

네트워크 기말고사

91613624 김민경
91613739 백수연



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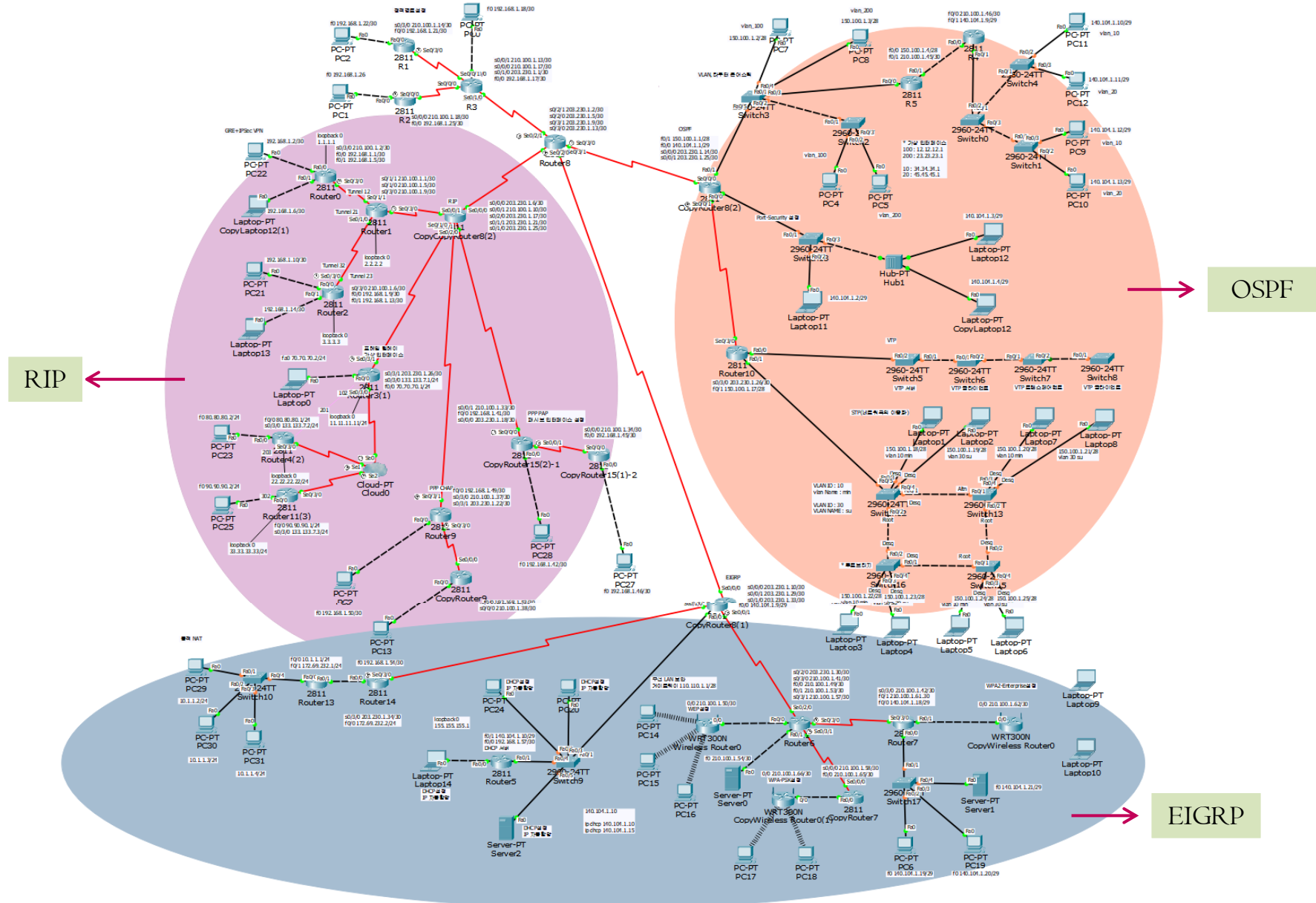
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I. 전체 토폴로지 (RIP, EIGRP, OSPF)



2. 정적 경로 (Static Routing)

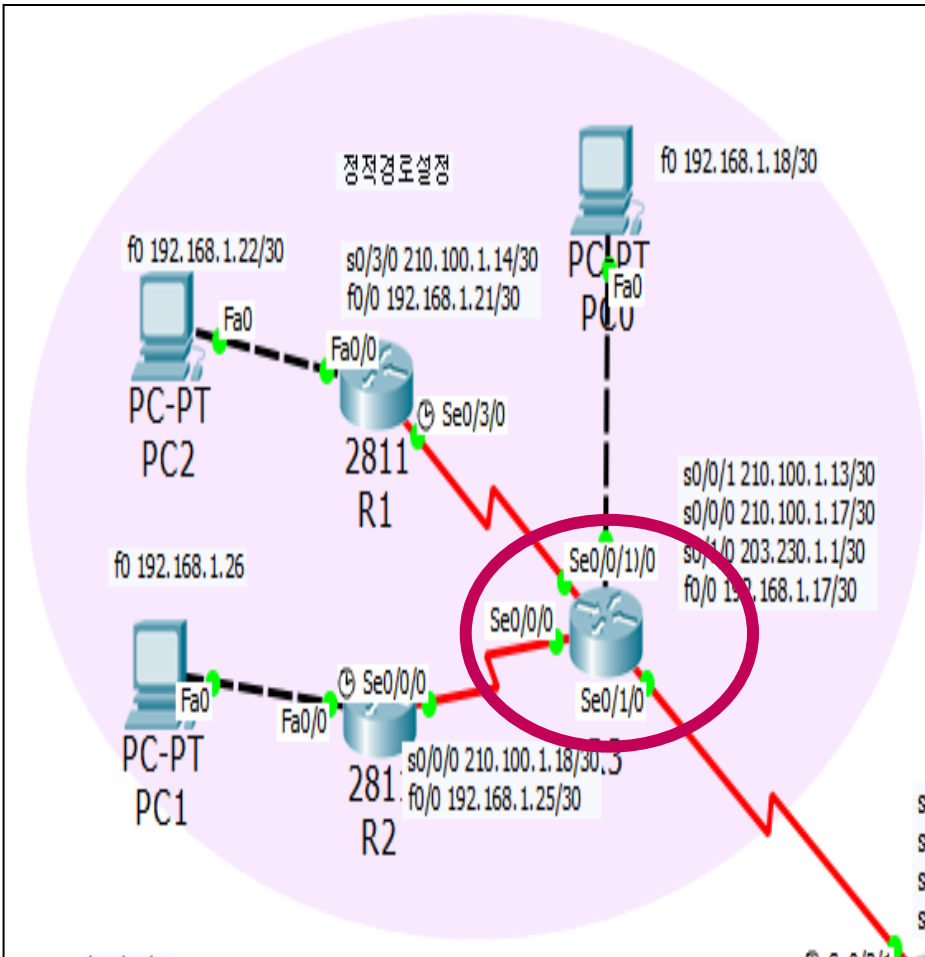
- 관리자가 경로를 직접 지정하는 방법으로 설정이 간단하다.
- 토폴로지가 변경되면 관리자가 직접 변경해야 한다.
- 경로 설정을 유지하기 위한 라우팅 정보 교환이 불필요하다.
- 소규모 네트워크, 경로가 고정된 네트워크에 주로 사용된다.
- 두 가지 방식의 정적 경로 설정
 - 1> 연결된 상대방 라우터의 IP 주소로 설정
 - 2> 자신의 출력 인터페이스 명으로 설정
- 스템브 네트워크 디폴트 정적 경로 설정
: 외부 네트워크와의 통신경로가 유일무이한 경우의 로컬 LAN의 경우 디폴트 정적 경로를 설정해준다.

