0.0.0.0 s0/0/1`

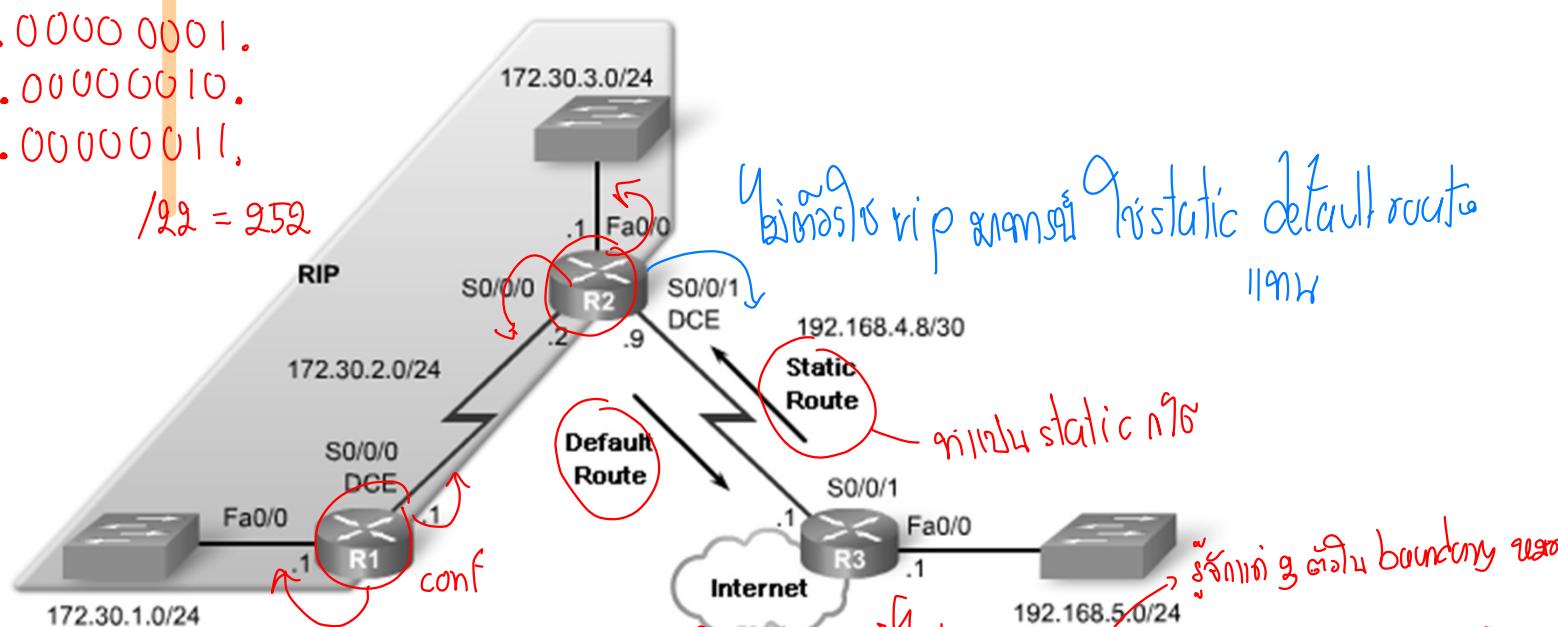
0:15 Nov 2017 19:20:41 routing table
jirasak



Default Route and RIPv1

10101100.00011110.0000 0001.
 10101100.00011110.00000010.
 10101100.00011110.00000011.

/22 = 252



- Disable RIP routing on R2 for the 192.168.4.0 network only.
- Configure R2 with a default route pointing to R3.

```
R2(config)#router rip
R2(config-router)#no network 192.168.4.0
R2(config-router)#exit
R2(config)#ip route 0.0.0.0 0.0.0.0 serial 0/0/1
```

- Completely disable RIP routing on R3.
- Configure R3 with a static route pointing R2.

```
R3(config)#no router rip
R3(config)#ip route 172.30.0.0 255.255.252.0 serial 0/0/1
```

~~Router R1~~
 X 172.30.0.0/24 is subnetted, 3 subnets
 C 172.30.1.0 is directly connected, FastEthernet0/0
 C 172.30.2.0 is directly connected, Serial0/0/0
 R 172.30.3.0 [120/1] via 172.30.2.2, 00:00:05, Serial0/0/0

