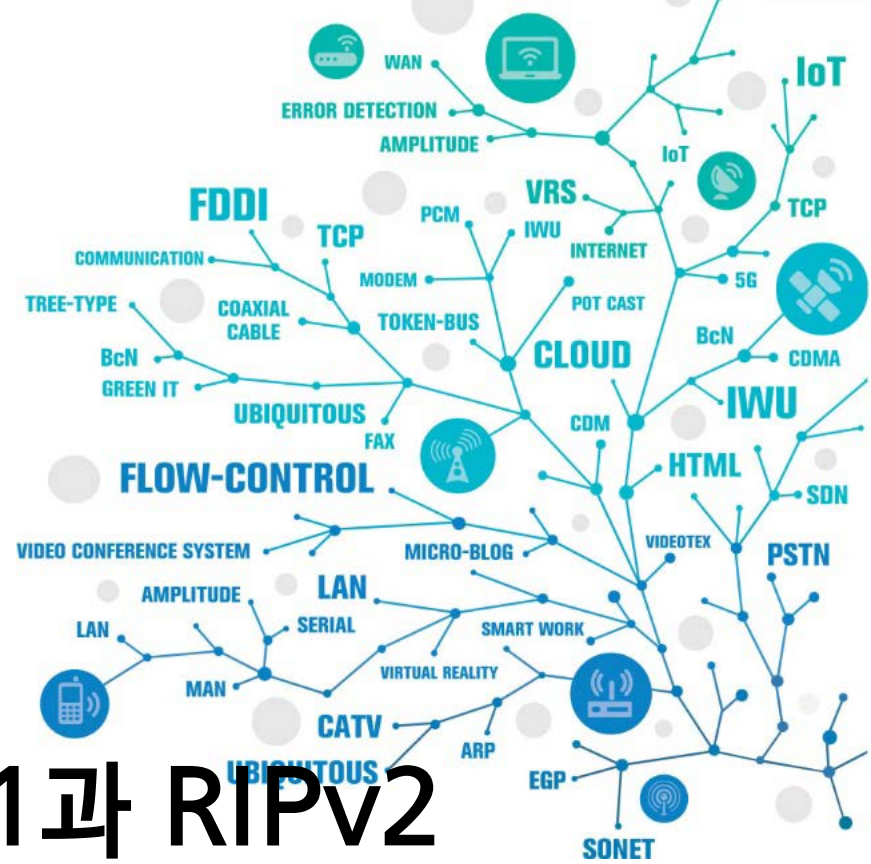


라우팅 프로토콜: RIPv1과 RIPv2

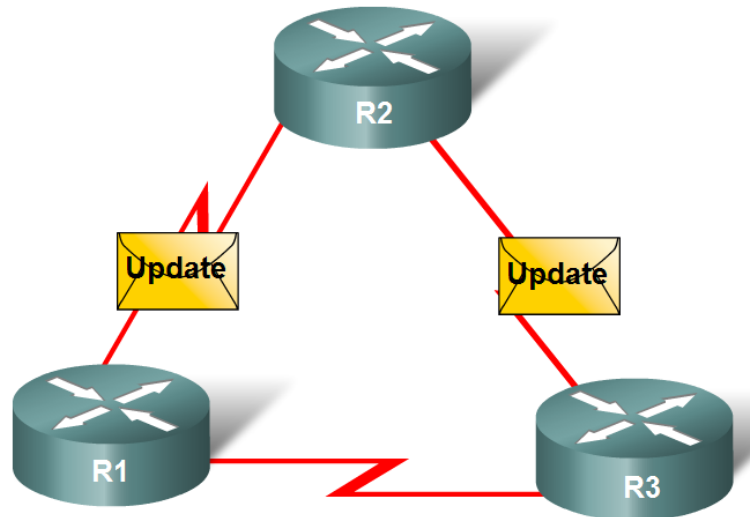


Dynamic Routing Protocols

■ Function(s) of Dynamic Routing Protocols:

- Dynamically share information between routers.
(라우터 간에 정보를 동적으로 공유합니다.)
- Automatically update routing table when topology changes.
(토폴로지가 변경되면 라우팅 테이블을 자동으로 업데이트합니다.)
- Determine best path to a destination.
(대상에 가장 적합한 경로를 결정합니다.)

Routers Dynamically Pass Updates



Dynamic Routing Protocols

■ The purpose of a dynamic routing protocol is to:

- **Discover** remote networks (원격 네트워크 발견)
- **Maintaining** up-to-date routing information (최신 라우팅 정보 유지)
- **Choosing the best path** to destination networks (대상 네트워크에 가장 적합한 경로 선택)
- Ability to **find a new best path** if the current path is no longer available (현재 경로를 더 이상 사용할 수 없는 경우 새로운 최상의 경로를 찾는 기능)

Routing Protocol Operation

Routing protocols are used to exchange routing information between the routers.

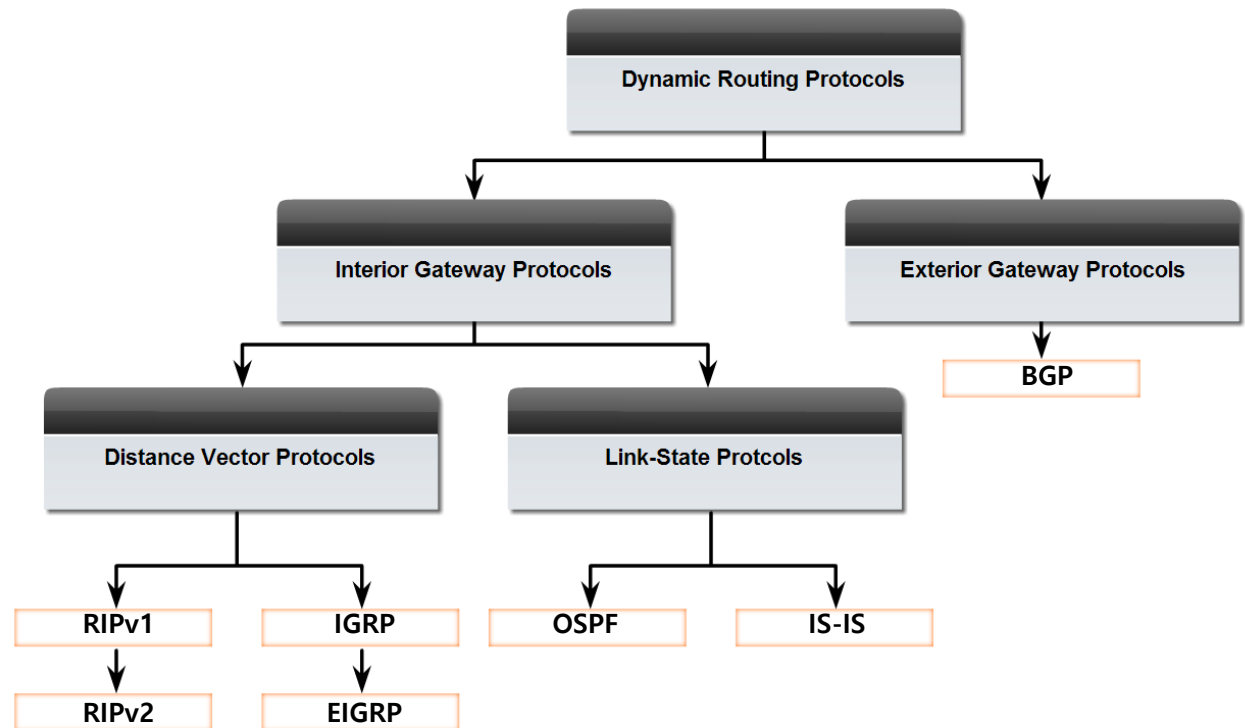


Classifying Routing Protocols

- Dynamic routing protocols are **grouped according to characteristics**.

Examples include:

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

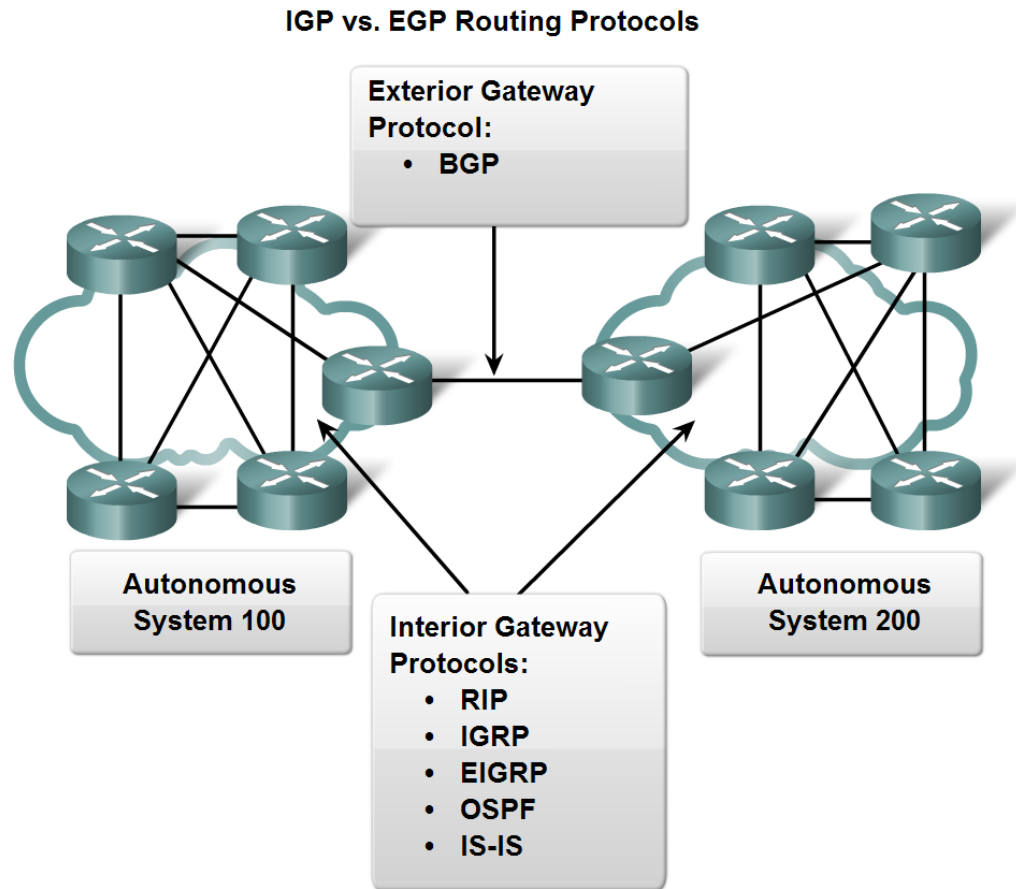


- Autonomous System is a group of routers under the control of a single authority. (Autonomous System은 단일 기관의 통제하에 있는 라우터 그룹)

Classifying Routing Protocols

■ Types of routing protocols:

- **Interior Gateway Protocols** (IGP)
- **Exterior Gateway Protocols** (EGP)



Classifying Routing Protocols

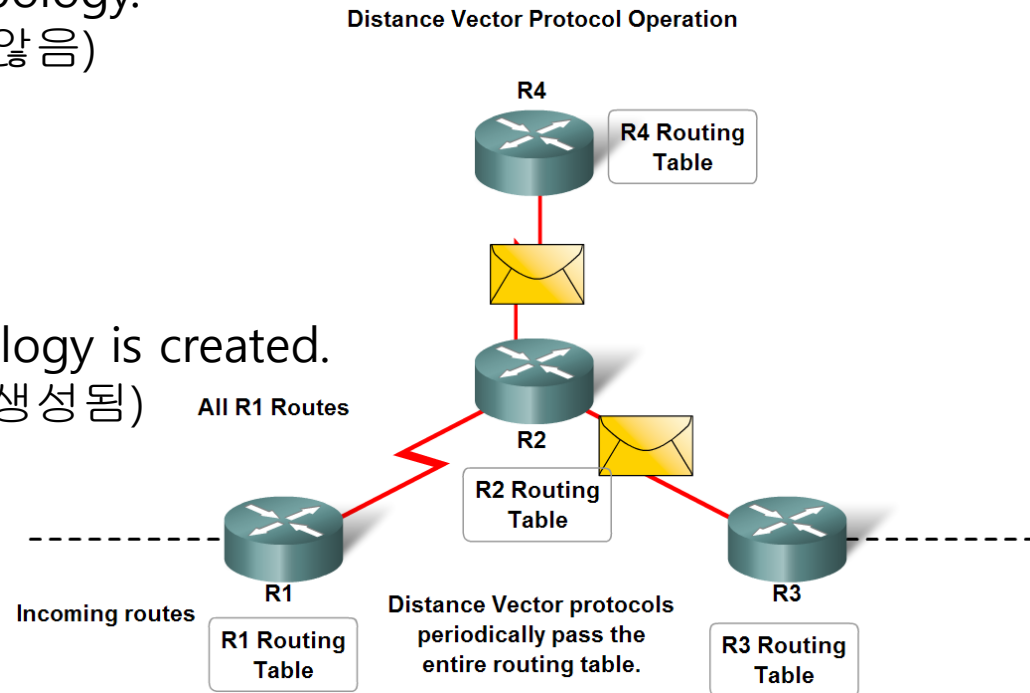
■ IGP: Comparison of **Distance Vector** & **Link State** Routing Protocols