2. 정적 경로 설정 (IP 주소로 설정)



정적 경로

R3



IP 주소를 이용한 정적 경로 설정

```
R3(config)#ip route 192.168.1.20 255.255.255.252
210.100.1.14
R3(config)#ip route 192.168.1.24 255.255.255.252
210.100.1.18
```

라우팅 테이블 확인

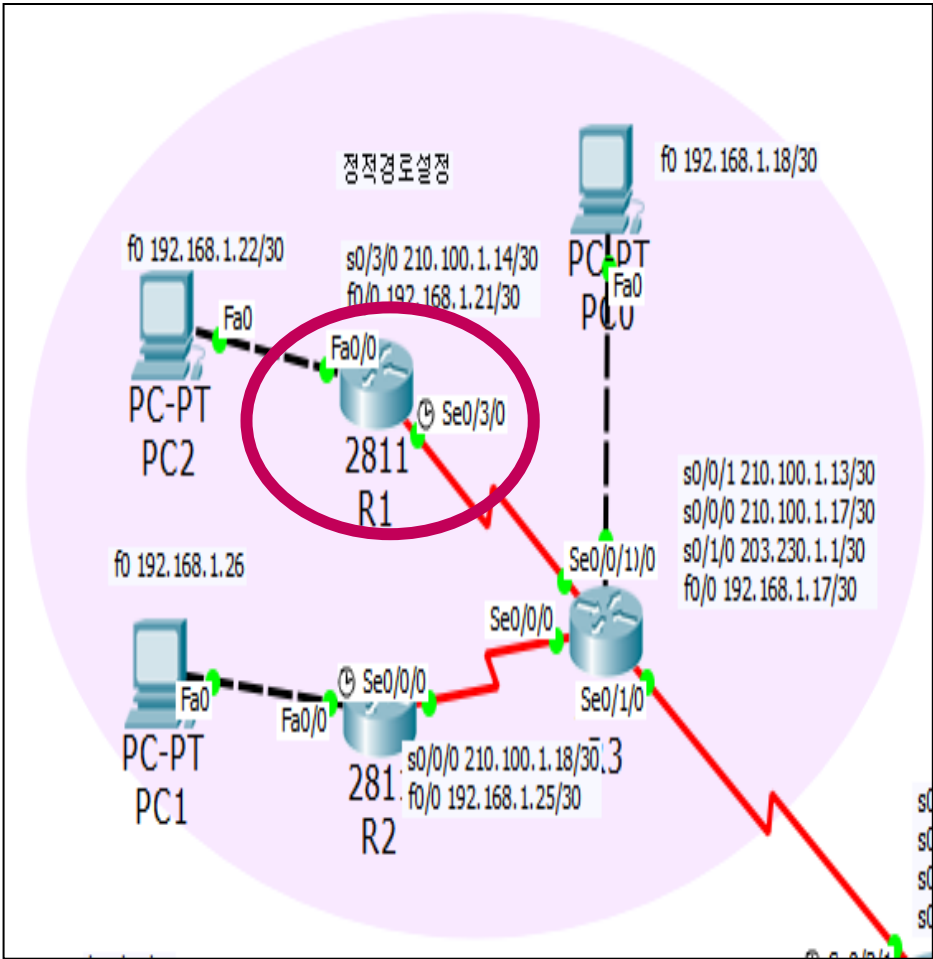
```
192.168.1.0/30 is subnetted, 3 subnets
C      192.168.1.16 is directly connected,
FastEthernet0/0
S      192.168.1.20 [1/0] via 210.100.1.14
S      192.168.1.24 [1/0] via 210.100.1.18
203.230.1.0/30 is subnetted, 1 subnets
C      203.230.1.0 is directly connected, Serial0/1/0
210.100.1.0/30 is subnetted, 2 subnets
C      210.100.1.12 is directly connected, Serial0/0/1
C      210.100.1.16 is directly connected, Serial0/0/0
```

2. 정적 경로 설정 (출력 인터페이스로 설정)



정적 경로

RI



출력 인터페이스를 이용한 정적 경로 설정

```

R1(config)#ip route 192.168.1.24 255.255.255.252
s0/3/0
R1(config)#ip route 210.100.1.16 255.255.255.252
s0/3/0
R1(config)#ip route 192.168.1.16 255.255.255.252
s0/3/0
    
```

라우팅 테이블 확인

```

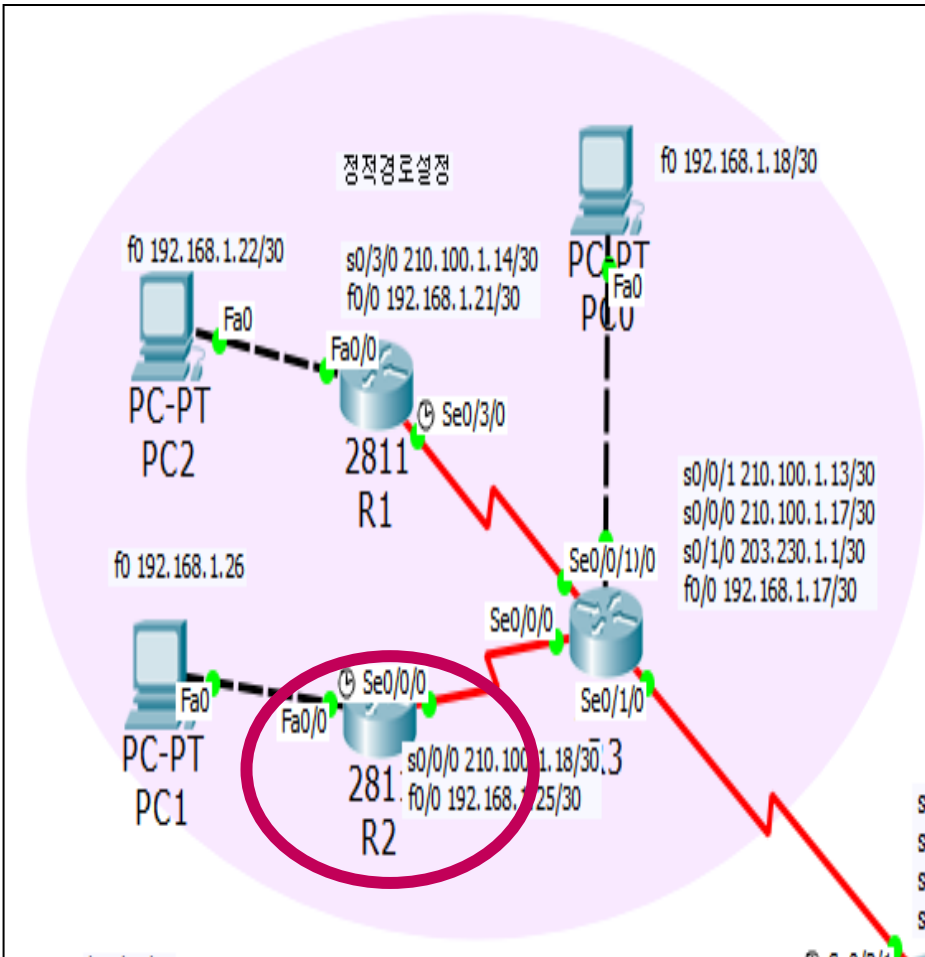
192.168.1.0/30 is subnetted, 3 subnets
S    192.168.1.16 [1/0] via 210.100.1.13
      is directly connected, Serial10/3/0
C    192.168.1.20 is directly connected, FastEthernet0/0
S    192.168.1.24 [1/0] via 210.100.1.13
      is directly connected, Serial10/3/0
210.100.1.0/30 is subnetted, 2 subnets
C    210.100.1.12 is directly connected, Serial10/3/0
S    210.100.1.16 [1/0] via 210.100.1.13
      is directly connected, Serial10/3/0
    
```

2. 정적 경로 설정 (스터브 네트워크 디폴트 정적 경로 설정)



정적 경로

R2



스터브 네트워크 디폴트 정적 경로 설정

```
R2# ip route 0.0.0.0 0.0.0.0 210.100.1.17
```

라우팅 테이블 확인

```
C 192.168.1.24 is directly connected, FastEthernet0/0
  210.100.1.0/30 is subnetted, 2 subnets
C   210.100.1.16 is directly connected, Serial0/0/0
S*  0.0.0.0/0 [1/0] via 210.100.1.17
```

모든 외부 IP 주소에 대해 210.100.1.17을 통해 연결하도록 설정하여 라우팅 설정을 단순화하고 라우팅 테이블을 간소화하였다.