~~Router R2~~
 172.30.0.0/24 is subnetted, 3 subnets
 R 172.30.1.0 [120/1] via 172.30.2.1, 00:00:03, Serial0/0/0
 C 172.30.2.0 is directly connected, Serial0/0/0
 C 172.30.3.0 is directly connected, FastEthernet0/0
 192.168.4.0/30 is subnetted, 1 subnets
 C 192.168.4.8 is directly connected, Serial0/0/1
 S* 0.0.0.0/0 is directly connected, Serial0/0/1

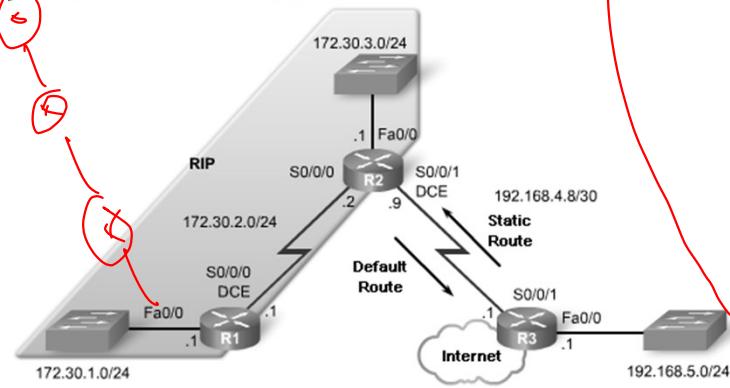
~~Router R3~~
 172.30.0.0/22 is subnetted, 1 subnets
 S 172.30.0.0 is directly connected, Serial0/0/1
 192.168.4.0/30 is subnetted, 1 subnets
 C 192.168.4.8 is directly connected, Serial0/0/1
 192.168.5.0/24 is directly connected, FastEthernet0/0

Default Route and RIPv1

- Propagating the Default Route in RIPv1
 - Default-information originate command
 - This command is used to specify that the router is to originate default information, by propagating the static default route in RIP update.

```
R2(config)#router rip  
R2(config-router)#default-information originate  
R2(config-router)#end  
R2#debug ip rip
```

```
RIP protocol debugging is on
RIP: sending v1 update to 255.255.255.255
RIP: build update entries
    subnet 0.0.0.0 metric 1
    subnet 172.30.3.0 metric 2
R2#undebug all
All possible debugging has been turned off
```



```
R1#show ip route
Codes: C - connected, S - static, I - IGRP, R - RIP, M - mobile, B- BGP
      D - EIGRP, EX - EIGRP external, O - OSPF, IA - OSPF inter area
      N1 - OSPF NSSA external type 1, N2 - OSPF NSSA external type 2
      E1 - OSPF external type 1, E2 - OSPF external type 2, E - EGP
      i - IS-IS, L1 - IS-IS level-1, L2 - IS-IS level-2, ia - IS-IS inter area
      * - candidate default, U - per-user static route, o - ODR
      P - periodic downloaded static route
```

Gateway of last resort is 172.30.2.2 to network 0.0.0.0

```
172.30.0.0/24 is subnetted, 3 subnets
C 172.30.2.0 is directly connected, Serial0/0/0
R 172.30.3.0 [120/1] via 172.30.2.2 00:00:16, Serial0/0/0
C 172.30.1.0 is directly connected, Fast Ethernet0/0
* 0.0.0.0 [120/1] via 172.30.2.2, 00:00:16, Serial0/0/0
```

default route

Summary

2400467828 = 0111
static กับ dynamic

- RIP characteristics include:
 - Classful, distance vector routing protocol
 - Metric is Hop Count *Network subnet Network*
 - Does not support VLSM or discontiguous subnets
 - Updates every 30 seconds *loop broadcast*
- Rip messages are encapsulated in a UDP segment with source and destination ports of 520

Summary: Commands used by RIP

~~กู้ Common~~

Command	Command's purpose
Rtr(config)#router rip	Enables RIP routing process
Rtr(config-router)#network	Associates a network with a RIP routing process
Rtr#debug ip rip	used to view real time RIP routing updates
Rtr(config-router)#passive-interface fa0/0	Prevent RIP updates from going out an interface
Rtr(config-router)#default-information originate	Used by RIP to propagate default routes
Rtr#show ip protocols	Used to display timers used by RIP

Questions and Answers