▪ Distance vector

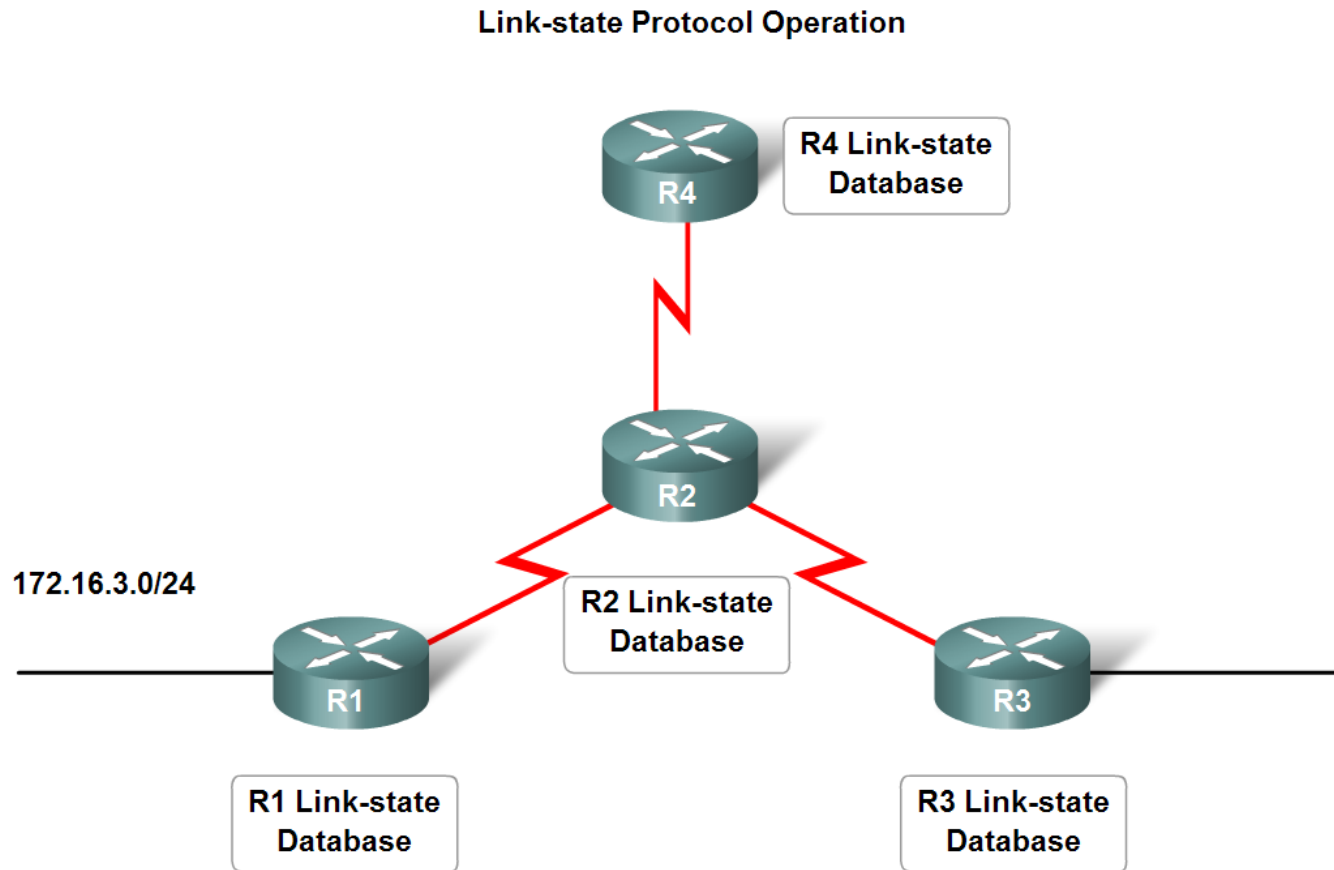
- routes are advertised as vectors of distance & direction.
(경로는 거리와 방향 벡터로 광고됨)
- incomplete view of network topology.
(네트워크 토폴로지가 완전하지 않음)
- Generally, periodic updates.
(일반적으로 주기적인 업데이트)

▪ Link state

- complete view of network topology is created.
(네트워크 토폴로지가 완전하게 생성됨)
- updates are not periodic.
(업데이트는 주기적이지 않음)



Classifying Routing Protocols



Link-state protocols pass updates when a link's state changes.

Classifying Routing Protocols

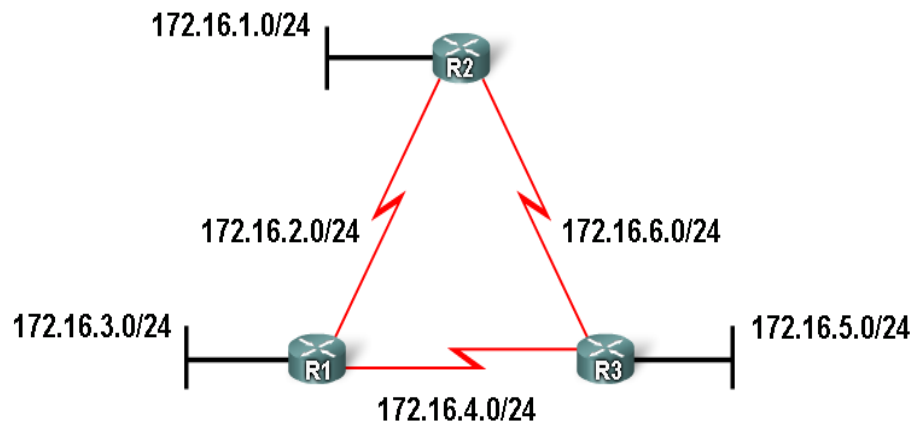
■ Classful routing protocols

- Do NOT send subnet mask in routing updates
(라우팅 업데이트에 서브넷마스크를 포함하지 않음)

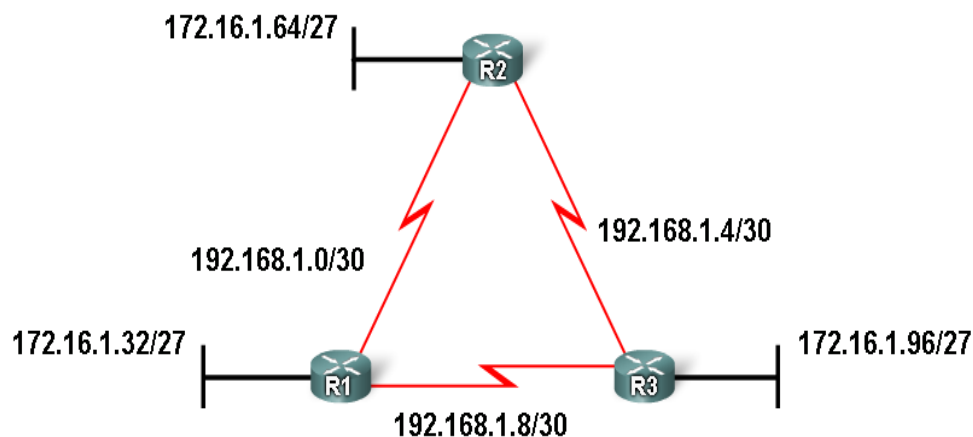
■ Classless routing protocols

- Do send subnet mask in routing updates.
(라우팅 업데이트에 서브넷마스크를 포함)

Classful vs. Classless Routing



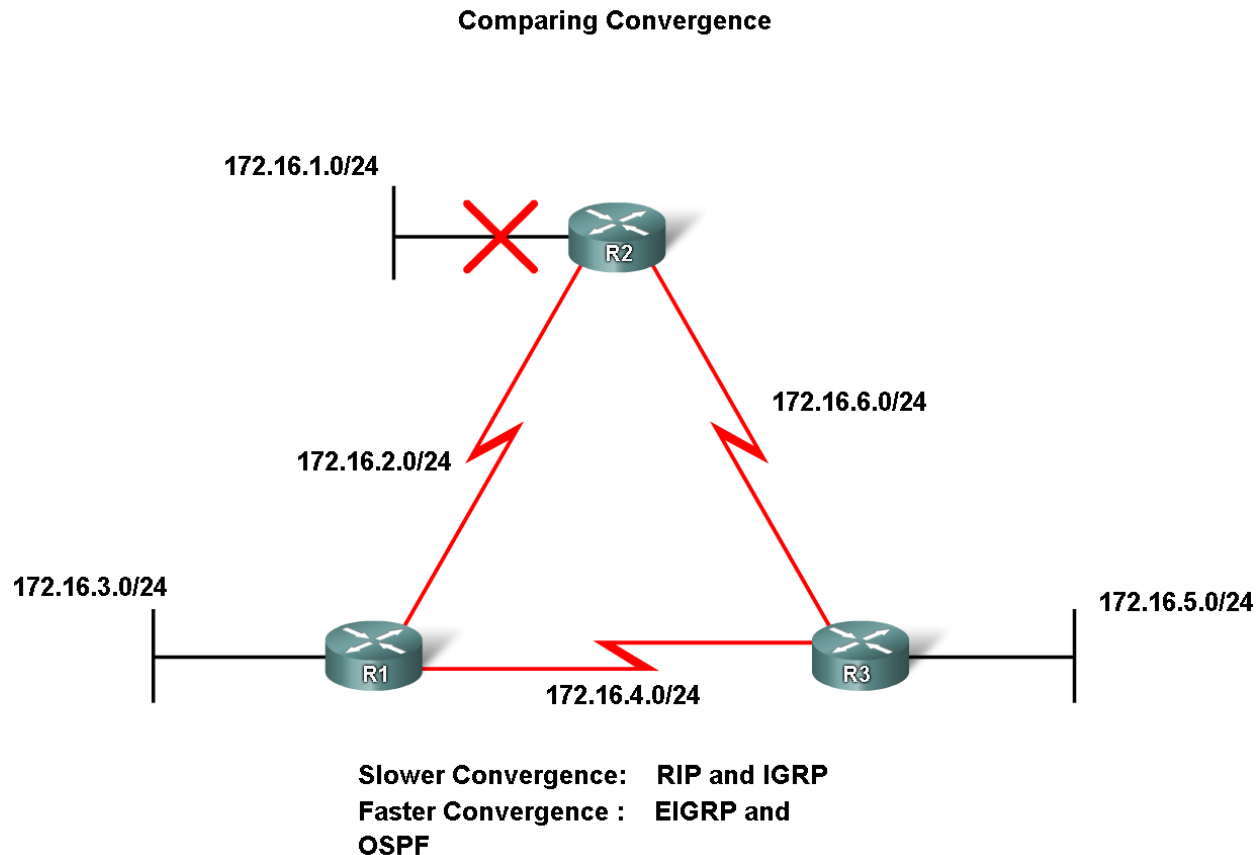
Classful: Subnet mask is the same throughout the topology



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** (컨버전스는 모든 라우터의 라우팅 테이블이 일관성 상태에 있을 때)