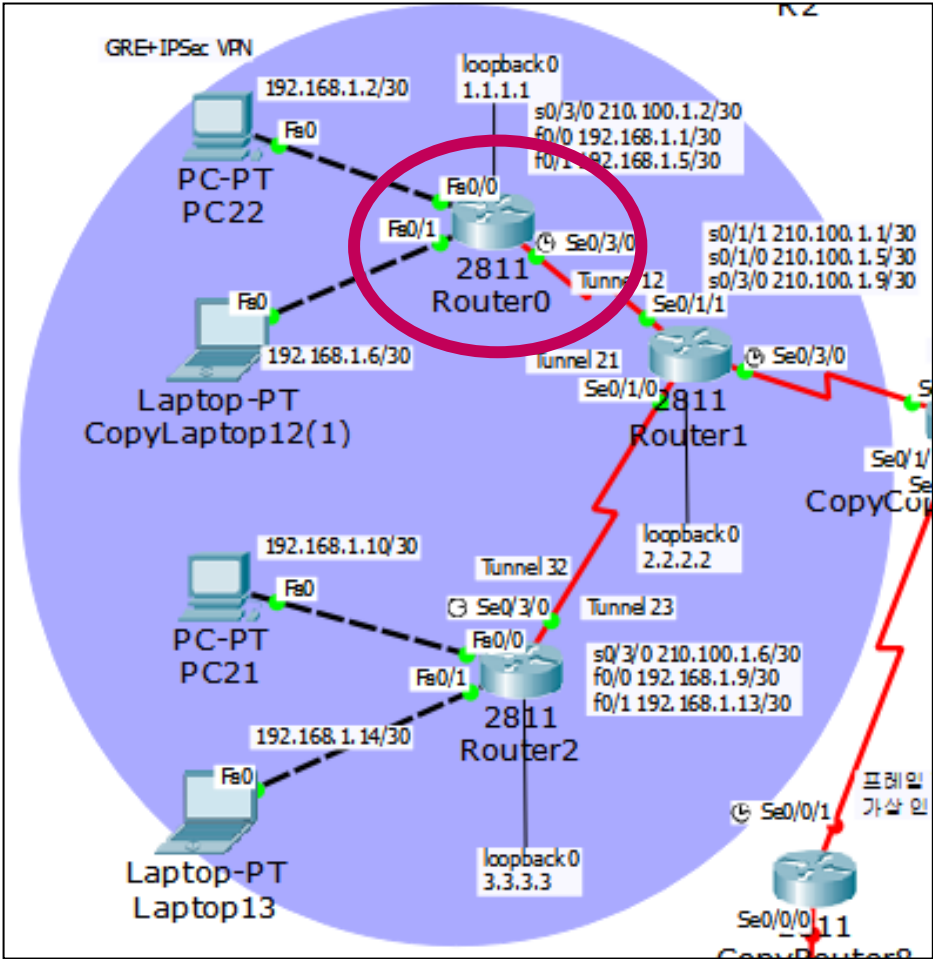
3. VPN (Virtual Private Network)

- 가상 사설 망으로 공중망에서 터널링 기술을 이용하여 사설망처럼 이용할 수 있도록 하는 기술이다.
- 암호프로토콜을 이용하여 인증, 보안, 기밀성 유지 등 보안 기능을 한다.
- 안전한 기업 업무 환경을 구축하는데 사용된다.
- GRE + IPSecVPN
: GRE 터널링은 데이터 보안성이 없기 때문에 IPSecVPN을 함께 사용하여 보안성을 향상시킨다.

3. VPN (GRE + IPsec VPN)



Router 0



ISAKMP 정책 선언

```
Router(config-if)#crypto isakmp policy I0
Router(config-isakmp)#encr aes 256
Router(config-isakmp)#authentication pre-share
Router(config-isakmp)#lifetime 3600
Router(config-isakmp)#hash sha
Router(config-isakmp)#exit
```

IPsec 정책 선언

```
Router(config)#crypto ipsec transform-set strong
esp-3des esp-md5-hmac
```

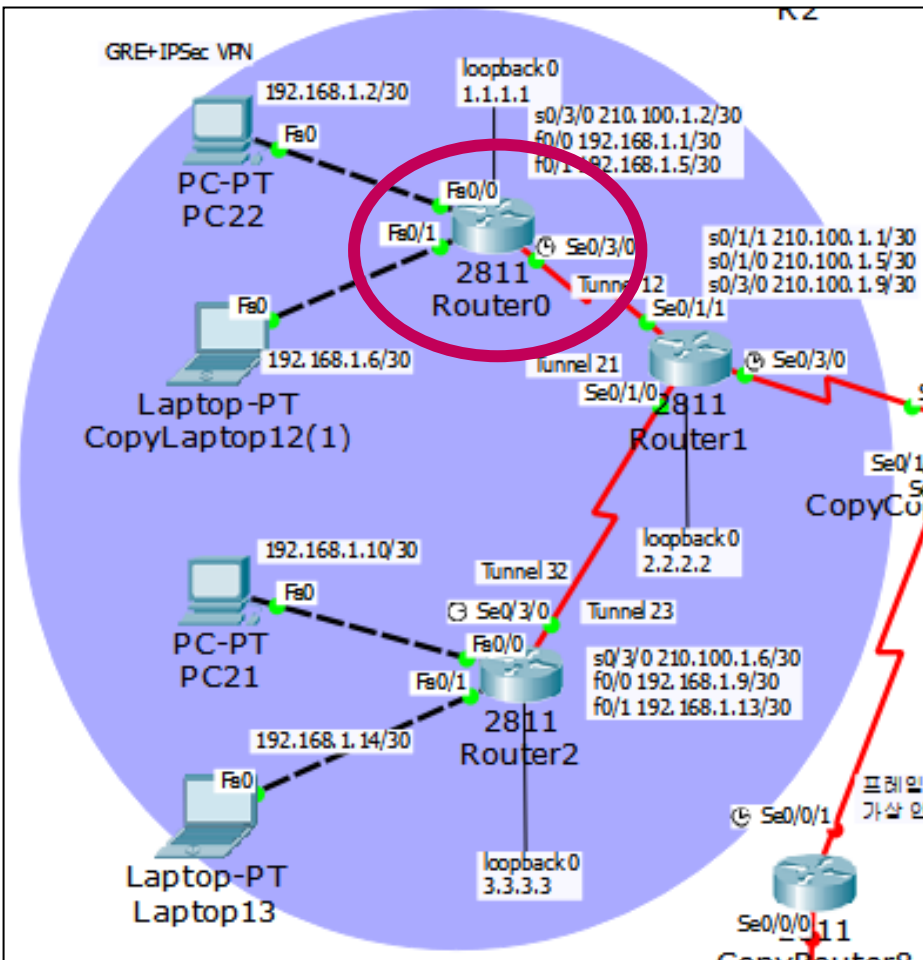
ISAKMP 인증 암호 선언

```
Router(config)#crypto isakmp key ciscoI23
address 0.0.0.0 0.0.0.0
```