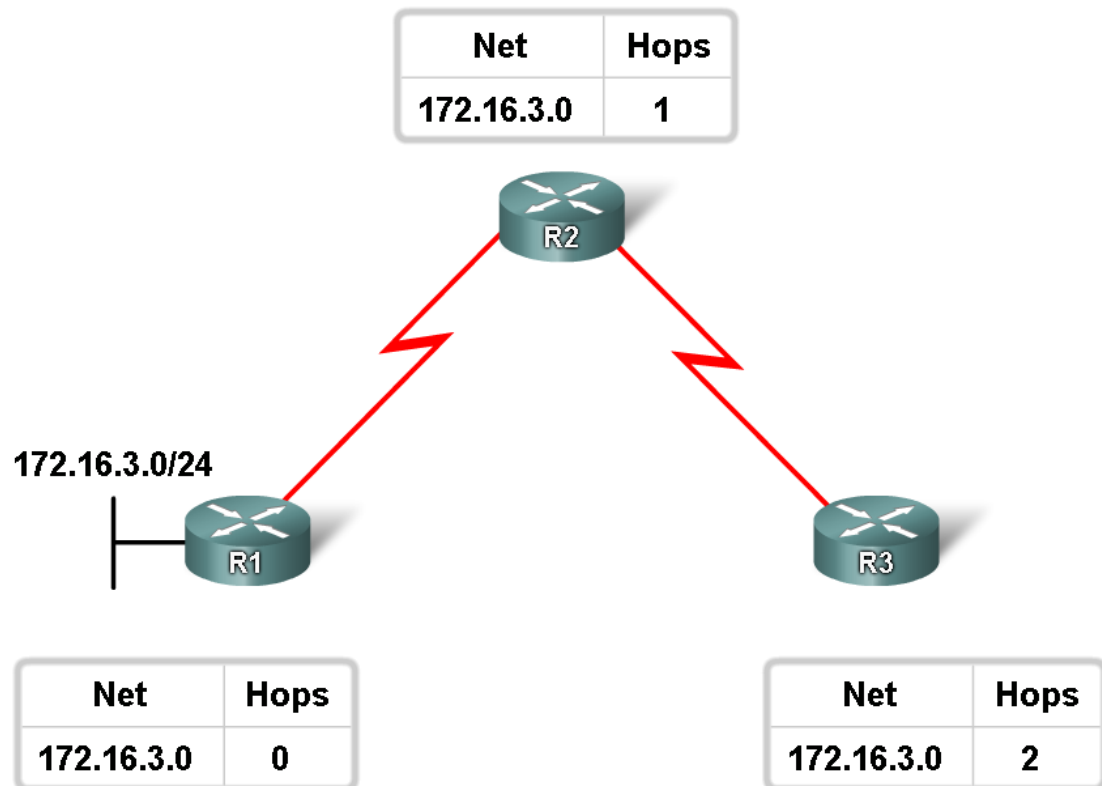


Routing Protocols Metrics

■ Metric

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

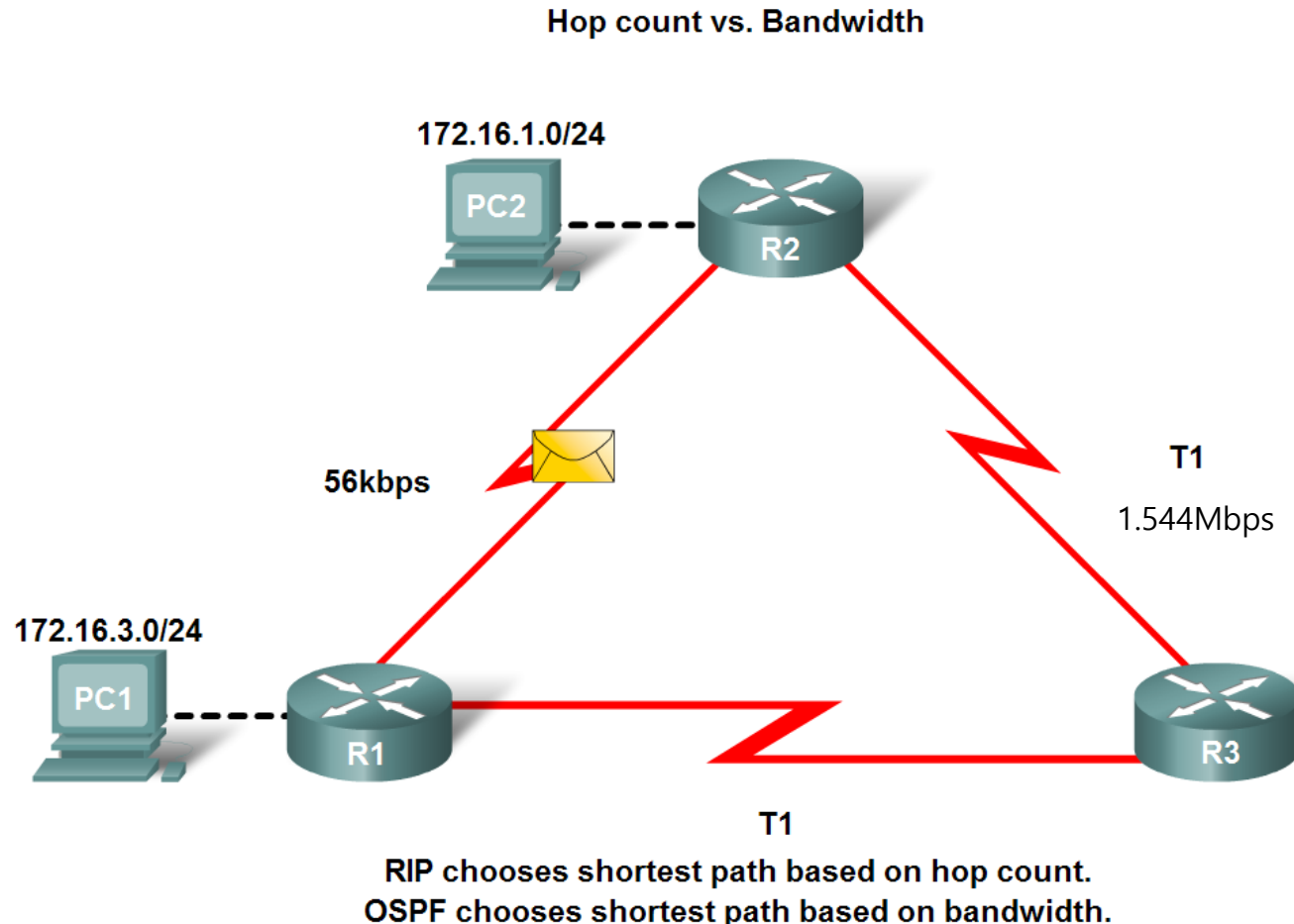
(라우팅 프로토콜이 다른 경로보다 더 나은 경로를 결정하는 데 사용하는 값)



Routing Protocols Metrics

■ Metrics used in IP routing protocols

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



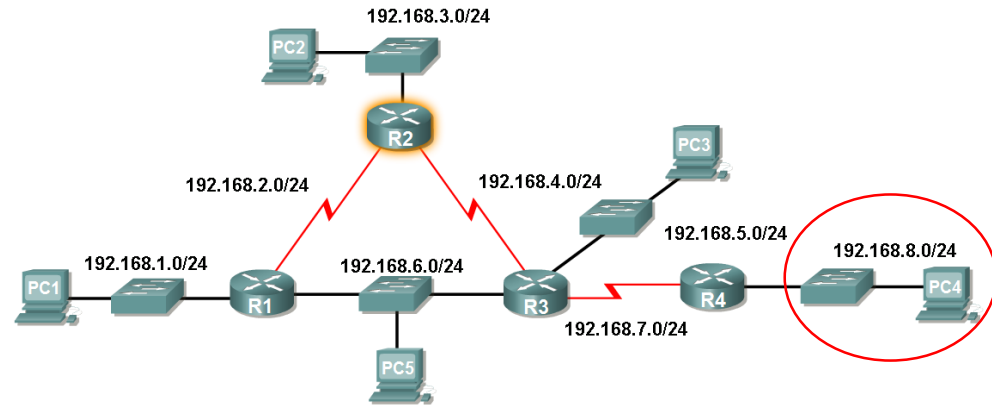
Routing Protocols Metrics

■ The Metric Field in the Routing Table

■ Metric used for each routing protocol

- RIP - hop count
- IGRP & EIGRP - Bandwidth (used by default), Delay (used by default), Load, Reliability
- IS-IS & OSPF – Cost, Bandwidth (Cisco's implementation)

Metric in the Routing Table



```
R2#show ip route
<output omitted>

Gateway of last resort is not set

R    192.168.1.0/24 [120/1] via 192.168.2.1, 00:00:24, Serial0/0
C    192.168.2.0/24 is directly connected, Serial0/0
C    192.168.3.0/24 is directly connected, FastEthernet0/0
C    192.168.4.0/24 is directly connected, Serial0/1
R    192.168.5.0/24 [120/1] via 192.168.4.1, 00:00:26, Serial0/1
R    192.168.6.0/24 [120/1] via 192.168.2.1, 00:00:24, Serial0/0
                                     [120/1] via 192.168.4.1, 00:00:26, Serial0/1
R    192.168.7.0/24 [120/1] via 192.168.4.1, 00:00:26, Serial0/1
R    192.168.8.0/24 [120/2] via 192.168.4.1, 00:00:26, Serial0/1
```

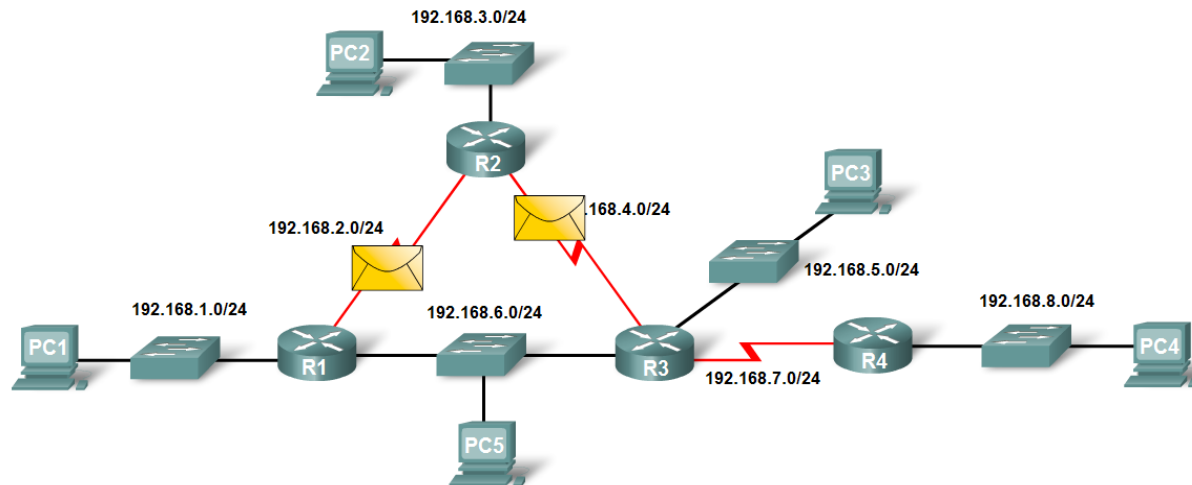
It is 2 hops from R2 to 192.168.8.0/24

Routing Protocols Metrics

■ Load balancing

- This is the ability of a router to distribute packets among multiple same cost paths (여러 동일한 비용인 경로 사이에서 패킷을 분배하는 라우터의 기능)

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
```

Administrative Distance of a Route

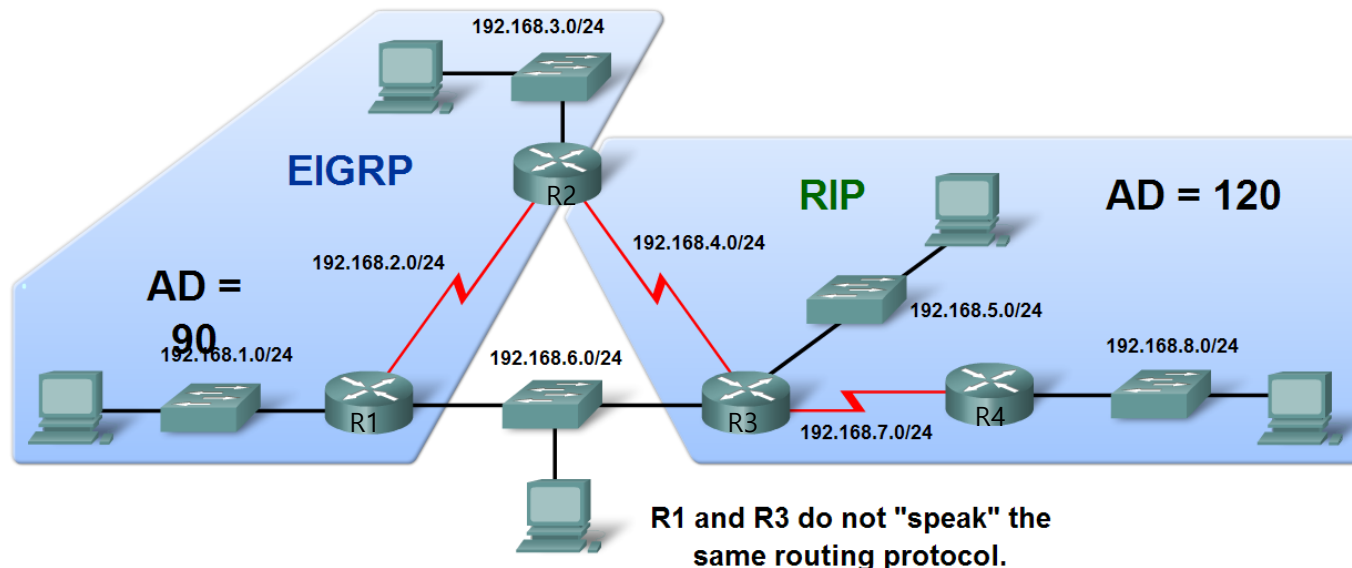
■ Purpose of a metric

- It's a calculated value **used to determine the best path** to a destination
(목적지까지의 최적 경로를 결정하는데 사용되는 계산된 값)

■ Purpose of **Administrative Distance**

- It's a numeric value that **specifies the preference of a particular route**
(특정 경로의 기본 설정을 지정하는 숫자 값)

Comparing Administrative Distances

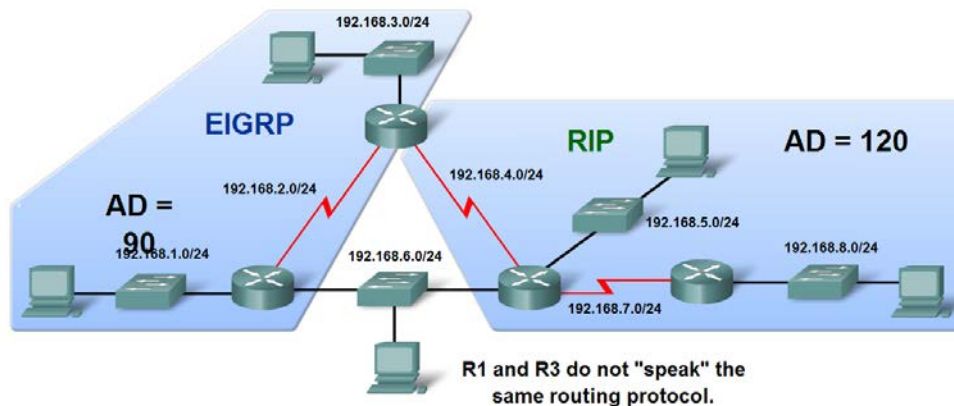


Administrative Distance of a Route

■ Identifying the Administrative Distance (AD) in a routing table

- It is the first number in the brackets in the routing table
(라우팅 테이블의 괄호안의 첫번째 숫자)

Comparing Administrative Distances