3. VPN (GRE + IPSec VPN)



Router 0



IPSec, ISAKMP를 적용할 트래픽 선언

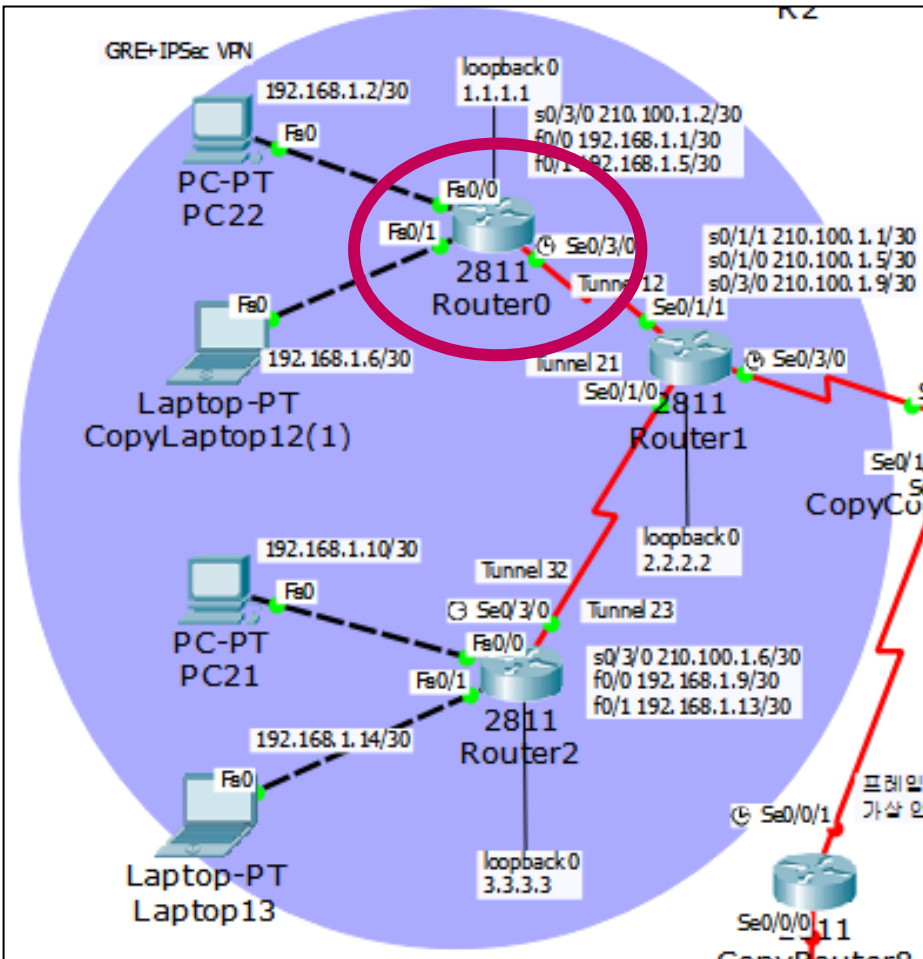
```

Router(config)#crypto map vpn 10 ipsec-isakmp
Router(config-crypto-map)#set peer 210.100.1.1
Router(config-crypto-map)#set transform-set strong
Router(config-crypto-map)#match address 110
Router(config-crypto-map)#exit
Router(config)#int s0/3/0
Router(config-if)#clock rate 64000
Router(config-if)#crypto map vpn
Router(config-if)#exit
Router(config)#int tunnel 13
Router(config-if)#ip add 150.183.235.1
255.255.255.252
Router(config-if)#tunnel source s0/3/0
Router(config-if)#tunnel destination 210.100.1.1
Router(config-if)#exit
    
```

3. VPN (GRE + IPSec VPN)



Router 0



RIP version 2 설정

```

Router(config)#router rip
Router(config-router)#version 2
Router(config-router)#no auto-summary
Router(config-router)#network 192.168.1.0
Router(config-router)#network 192.168.1.4
Router(config-router)#network 210.100.1.0
Router(config-router)#network 1.1.1.0
Router(config-router)#network 150.183.0.0
Router(config-router)#exit
    
```

정책이 적용될 범위를 ACL로 정의

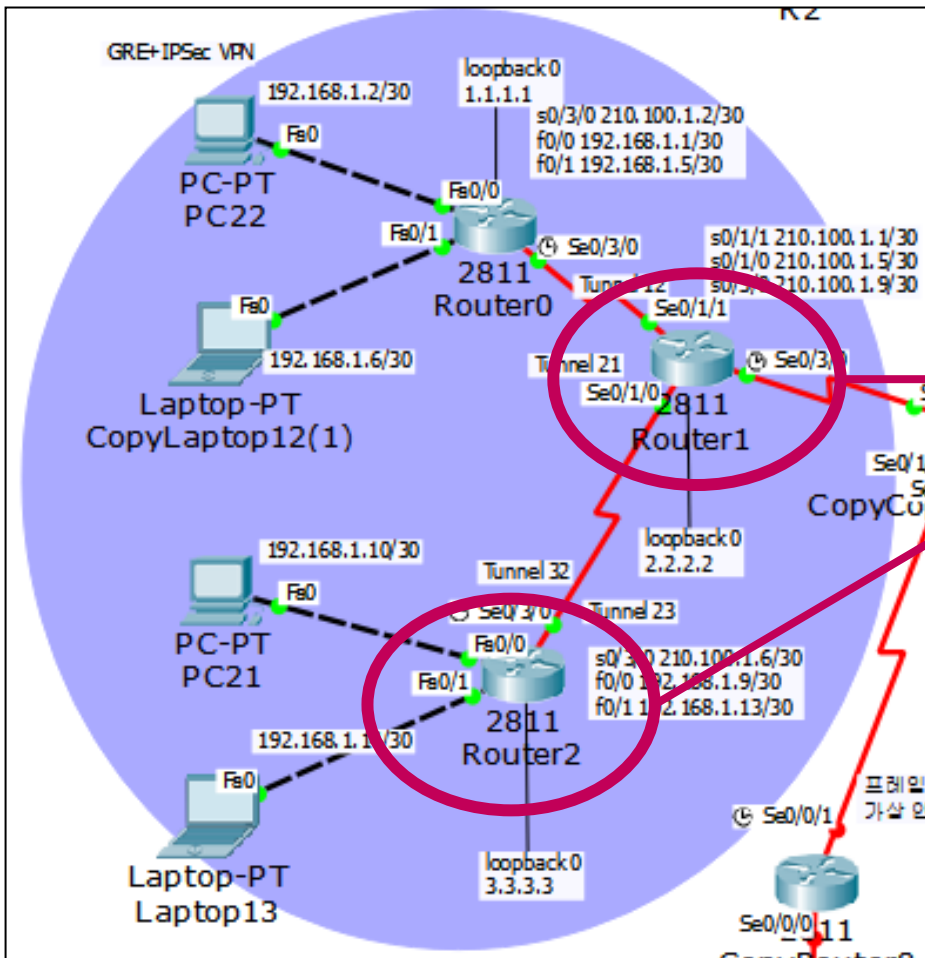
```

Router(config)#access-list 110 permit gre host
210.100.1.2 host 210.100.1.1
    
```

3. VPN (GRE + IPSec VPN)



Router 0



Router 1, Router 2 도 같은 방법으로 설정해줍니다.

3. VPN (GRE + IPSec VPN)



```
PC>tracert 192.168.1.10

Tracing route to 192.168.1.10 over a maximum of 30 hops:

  0  0 ms    1 ms    0 ms    192.168.1.1
  1  1 ms    1 ms    1 ms    210.100.1.1
  2  2 ms    1 ms   10 ms   210.100.1.6
  3  1 ms   29 ms    3 ms   192.168.1.10

Trace complete.

PC>tracert 192.168.1.14

Tracing route to 192.168.1.14 over a maximum of 30 hops:

  0  1 ms    0 ms    0 ms    192.168.1.1
  1  3 ms    1 ms    1 ms    150.183.235.2
  2 30 ms    5 ms    1 ms    210.100.1.6
  3  3 ms    1 ms    4 ms    192.168.1.14

Trace complete.
```

→ 통신이 된 것을 볼 수 있다.

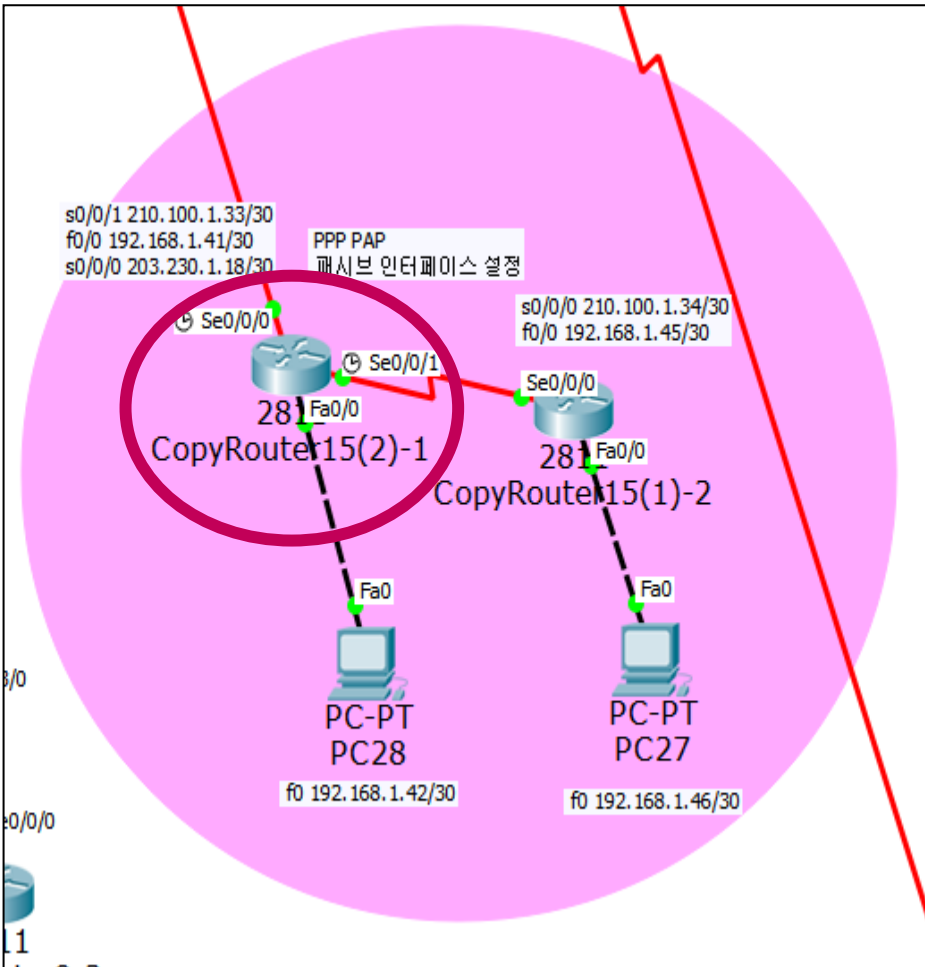
4. PPP (Point to Point)

- PPP 설정을 해주면 캡슐화 방식이 PPP로 변경된다.
- PPP-PAP는 패스워드 인증된 라우터들과만 PPP 연결을 한다. 사용자 이름과 암호를 평문으로 전달하고 최초 한 번만 인증 검사를 한다.
- PPP-CHAP는 3-way handshake 방식으로 주기적 인증 검사를 하고 사용자 이름과 암호가 MD5 해쉬 값으로 전송 된다.

4. PPP (PPP-PAP)



CopyRouterI5(2)-I



PPP-PAP 설정

```
Router(config)#username CopyRouterI5(1)-2 password infocomm
Router(config)#int s0/0/1
Router(config-if)#encapsulation ppp

Router(config-if)#ppp authentication pap
Router(config-if)#ppp pap sent-username CopyRouterI5(2)-I password infocomm
```

RIP version 2 설정

```
Router(config-if)#router rip
Router(config-router)#version 2
Router(config-router)#no auto-summary
Router(config-router)#network 210.100.1.32
Router(config-router)#network 192.168.1.40
```

CopyRouterI5(1)-2도 같은 방법으로 설정을 해준다.

4. PPP (PPP-PAP)



CopyRouterI5(2)-I

```
Router#show int s0/0/1
Serial0/0/1 is up, line protocol is up (connected)
  Hardware is HD64570
  Internet address is 210.100.1.33/30
  MTU 1500 bytes, BW 1544 Kbit, DLY 20000 usec,
    reliability 255/255, txload 1/255, rxload 1/255
  Encapsulation PPP, loopback not set, keepalive set (10
sec)
  LCP Open
```

CopyRouterI5(1)-2

```
Router#show int s0/0/0
Serial0/0/0 is up, line protocol is up (connected)
  Hardware is HD64570
  Internet address is 210.100.1.34/30
  MTU 1500 bytes, BW 1544 Kbit, DLY 20000 usec,
    reliability 255/255, txload 1/255, rxload 1/255
  Encapsulation PPP, loopback not set, keepalive set (10
sec)
  LCP Open
```

→ 캡슐화 방식이 PPP로 설정된 것을 볼 수 있다.

4. PPP (PPP-PAP)

- 결과 확인하기

올바른 패스워드를 입력 해준다.

```
CopyRouter15(2)-1(config)#username CopyRouter15(1)-2 password infocomm
```

```
CopyRouter15(2)-1#debug ppp authentication
```

인증 결과를 확인하기 위한 명령어

```
Serial0/0/1 Using hostname from interface PAP
```

```
Serial0/0/1 Using password from interface PAP
```

```
Serial0/0/1 PAP: O AUTH-REQ id 17 len 15
```

```
Serial0/0/1 PAP: Phase is FORWARDING, Attempting Forward
```

```
Serial0/0/1 PAP: I AUTH-REQ id 17 len 15
```

```
Serial0/0/1 PAP: Authenticating peer
```

```
Serial0/0/1 PAP: Phase is FORWARDING, Attempting Forward
```

4. PPP (PPP-PAP)

올바르지 않은 패스워드를 입력해준다.

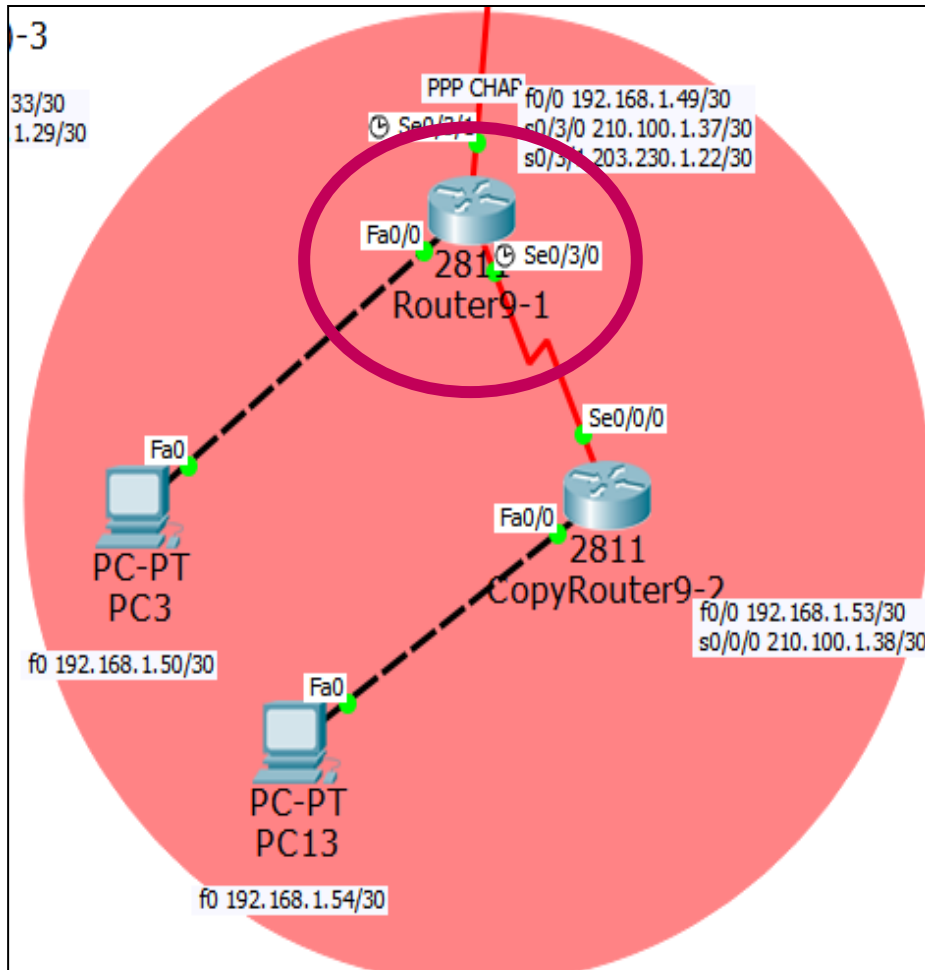
```
CopyRouter15(2)-1(config)#username CopyRouter15(1)-2 password info
CopyRouter15(2)-1#debug ppp authentication
Serial0/0/1 Using hostname from interface PAP
Serial0/0/1 Using password from interface PAP
Serial0/0/1 PAP: O AUTH-REQ id 17 len 15
Serial0/0/1 PAP: Phase is FORWARDING, Attempting Forward
Serial0/0/1 PAP: I AUTH-REQ id 17 len 15
Serial0/0/1 PAP: Authenticating peer
Serial0/0/1 PAP: Phase is AUTHENTICATING, Unauthenticated User
Serial0/0/1 PAP: O AUTH-NAK id 17 len 26 msg is "Authentication failed"
```

인증 결과를 확인하기 위한 명령어

인증에 실패한 것을 볼 수 있다.