```
R2#show ip route  
<output omitted>
```

Gateway of last resort is not set

```
D 192.168.1.0/24 [90/2172416] via 192.168.2.1, 00:00:24, Serial0/0/0  
C 192.168.2.0/24 is directly connected, Serial0/0/0  
C 192.168.3.0/24 is directly connected, FastEthernet0/0  
C 192.168.4.0/24 is directly connected, Serial0/0/1  
R 192.168.5.0/24 [120/1] via 192.168.4.1, 00:00:08, Serial0/0/1  
D 192.168.6.0/24 [90/2172416] via 192.168.2.1, 00:00:24, Serial0/0/0  
R 192.168.7.0/24 [120/1] via 192.168.4.1, 00:00:08, Serial0/0/1  
R 192.168.8.0/24 [120/2] via 192.168.4.1, 00:00:08, Serial0/0/1
```

```
R2#show ip rip database
```

```
192.168.3.0/24 directly connected, FastEthernet0/0  
192.168.4.0/24 directly connected, Serial0/0/1  
192.168.5.0/24  
[1] via 192.168.4.1, Serial0/0/1  
192.168.6.0/24  
[1] via 192.168.4.1, Serial0/0/1  
192.168.7.0/24  
[1] via 192.168.4.1, Serial0/0/1  
192.168.8.0/24  
[2] via 192.168.4.1, Serial0/0/1
```

Administrative Distance of a Route

■ Dynamic Routing Protocols

Default Administrative Distances

Route source	Default AD
Connected interface	0
Static	1
EIGRP summary route	5
eBGP	20
EIGRP (Internal)	90
IGRP	100
OSPF	110
IS - IS	115
RIP	120
EIGRP (External)	170
iBGP	200
Unknown	255

Administrative Distance of a Route

■ Directly connected routes

- Have a default **AD of 0**

■ Static Routes

- Administrative distance of a static route has a **default value of 1**

```
R2#show ip route 172.16.3.0
Routing entry for 172.16.3.0/24
Known via "static", distance 1, metric 0 (connected)
  Routing Descriptor Blocks:
    * directly connected, via Serial0/0/0
      Route metric is 0, traffic share count is 1
```

Administrative Distance of a Route

■ Directly connected routes

- Immediately appear in the routing table as soon as the interface is configured