4. PPP (PPP-CHAP)

Router9-1



PPP-CHAP 설정

```
Router9-1(config)#username CopyRouter9-2 password  
minsu  
Router9-1(config)#int s0/3/0  
Router9-1(config-if)#encapsulation ppp  
Router9-1(config-if)#ppp authentication chap
```

RIP version 2 설정

```
Router(config-if)#router rip  
Router(config-router)#version 2  
Router(config-router)#network 210.100.1.36  
Router(config-router)#network 192.168.1.48  
Router(config-router)#no auto-summary
```

CopyRouter9-2도 같은 방법으로 설정을 해준다.

4. PPP (PPP-CHAP)

```
Router9-1(config)#username CopyRouter9-2 password minsu
Serial0/3/0 PPP: Phase is FORWARDING, Attempting Forward
Serial0/3/0 Phase is ESTABLISHING, Finish LCP
Serial0/3/0 Phase is UP
```

올바른 패스워드를 입력 해준다.

인증에 성공한 것을 볼 수 있다.

```
Router9-1(config)#username CopyRouter9-2 password hi
Serial0/3/0 PPP: Phase is TERMINATING
Serial0/3/0 LCP: State is Closed
Serial0/3/0 PPP: Phase is DOWN
```

올바르지 않은 패스워드를 입력해준다.

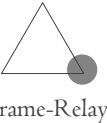
인증에 실패한 것을 볼 수 있다.

5. Frame-Relay

- 물리계층, 데이터링크계층에서 동작하는 WAN 프로토콜이다.
- 패킷에 오류가 검출되면 오류복원을 제공하는 것이 아니라 패킷을 폐기해 버린다.
- 하나의 물리적인 회선 여러 가상회선을 만들어 전용선처럼 취급하여 서비스 한다.

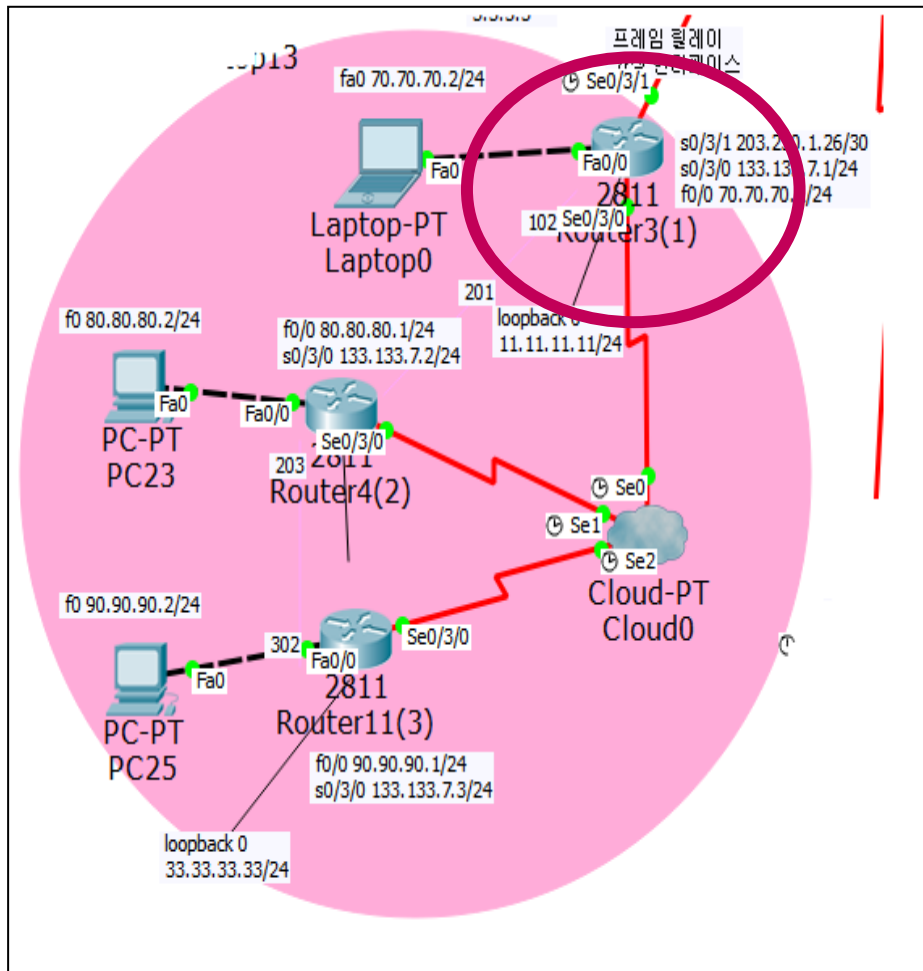
5. Frame-Relay

(프레임릴레이 설정)



Frame-Relay

Router3(I)



Frame-Relay 설정

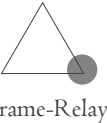
```
Router(config)#int lo 0
Router(config-if)#ip add 11.11.11.11 255.255.255.0
Router(config-if)#exit
Router(config)#int s0/3/0
Router(config-if)#encapsulation frame-relay
Router(config-if)#frame-relay map ip 133.133.7.2 102
broadcast
Router(config-if)#frame-relay map ip 133.133.7.3 102
broadcast
Router(config-if)#no shutdown
Router(config-if)#exit
```

RIP version 2 설정

```
Router(config-if)#router rip
Router(config-router)#version 2
Router(config-router)#network 11.0.0.0
Router(config-router)#network 70.0.0.0
Router(config-router)#network 133.133.7.0
Router(config-router)#no auto-summary
```

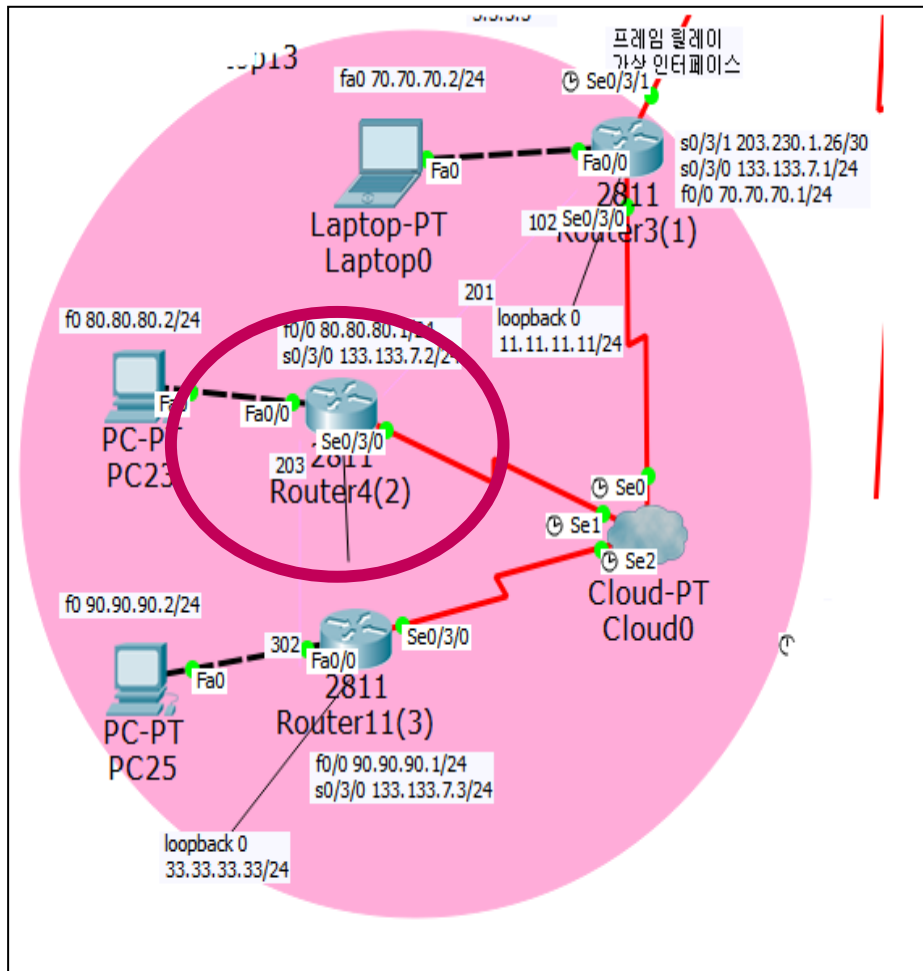
5. Frame-Relay

(프레임릴레이 설정)



Frame-Relay

Router4(2)



Frame-Relay 설정

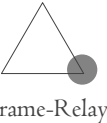
```
Router(config)#int lo 0
Router(config-if)#ip add 22.22.22.22 255.255.255.0
Router(config-if)#exit
Router(config)#int s0/3/0
Router(config-if)#encapsulation frame-relay
Router(config-if)#frame-relay map ip 133.133.7.1 201
broadcast
Router(config-if)#frame-relay map ip 133.133.7.3 203
broadcast
Router(config-if)#no shutdown
Router(config-if)#exit
```

RIP version 2 설정

```
Router(config-router)#router rip
Router(config-router)#version 2
Router(config-router)#network 80.0.0.0
Router(config-router)#network 133.133.7.0
Router(config-router)#no auto-summary
```

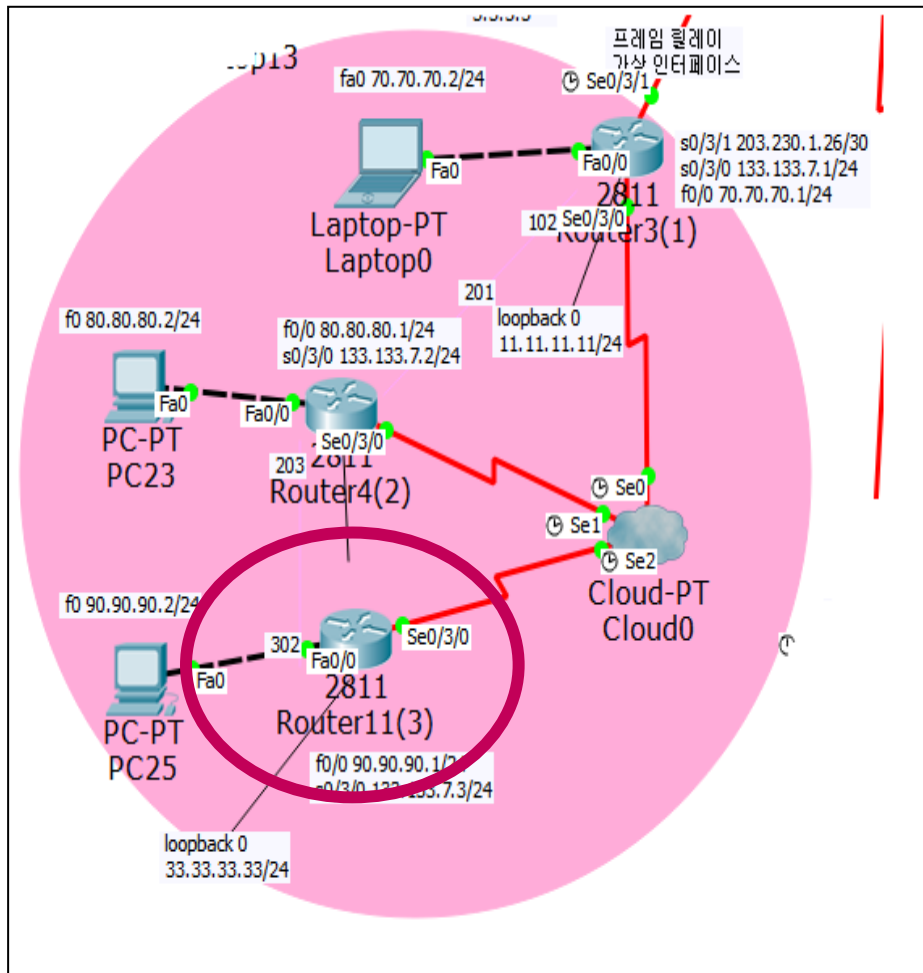

5. Frame-Relay

(프레임릴레이 설정)



Frame-Relay

RouterII(3)



Frame-Relay 설정

```
Router(config)#int lo 0
Router(config-if)#ip add 33.33.33.33 255.255.255.0
Router(config-if)#exit
Router(config)#int s0/3/0
Router(config-if)#encapsulation frame-relay
Router(config-if)#frame-relay map ip 133.133.7.2 302
broadcast
Router(config-if)#frame-relay map ip 133.133.7.1 302
broadcast
Router(config-if)#no shutdown
Router(config-if)#exit
```

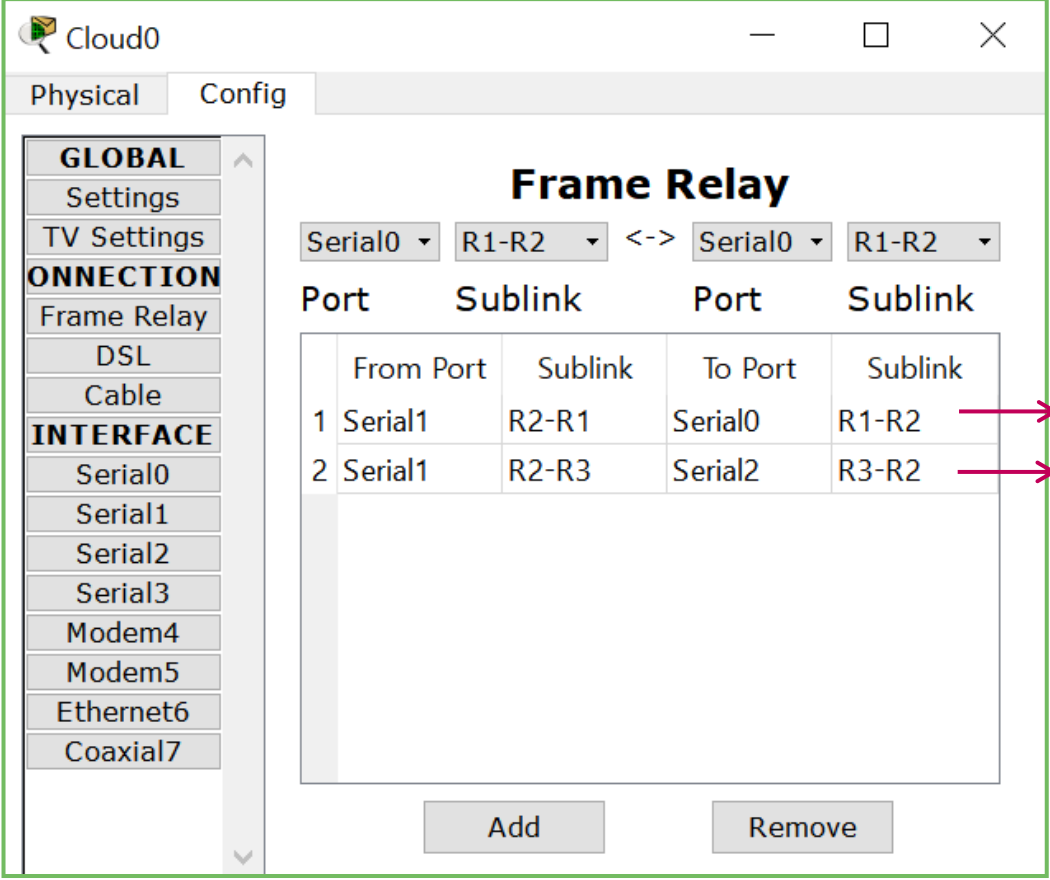
RIP version 2 설정

```
Router(config)#router rip
Router(config-router)#version 2
Router(config-router)#network 33.0.0.0
Router(config-router)#network 90.0.0.0
Router(config-router)#network 133.133.7.0
Router(config-router)#no auto-summary
```