```
R2#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 not set
```

```
172.16.0.0/24 is subnetted, 3 subnets
```

```
C      172.16.1.0 is directly connected, FastEthernet0/0  
C      172.16.2.0 is directly connected, Serial0/0/0  
S      172.16.3.0 is directly connected, Serial0/0/0  
C      192.168.1.0/24 is directly connected, Serial0/0/1  
S      192.168.2.0/24 [1/0] via 192.168.1.1
```

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 Routing Protocols

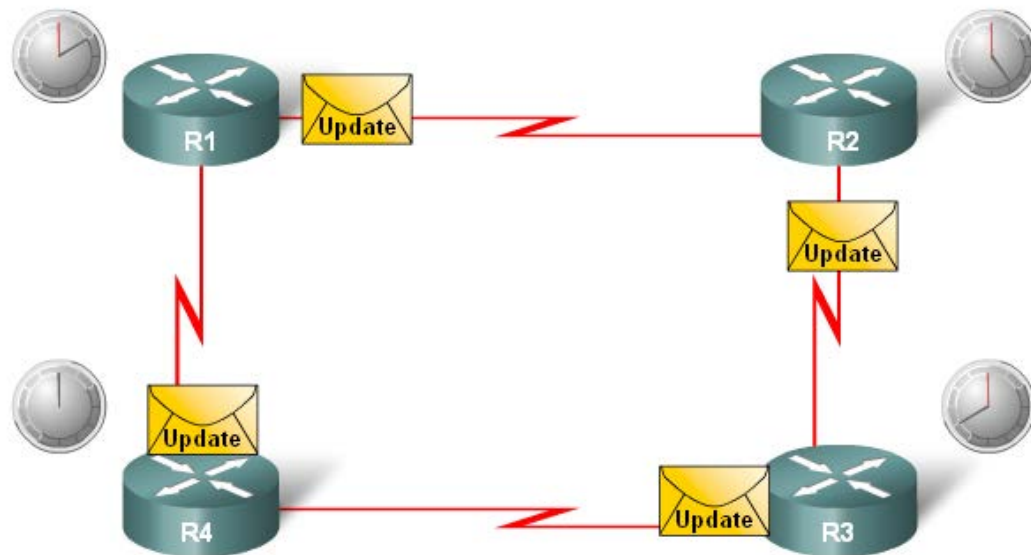
■ Distance Vector Technology

–The Meaning of Distance Vector:

- A router using distance vector routing protocols knows 2 things:
(거리 벡터 라우팅 프로토콜을 사용하는 라우터는 다음 두 가지를 알고 있습니다.)
 - **Distance** to final destination (최종 목적지까지의 거리)
 - **Vector, or direction**, traffic should be directed (트래픽이 유도되는 벡터(또는 방향))

Distance Vector Routing Protocols

- **Characteristics of Distance Vector routing protocols:**
 - Periodic updates (주기적인 업데이트)
 - Neighbors (이웃하는 라우터들)
 - Broadcast updates (브로드캐스트 업데이트)
 - Entire routing table is included with routing update (라우팅 업데이트에 전체 라우팅 테이블 포함)



Distance Vector Routing Protocols

Routing Protocol Characteristics

- Criteria used to compare routing protocols includes
(라우팅 프로토콜을 비교하는 기준)
 - Time to convergence (컨버전스되는 시간)
 - Scalability (확장성)
 - Resource usage (자원 사용)
 - Implementation & maintenance (구현 & 유지보수)

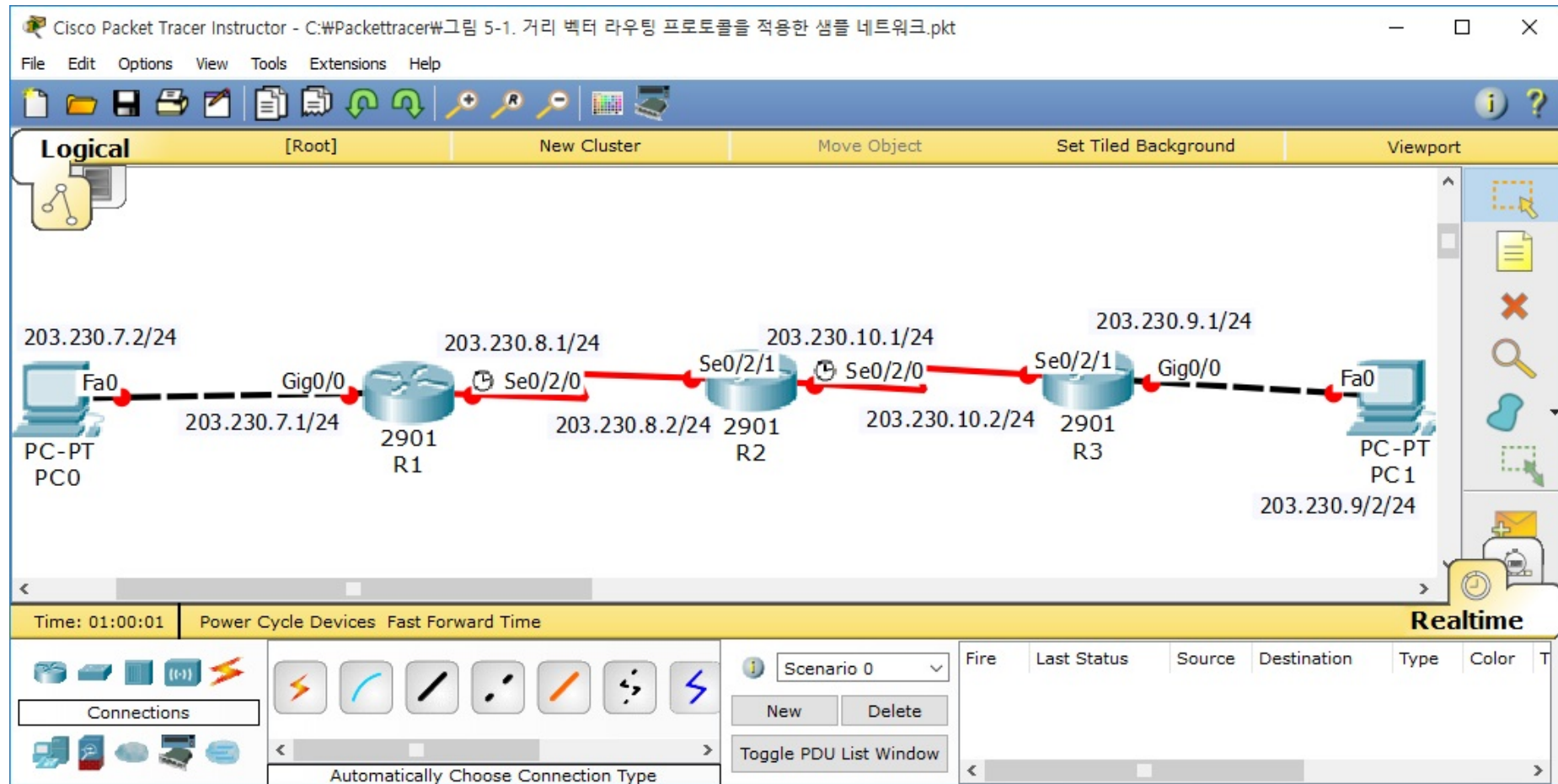
Routing Protocols Today

- Factors used to determine whether to use RIP or EIGRP include
 - Network size
 - Compatibility between models of routers
 - Administrative knowledge

Distance Vector Routing Protocols Compared

	Ripv1	Ripv2	IGRP	EIGRP
Speed of Convergence	Slow	Slow	Slow	Fast
Scalability – size of network	Small	Small	Small	Large
Use of VLSM	No	Yes	No	Yes
Resource usage	Low	Low	Low	Medium
Implementation and maintenance	Simple	Simple	Simple	Complex

거리 벡터 라우팅 프로토콜 샘플 네트워크



거리-벡터 라우팅 프로토콜의 라우팅 테이블 업데이트 과정

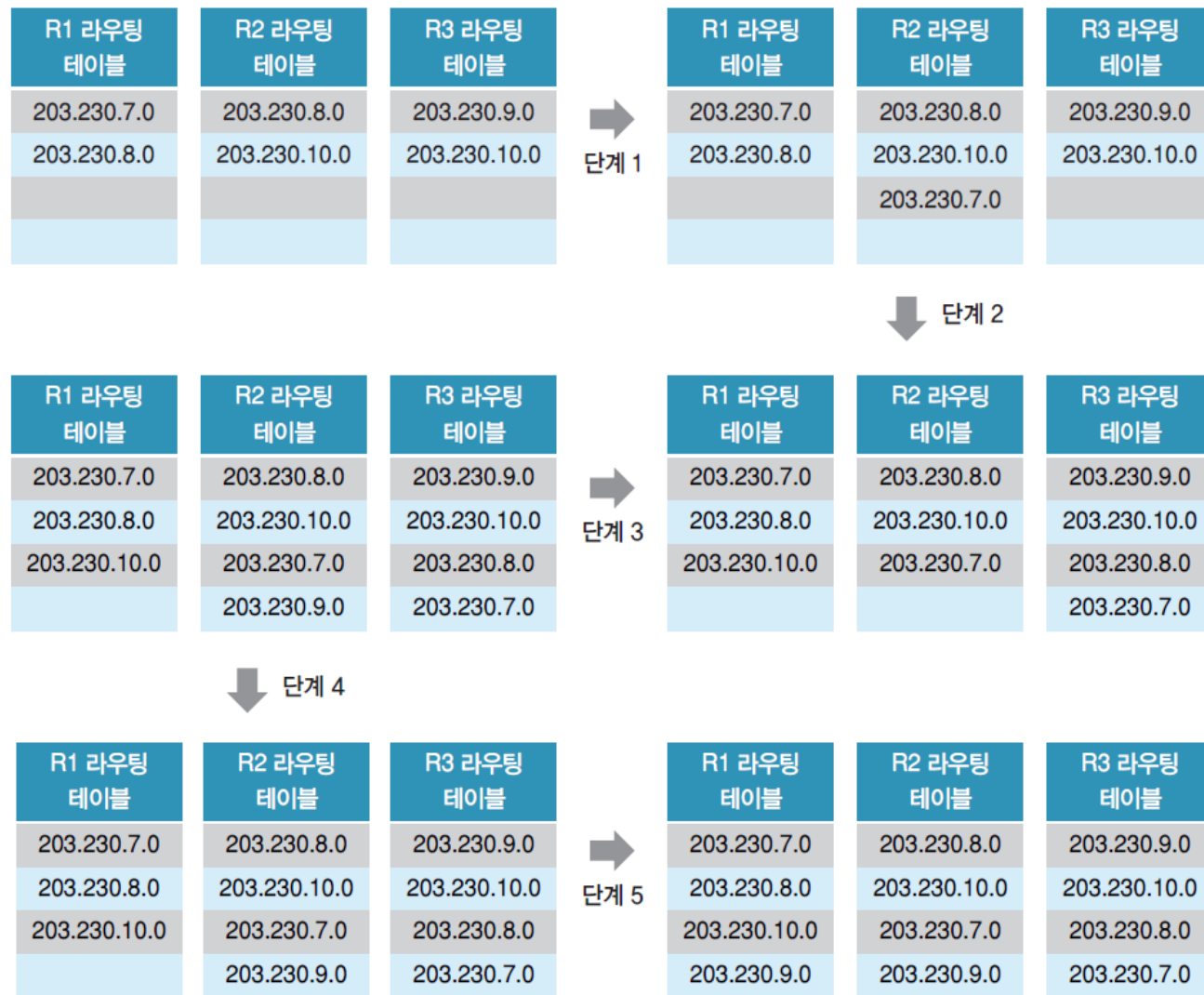
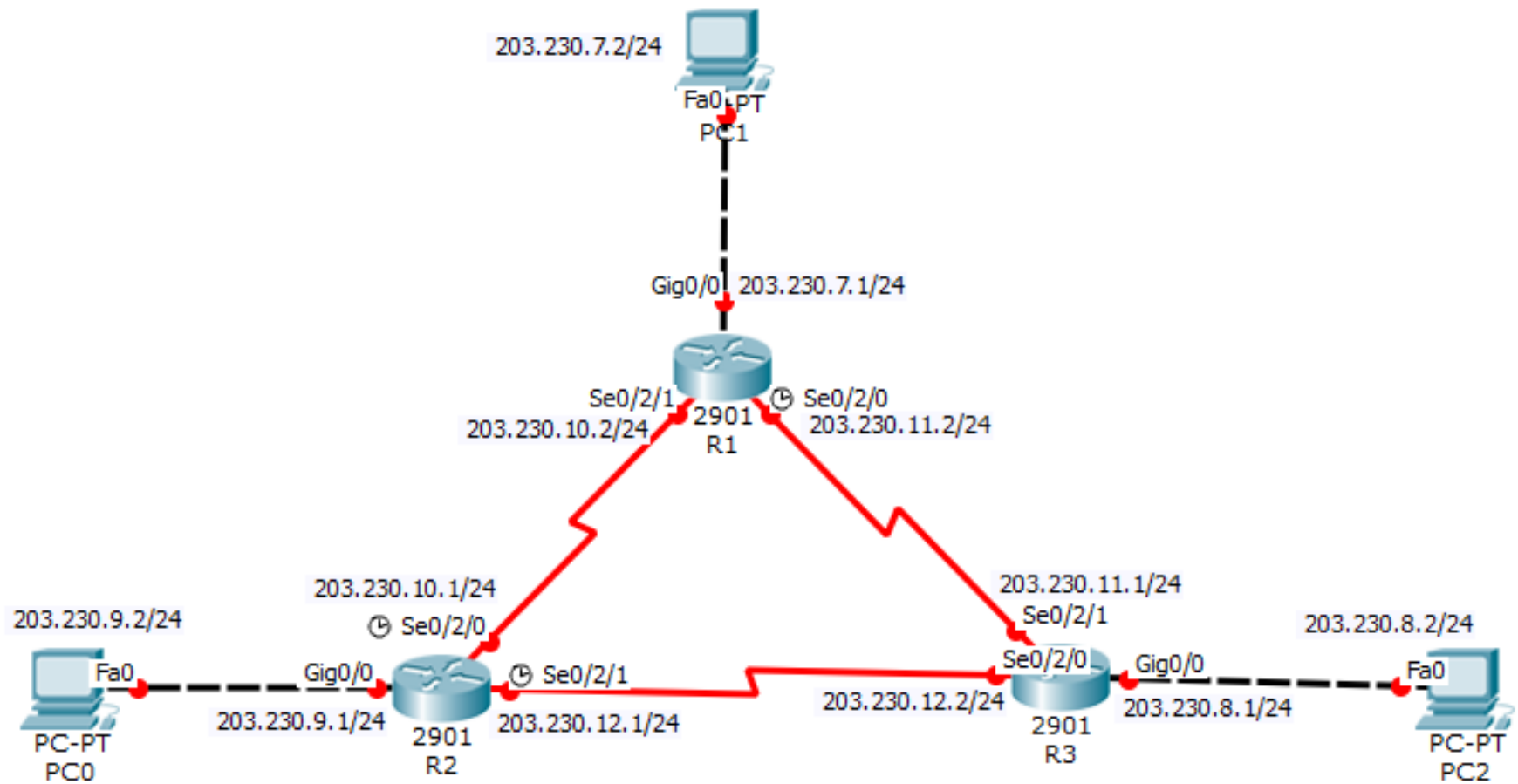


그림 5-2 라우팅 테이블 업데이트 과정

RIPv1 - 기본 네트워크 토폴로지



Configuring RIP

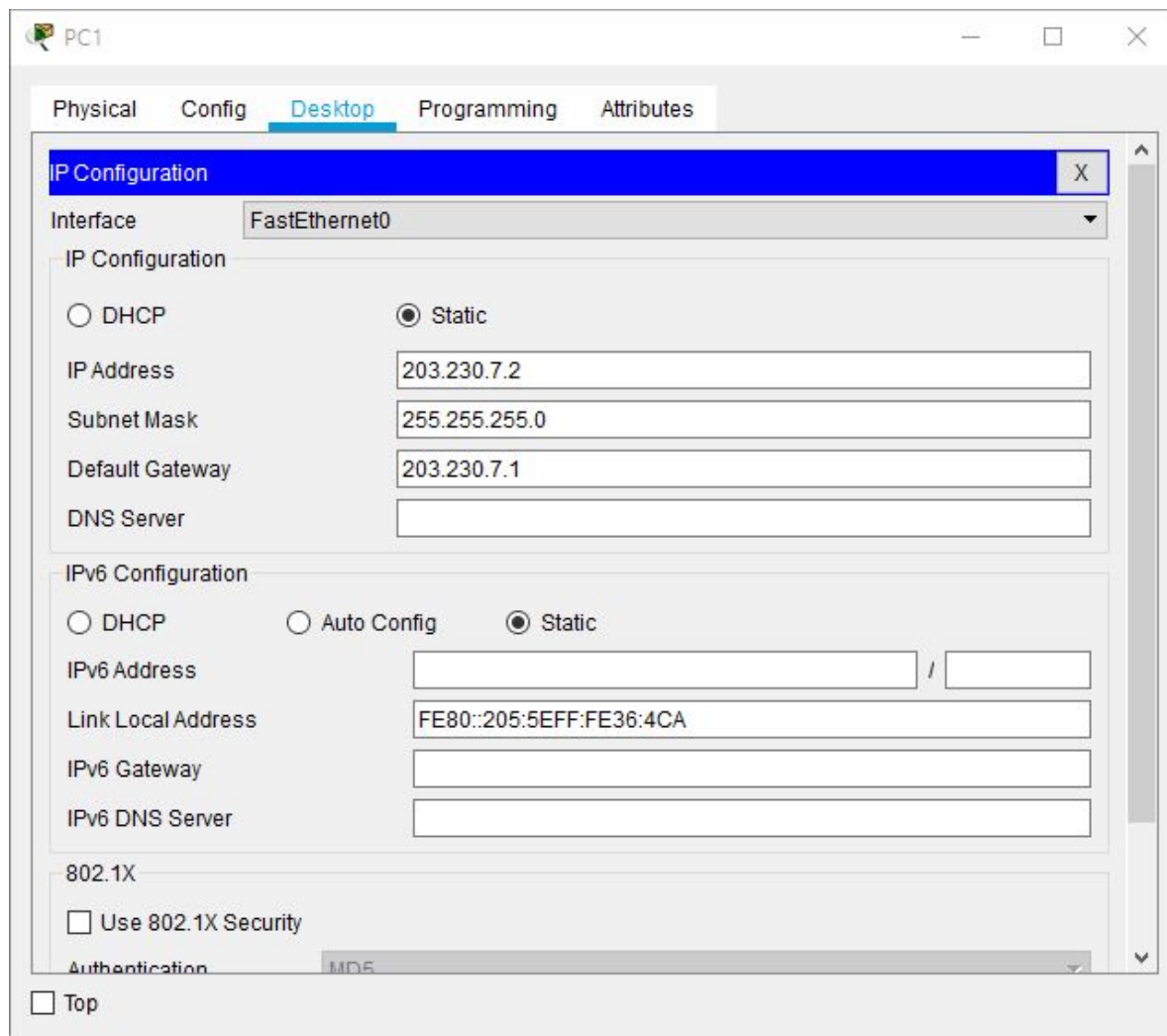
■ PC0 IP 주소 할당

The screenshot shows a configuration window for PC0 with the following details:

- Window Title:** PC0
- Tabs:** Physical, Config, Desktop (selected), Programming, Attributes
- IP Configuration Section:**
 - Interface:** FastEthernet0
 - IP Configuration:**
 - ☐ DHCP
 - ☒ Static
 - IP Address:** 203.230.9.2
 - Subnet Mask:** 255.255.255.0
 - Default Gateway:** 203.230.9.1
 - DNS Server:** (empty)
- IPv6 Configuration Section:**
 - ☐ DHCP
 - ☐ Auto Config
 - ☒ Static
 - IPv6 Address:** (empty) / (empty)
 - Link Local Address:** FE80::2D0:BAFF:FE87:9D53
 - IPv6 Gateway:** (empty)
 - IPv6 DNS Server:** (empty)
- 802.1X Section:**
 - ☐ Use 802.1X Security
- Bottom:** ☐ Top

Configuring RIP

■ PC1 IP 주소 할당

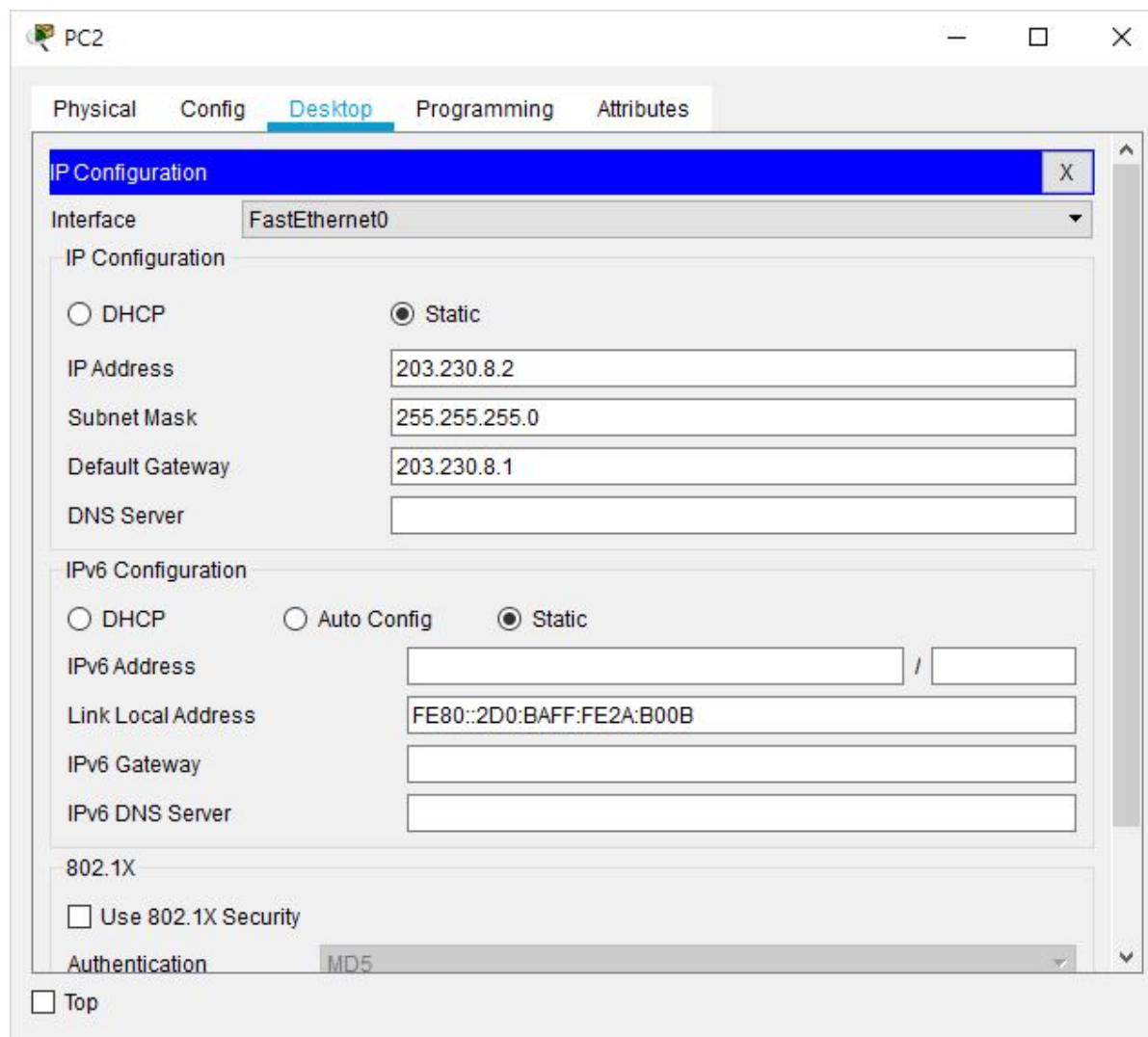


The screenshot shows a configuration window for PC1 with the following details:

- Physical** | **Config** | **Desktop** | **Programming** | **Attributes**
- IP Configuration** (tab selected)
- Interface:** FastEthernet0
- IP Configuration:**
 - ☐ DHCP
 - ☒ **Static**
 - IP Address:** 203.230.7.2
 - Subnet Mask:** 255.255.255.0
 - Default Gateway:** 203.230.7.1
 - DNS Server:** (empty)
- IPv6 Configuration:**
 - ☐ DHCP
 - ☐ Auto Config
 - ☒ **Static**
 - IPv6 Address:** (empty) / (empty)
 - Link Local Address:** FE80::205:5EFF:FE36:4CA
 - IPv6 Gateway:** (empty)
 - IPv6 DNS Server:** (empty)
- 802.1X:**
 - ☐ Use 802.1X Security
- Authentication:** MD5
- ☐ Top

Configuring RIP

■ PC2 IP 주소 할당



The screenshot shows the 'PC2' configuration window with the 'Desktop' tab selected. The 'IP Configuration' section is expanded, showing settings for the 'FastEthernet0' interface. The 'Static' radio button is selected under 'IP Configuration'. The IP Address is set to 203.230.8.2, Subnet Mask to 255.255.255.0, and Default Gateway to 203.230.8.1. The 'IPv6 Configuration' section shows 'Static' selected, with a Link Local Address of FE80::2D0:BAFF:FE2A:B00B. The '802.1X' section has 'Use 802.1X Security' unchecked and 'Authentication' set to MD5.

PC2

Physical Config **Desktop** Programming Attributes

IP Configuration X

Interface FastEthernet0

IP Configuration

☐ DHCP ☒ Static

IP Address 203.230.8.2

Subnet Mask 255.255.255.0

Default Gateway 203.230.8.1

DNS Server

IPv6 Configuration

☐ DHCP ☐ Auto Config ☒ Static

IPv6 Address /

Link Local Address FE80::2D0:BAFF:FE2A:B00B

IPv6 Gateway

IPv6 DNS Server

802.1X

☐ Use 802.1X Security

Authentication MD5

☐ Top

Configuring RIP

■ 라우터 R1 인터페이스 설정

```
Router> enable
Router# config terminal
Enter configuration commands, one per Line. End with CNTL/z.
Router(config)# hostname R1
R1(config)# interface gi0/0
R1(config-if)# ip address 203.230.7.1 255.255.255.0
R1(config-if)# no shutdown
R1(config-if)# exit
R1(config)# interface se0/2/0
R1(config-if)# ip address 203.230.11.2 255.255.255.0
R1(config-if)# clock rate 64000
R1(config-if)# no shutdown
R1(config-if)# exit
R1(config)# interface se0/2/1
R1(config-if)# ip address 203.230.10.2 255.255.255.0
R1(config-if)# no shutdown
```

Configuring RIP

■ 라우터 R2 인터페이스 설정

```
Router> enable
Router# config terminal
Enter configuration commands, one per Line. End with CNTL/z.
Router(config)# hostname R2
R2(config)# interface gi0/0
R2(config-if)# ip address 203.230.9.1 255.255.255.0
R2(config-if)# no shutdown
R2(config-if)# exit
R2(config)# interface se0/2/0
R2(config-if)# ip address 203.230.10.1 255.255.255.0
R2(config-if)# clock rate 64000
R2(config-if)# no shutdown
R2(config-if)# exit
R2(config)# interface se0/2/1
R2(config-if)# ip address 203.230.12.1 255.255.255.0
R2(config-if)# clock rate 64000
R2(config-if)# no shutdown
```

Configuring RIP

■ 라우터 R3 인터페이스 설정

```
Router> enable
Router# config terminal
Enter configuration commands, one per Line. End with CNTL/z.
Router(config)# hostname R3
R3(config)# interface gi0/0
R3(config-if)# ip address 203.230.8.1 255.255.255.0
R3(config-if)# no shutdown
R3(config-if)# exit
R3(config)# interface se0/2/0
R3(config-if)# ip address 203.230.12.2 255.255.255.0
R3(config-if)# no shutdown
R3(config-if)# exit
R3(config)# interface se0/2/1
R3(config-if)# ip address 203.230.11.1 255.255.255.0
R3(config-if)# no shutdown
```


Configuring RIP

■ 라우터에서 RIPv1 기본적인 설정 방법

```
Router>enable
```

```
Router#conf t
```

```
Router(config)#router rip
```

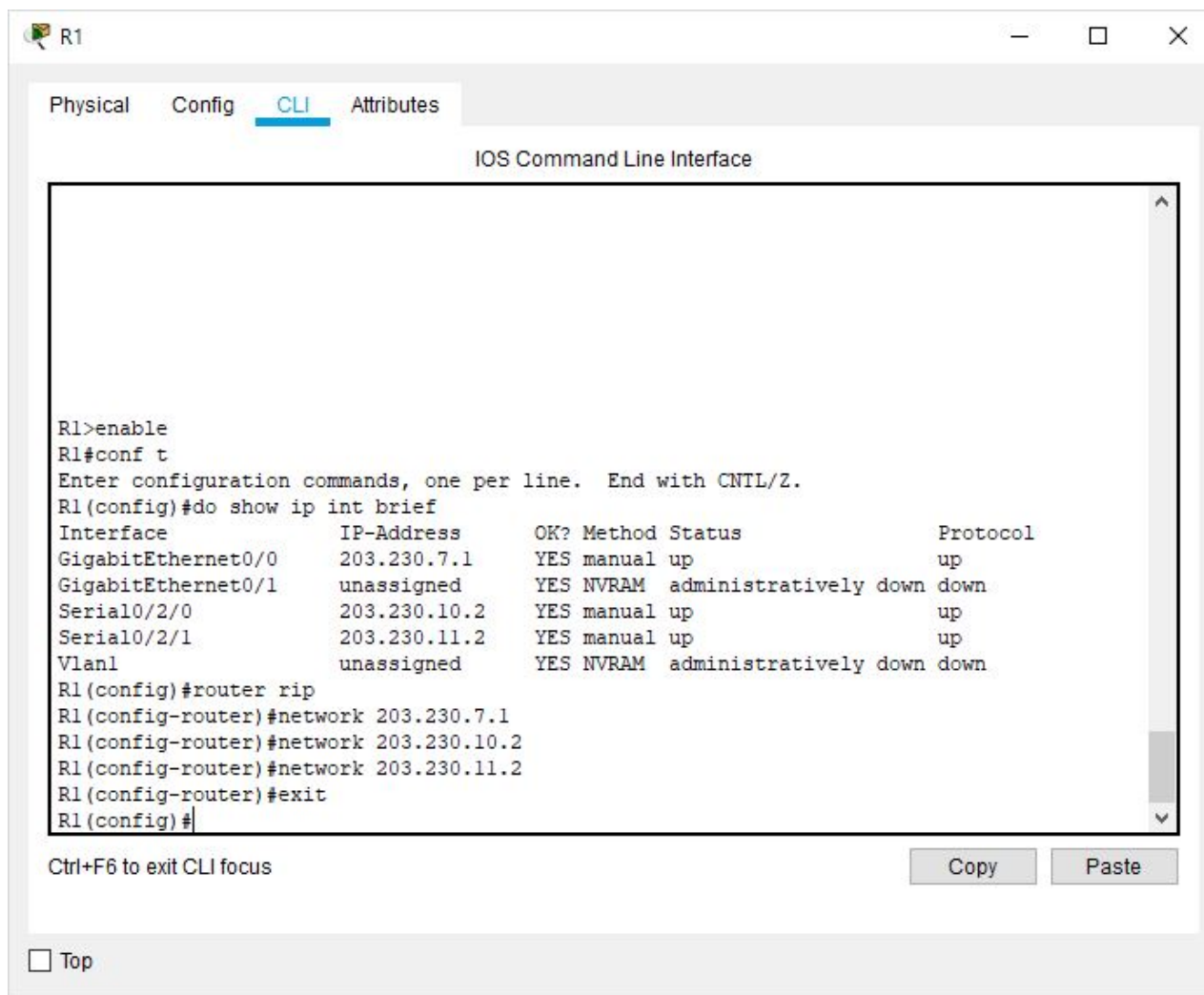
→ 라우팅 프로토콜로 RIP을 사용할 것을 선언.

```
Router(config-network)#network 네트워크 주소
```

→ `network` 명령어로 라우터에 직접 연결되어 있는 네트워크 주소를 입력.

Configuring RIP

■ R1에서 RIPv1 설정



```
R1>enable
R1#conf t
Enter configuration commands, one per line. End with CNTL/Z.
R1(config)#do show ip int brief
Interface                IP-Address      OK? Method Status      Protocol
GigabitEthernet0/0       203.230.7.1     YES manual  up          up
GigabitEthernet0/1       unassigned      YES NVRAM   administratively down down
Serial0/2/0              203.230.10.2    YES manual  up          up
Serial0/2/1              203.230.11.2    YES manual  up          up
Vlan1                    unassigned      YES NVRAM   administratively down down
R1(config)#router rip
R1(config-router)#network 203.230.7.1
R1(config-router)#network 203.230.10.2
R1(config-router)#network 203.230.11.2
R1(config-router)#exit
R1(config)#
```

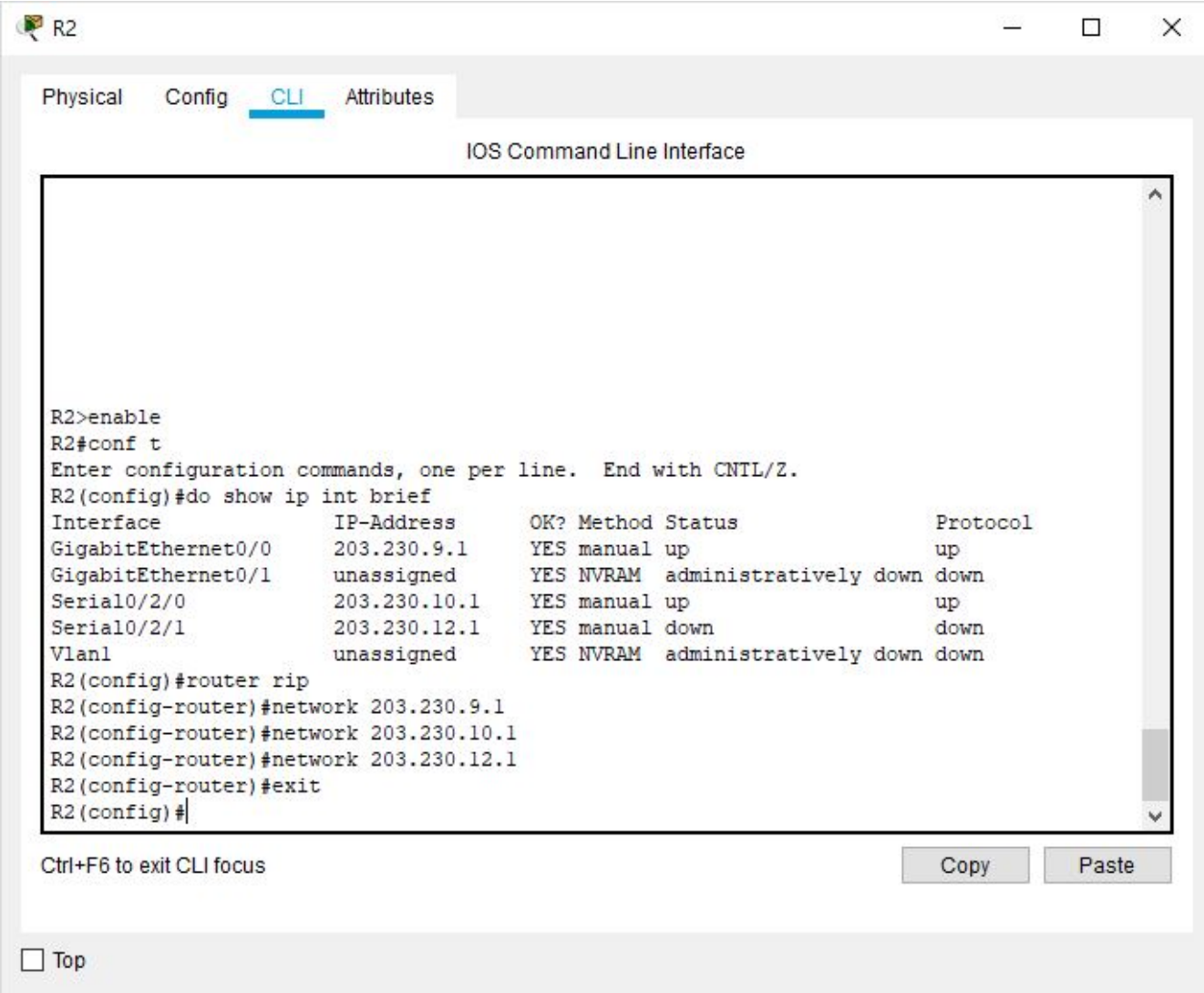
Ctrl+F6 to exit CLI focus

Copy Paste

☐ Top

Configuring RIP

■ R2에서 RIPv1 설정



The screenshot shows a network simulator window titled "R2" with tabs for Physical, Config, CLI, and Attributes. The CLI tab is active, displaying the "IOS Command Line Interface". The terminal output shows the following commands and their results:

```
R2>enable
R2#conf t
Enter configuration commands, one per line. End with CNTL/Z.
R2(config)#do show ip int brief
```

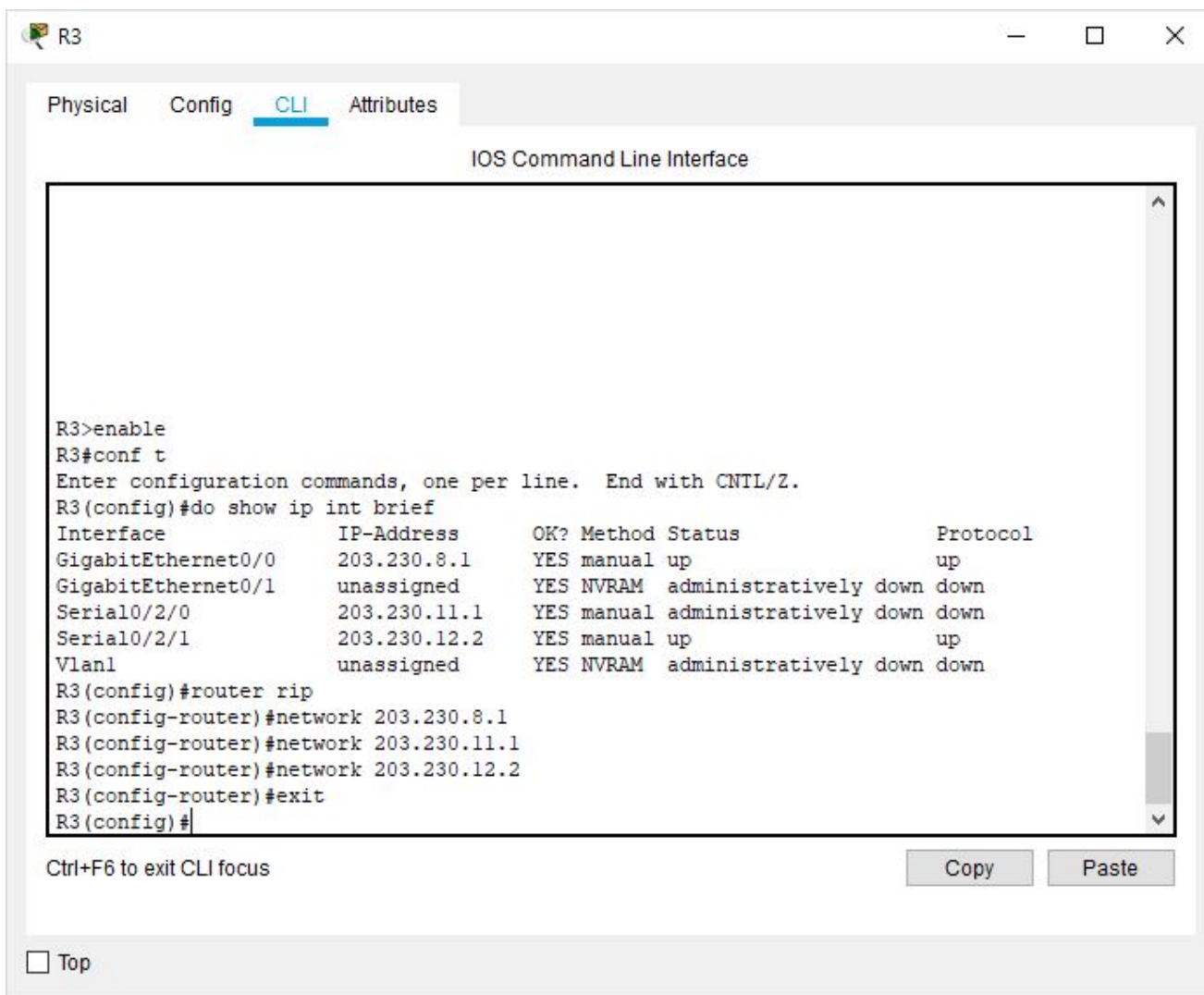
Interface	IP-Address	OK?	Method	Status	Protocol
GigabitEthernet0/0	203.230.9.1	YES	manual	up	up
GigabitEthernet0/1	unassigned	YES	NVRAM	administratively down	down
Serial0/2/0	203.230.10.1	YES	manual	up	up
Serial0/2/1	203.230.12.1	YES	manual	down	down
Vlan1	unassigned	YES	NVRAM	administratively down	down

```
R2(config)#router rip
R2(config-router)#network 203.230.9.1
R2(config-router)#network 203.230.10.1
R2(config-router)#network 203.230.12.1
R2(config-router)#exit
R2(config)#
```

Below the terminal output, there is a status bar with the text "Ctrl+F6 to exit CLI focus" and two buttons: "Copy" and "Paste". At the bottom left, there is a checkbox labeled "Top".

Configuring RIP

■ R3에서 RIPv1 설정



The screenshot shows a window titled 'R3' with tabs for 'Physical', 'Config', 'CLI', and 'Attributes'. The 'CLI' tab is active, displaying the 'IOS Command Line Interface'. The terminal output shows the following commands and their results:

```
R3>enable
R3#conf t
Enter configuration commands, one per line. End with CNTL/Z.
R3(config)#do show ip int brief
```

Interface	IP-Address	OK?	Method	Status	Protocol
GigabitEthernet0/0	203.230.8.1	YES	manual	up	up
GigabitEthernet0/1	unassigned	YES	NVRAM	administratively down	down
Serial0/2/0	203.230.11.1	YES	manual	administratively down	down
Serial0/2/1	203.230.12.2	YES	manual	up	up
Vlan1	unassigned	YES	NVRAM	administratively down	down

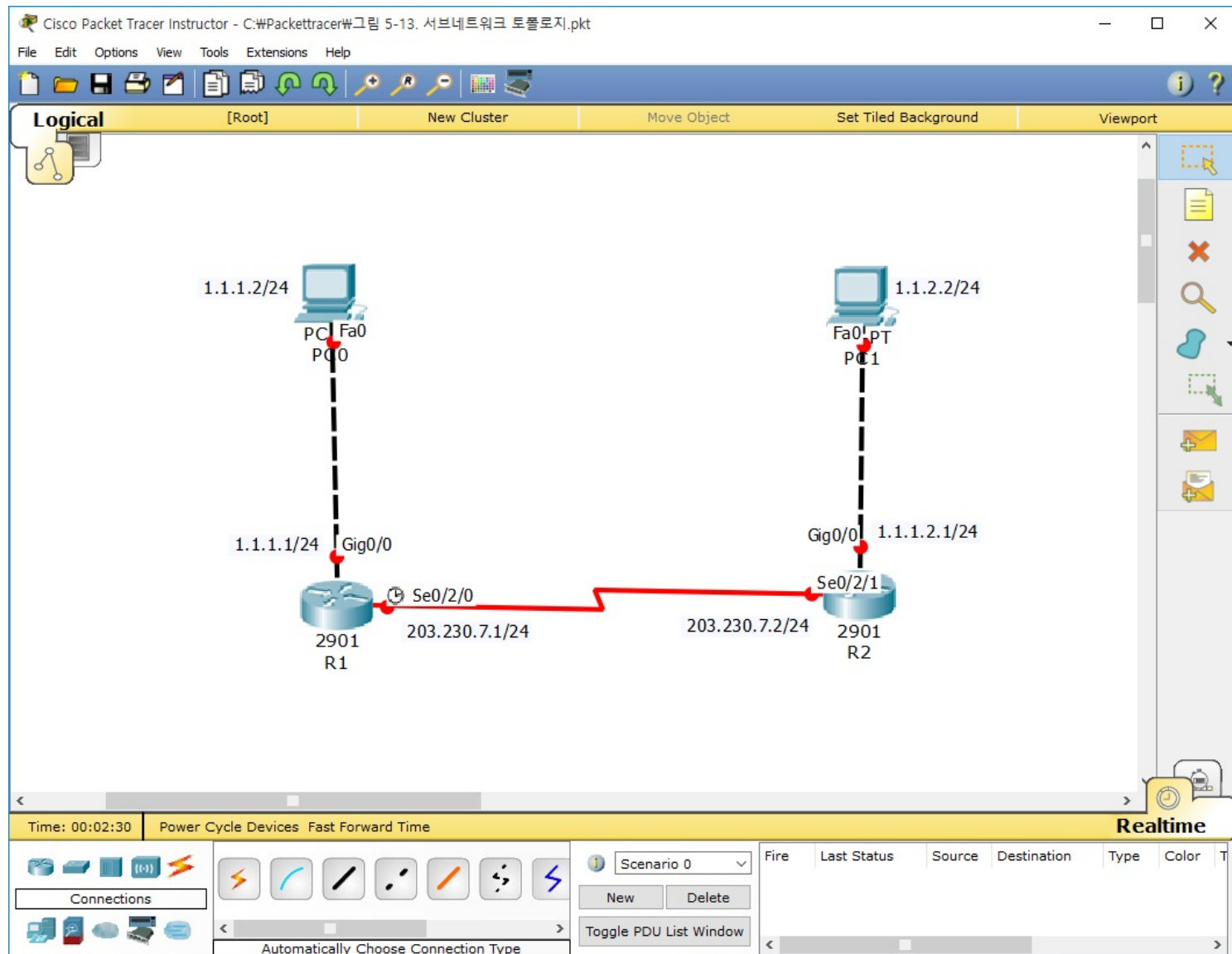
```
R3(config)#router rip
R3(config-router)#network 203.230.8.1
R3(config-router)#network 203.230.11.1
R3(config-router)#network 203.230.12.2
R3(config-router)#exit
R3(config)#
```

At the bottom of the CLI window, there is a prompt 'Ctrl+F6 to exit CLI focus' and two buttons: 'Copy' and 'Paste'. Below the CLI window, there is a checkbox labeled 'Top'.

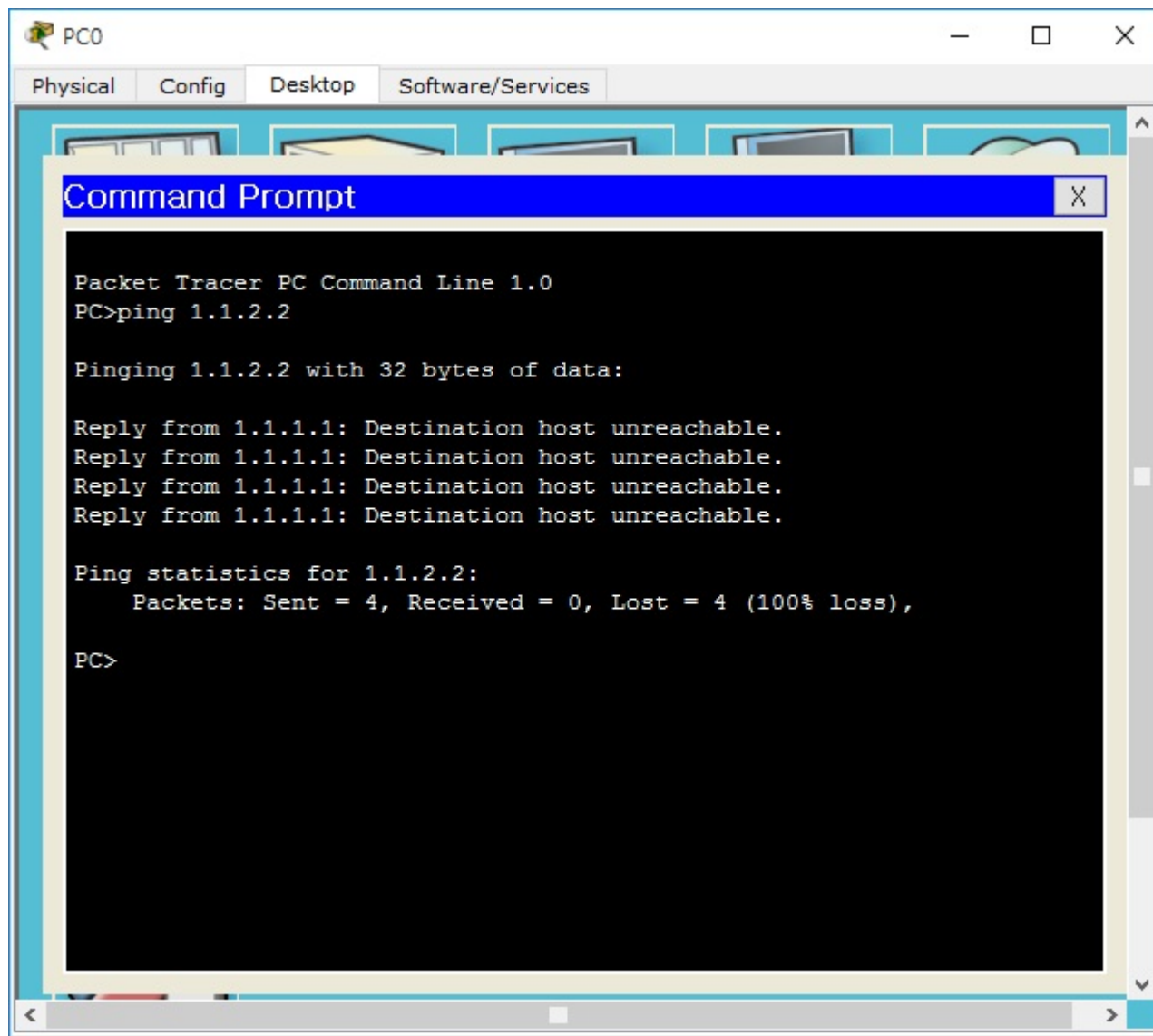
Verifying routing tables on R1, R2, and R3

- **show ip route**
- **show ip protocols**
- **debug ip rip**
- **passive-interface GigabitEthernet0/0**
 - 특정 인터페이스에 라우팅 업데이트 정보를 보내지 않도록 설정

서브네트워크 토폴로지



ping test between PC0 and PC1



The screenshot shows a Packet Tracer PC Command Line window for PC0. The window has tabs for Physical, Config, Desktop, and Software/Services. The Desktop tab is active, showing a desktop environment with a Command Prompt window open. The Command Prompt window has a title bar that says "Command Prompt" and a close button. The text inside the Command Prompt window is as follows:

```
Packet Tracer PC Command Line 1.0
PC>ping 1.1.2.2

Pinging 1.1.2.2 with 32 bytes of data:

Reply from 1.1.1.1: Destination host unreachable.
Reply from 1.1.1.1: Destination host unreachable.
Reply from 1.1.1.1: Destination host unreachable.
Reply from 1.1.1.1: Destination host unreachable.

Ping statistics for 1.1.2.2:
    Packets: Sent = 4, Received = 0, Lost = 4 (100% loss),

PC>
```

ping test between PC0 and PC1

```
R1#show ip route
```

```
Codes: L - local, C - connected, S - static, 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 not set
```

```
      1.0.0.0/8 is variably subnetted, 2 subnets, 2 masks
```

```
C      1.1.1.0/24 is directly connected, GigabitEthernet0/0
```

```
L      1.1.1.1/32 is directly connected, GigabitEthernet0/0
```

```
     203.230.7.0/24 is variably subnetted, 2 subnets, 2 masks
```

```
C      203.230.7.0/24 is directly connected, Serial0/2/0
```

```
L      203.230.7.1/32 is directly connected, Serial0/2/0
```

```
R1#
```


Considerations regarding RIPv1

```
R1#debug ip rip
RIP protocol debugging is on
R1#RIP: sending v1 update to 255.255.255.255 via GigabitEthernet0/0 (1.1.1.1)
RIP: build update entries
      network 203.230.7.0 metric 1
RIP: sending v1 update to 255.255.255.255 via Serial0/2/0 (203.230.7.1)
RIP: build update entries
      network 1.0.0.0 metric 1
RIP: received v1 update from 203.230.7.2 on Serial0/2/0
      1.0.0.0 in 1 hops
RIP: sending v1 update to 255.255.255.255 via GigabitEthernet0/0 (1.1.1.1)
RIP: build update entries
      network 203.230.7.0 metric 1
RIP: sending v1 update to 255.255.255.255 via Serial0/2/0 (203.230.7.1)
RIP: build update entries
      network 1.0.0.0 metric 1
RIP: received v1 update from 203.230.7.2 on Serial0/2/0
      1.0.0.0 in 1 hops

R2#debug ip rip
RIP protocol debugging is on
R2#RIP: received v1 update from 203.230.7.1 on Serial0/2/1
      1.0.0.0 in 1 hops
RIP: sending v1 update to 255.255.255.255 via Serial0/2/1 (203.230.7.2)
RIP: build update entries
      network 1.0.0.0 metric 1
RIP: sending v1 update to 255.255.255.255 via GigabitEthernet0/0 (1.1.2.1)
RIP: build update entries
      network 203.230.7.0 metric 1
```

Considerations regarding RIPv1 (cont.)

- R1과 R2 간의 v1 업데이트 엔트리에 *network 1.0.0.0* 이 포함
- R1과 R2가 모두 상대방에게 받은 네트워크 1.0.0.0을 라우팅 테이블에

반영하지 않는 이유는 무엇인가?

- 1.0.0.0 네트워크가 자신에 직접 연결된 (directly connected) 인터페이스에서도 사용하는 네트워크 주소
- 더 나아가 수신한 네트워크 정보 1.0.0.0의 AD 값은 120이지만 직접 연결된 네트워크 1.0.0.0의 AD 값은 0
- 따라서 상대 라우터로부터 수신한 1.0.0.0 네트워크 정보는 반영될 수가 없음
- RIPv1은 클래스풀 라우팅 프로토콜!

RIPv2

- RIPv2는 클래스리스 라우팅 프로토콜
- 라우팅 업데이트 시 네트워크 정보와 함께 서브넷 마스크 정보도 전달
- 자동 요약 기능은 설정할 수도 해제할 수도 있음
- RIPv2는 RIPv1에 비해 보안성 강화
- 라우팅 정보 전달 방식: RIPv1의 경우는 라우팅 정보 전달 시 브로드캐스트 주소 (255.255.255.255)를 사용하지만, RIPv2는 멀티캐스트 주소 (224.0.0.9)를 사용

Configuring RIPv2

```
R1>en
R1#conf t
Enter configuration commands, one per line. End with CNTL/Z.
R1(config)#router rip
R1(config-router)#version 2
R1(config-router)#no auto-summary
R1(config-router)#

R2>en
R2#conf t
Enter configuration commands, one per line. End with CNTL/Z.
R2(config)#router rip
R2(config-router)#version 2
R2(config-router)#no auto-summary
R2(config-router)#
```

Routing table

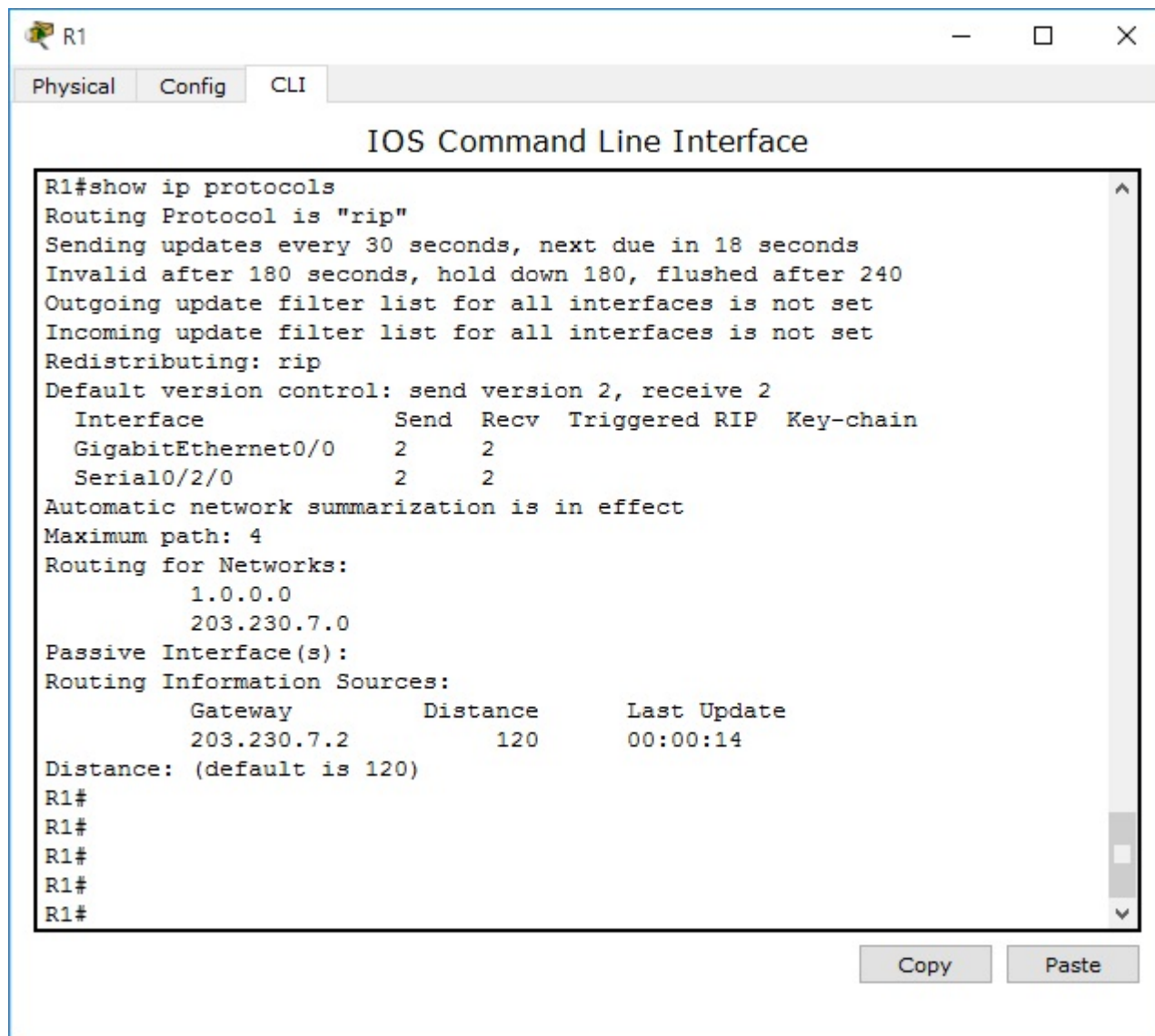
```
R1#show ip route
```

```
Codes: L - local, C - connected, S - static, 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 not set
```

```
      1.0.0.0/8 is variably subnetted, 3 subnets, 2 masks  
C       1.1.1.0/24 is directly connected, GigabitEthernet0/0  
L       1.1.1.1/32 is directly connected, GigabitEthernet0/0  
R       1.1.2.0/24 [120/1] via 203.230.7.2, 00:00:12, Serial0/2/0  
      10.0.0.0/8 is variably subnetted, 2 subnets, 2 masks  
C       10.10.10.0/24 is directly connected, Loopback0  
L       10.10.10.1/32 is directly connected, Loopback0  
      203.230.7.0/24 is variably subnetted, 2 subnets, 2 masks  
C       203.230.7.0/24 is directly connected, Serial0/2/0  
L       203.230.7.1/32 is directly connected, Serial0/2/0  
R1#
```

Routing protocols in detail



```
R1#show ip protocols
Routing Protocol is "rip"
Sending updates every 30 seconds, next due in 18 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 2, receive 2
  Interface                Send  Recv  Triggered RIP  Key-chain
GigabitEthernet0/0         2      2
Serial0/2/0                2      2
Automatic network summarization is in effect
Maximum path: 4
Routing for Networks:
  1.0.0.0
  203.230.7.0
Passive Interface(s):
Routing Information Sources:
  Gateway         Distance      Last Update
  203.230.7.2          120          00:00:14
Distance: (default is 120)
R1#
R1#
R1#
R1#
R1#
```

Copy Paste

debug ip rip

```
R1#debug ip rip
RIP protocol debugging is on
R1#RIP: sending v2 update to 224.0.0.9 via GigabitEthernet0/0 (1.1.1.1)
RIP: build update entries
    1.0.0.0/8 via 0.0.0.0, metric 2, tag 0
    203.230.7.0/24 via 0.0.0.0, metric 1, tag 0
RIP: sending v2 update to 224.0.0.9 via Serial0/2/0 (203.230.7.1)
RIP: build update entries
    1.0.0.0/8 via 0.0.0.0, metric 1, tag 0
RIP: received v2 update from 203.230.7.2 on Serial0/2/0
    1.0.0.0/8 via 0.0.0.0 in 1 hops
RIP: sending v2 update to 224.0.0.9 via GigabitEthernet0/0 (1.1.1.1)
RIP: build update entries
    1.0.0.0/8 via 0.0.0.0, metric 2, tag 0
    203.230.7.0/24 via 0.0.0.0, metric 1, tag 0
RIP: sending v2 update to 224.0.0.9 via Serial0/2/0 (203.230.7.1)
RIP: build update entries
    1.0.0.0/8 via 0.0.0.0, metric 1, tag 0
RIP: received v2 update from 203.230.7.2 on Serial0/2/0
    1.0.0.0/8 via 0.0.0.0 in 1 hops
RIP: received v2 update from 203.230.7.2 on Serial0/2/0
    1.0.0.0/8 via 0.0.0.0 in 1 hops
RIP: sending v2 update to 224.0.0.9 via GigabitEthernet0/0 (1.1.1.1)
```

Default Route

- 그림 5-13 서브네트워크 토폴로지에서 라우터 R1을 이 토폴로지에 있는 모든 로컬 LAN 들이 외부 인터넷과 연결하기 위한 라우터라고 가정 (즉, R2는 인터넷에 연결된 다른 라우터와 패킷을 주고받기 위해서는 반드시 R1을 거쳐야만 됨)
- 이 경우 라우터 R1이나 R2는 외부 인터넷에 있는 무수히 많은 네트워크에 대한 정보를 라우팅 테이블에 가지고 있어야 할까?
 - 라우팅 테이블에 어떤 네트워크에 대한 정보가 없다면 해당 네트워크와는 통신을 할 수 없으나,
 - 이때 발생하는 아주 심각한 문제는 라우터의 라우팅 테이블이 매우 커지고 복잡해진다는 것이다.
- 디폴트 경로의 개념을 복잡하게 커지는 라우팅 테이블을 간소화하기 위해 적용

Adding a loopback interface

```
R1(config)#interface loopback 0

%LINK-5-CHANGED: Interface Loopback0, changed state to up

%LINEPROTO-5-UPDOWN: Line protocol on Interface Loopback0, changed state to up

R1(config-if)#ip address 10.10.10.1 255.255.255.0
R1(config-if)#exit
R1(config)#do show ip route
Codes: L - local, C - connected, S - static, 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 not set

    1.0.0.0/8 is variably subnetted, 3 subnets, 2 masks
C       1.1.1.0/24 is directly connected, GigabitEthernet0/0
L       1.1.1.1/32 is directly connected, GigabitEthernet0/0
R       1.1.2.0/24 [120/1] via 203.230.7.2, 00:00:25, Serial0/2/0
    10.0.0.0/8 is variably subnetted, 2 subnets, 2 masks
C       10.10.10.0/24 is directly connected, Loopback0
L       10.10.10.1/32 is directly connected, Loopback0
    203.230.7.0/24 is variably subnetted, 2 subnets, 2 masks
C       203.230.7.0/24 is directly connected, Serial0/2/0
L       203.230.7.1/32 is directly connected, Serial0/2/0
```

Configuring default route

- **R1(config)# ip route 0.0.0.0 0.0.0.0 loopback 0**

**%Default route without gateway, if not a point-to-point interface,
may impact performance**

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

- **R1(config-router)# default-information originate**

- **Verify routing tables on R1 and R2**



Thank You