5. Frame-Relay

(프레임릴레이 설정)

프레임릴레이에서 DLCI 번호 연결



The screenshot shows the 'Frame Relay' configuration window in a 'Config' tab. On the left is a sidebar with categories: GLOBAL (Settings, TV Settings), CONNECTION (Frame Relay, DSL, Cable), and INTERFACE (Serial0-3, Modem4-5, Ethernet6, Coaxial7). The main area is titled 'Frame Relay' and has dropdown menus for 'Serial0' and 'R1-R2' on both sides, with a bidirectional arrow between them. Below this is a table with columns 'Port', 'Sublink', 'Port', and 'Sublink'. The table contains two entries:

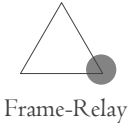
	From Port	Sublink	To Port	Sublink
1	Serial1	R2-R1	Serial0	R1-R2
2	Serial1	R2-R3	Serial2	R3-R2

At the bottom of the table are 'Add' and 'Remove' buttons. Two red arrows point from the table rows to callouts on the right.

201-102 연결이 되었다.
203-302 연결이 되었다.

5. Frame-Relay

(프레임릴레이 설정)



PING 테스트

트

```
Packet Tracer PC Command Line 1.0
PC>ping 80.80.80.2

Pinging 80.80.80.2 with 32 bytes of data:

Reply from 80.80.80.2: bytes=32 time=3ms TTL=126
Reply from 80.80.80.2: bytes=32 time=3ms TTL=126
Reply from 80.80.80.2: bytes=32 time=3ms TTL=126
Reply from 80.80.80.2: bytes=32 time=32ms TTL=126

Ping statistics for 80.80.80.2:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 3ms, Maximum = 32ms, Average = 10ms

PC>
```

Laptop0 -> PC23 PING 성공
(Router3(1)->Router4(2))
(프레임릴레이 102-201)

```
Packet Tracer PC Command Line 1.0
PC>ping 90.90.90.2

Pinging 90.90.90.2 with 32 bytes of data:

Reply from 90.90.90.2: bytes=32 time=4ms TTL=126
Reply from 90.90.90.2: bytes=32 time=33ms TTL=126
Reply from 90.90.90.2: bytes=32 time=58ms TTL=126
Reply from 90.90.90.2: bytes=32 time=2ms TTL=126

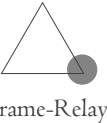
Ping statistics for 90.90.90.2:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 2ms, Maximum = 58ms, Average = 24ms

PC>
```

PC23 -> PC25 PING 성공
(Router4(2)->RouterI(3))
(프레임릴레이 203-302)

5. Frame-Relay

(프레임릴레이 설정)



Frame-Relay

```
PC>ping 90.90.90.2

Pinging 90.90.90.2 with 32 bytes of data:

Reply from 70.70.70.1: Destination host unreachable.
Reply from 70.70.70.1: Destination host unreachable.
Reply from 70.70.70.1: Destination host unreachable.
Request timed out.

Ping statistics for 90.90.90.2:
    Packets: Sent = 4, Received = 0, Lost = 4 (100%
loss),
PC>
```

Laptop0 -> PC25 PING 실패
(Router3(I)->RouterII(3))

따라서
Router3(I)-Router4(2) 연결
Router4(2)-RouterII(3)연결
Router3(I)-RouterII(3)연결 안됨

→ 스플릿 호라이즌 문제가 발생한
다!

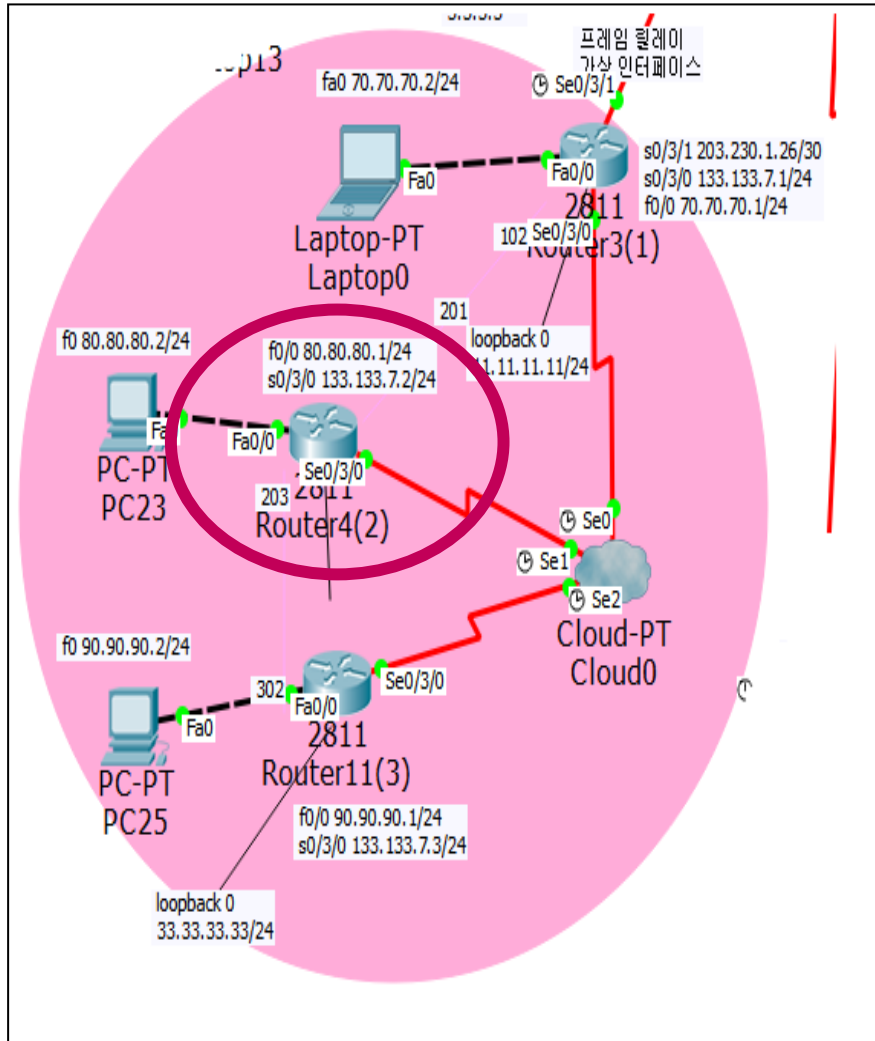
5. Frame-Relay

(가상인터페이스를 이용한 연결)



Frame-Relay

Router4(2)



가상인터페이스 설정

```
Router(config)#int s0/3/0
Router(config-if)#no ip add 133.133.7.2 255.255.255.0
Router(config-if)#encapsulation frame-relay
Router(config-if)#no frame-relay map ip 133.133.7.1 201
broadcast
Router(config-if)#no frame-relay map ip 133.133.7.3 203
broadcast
Router(config-if)#no shutdown
Router(config-if)#int s0/3/0.201 point-to-point
Router(config-subif)#ip add 133.133.7.2 255.255.255.0
Router(config-subif)#frame-relay interface-dlci 201
Router(config-subif)#exit
Router(config)#int s0/3/0.203 point-to-point
Router(config-subif)#ip add 133.133.8.2 255.255.255.0
Router(config-subif)#frame-relay interface-dlci 203
```

RIP 설정

```
Router(config)#router rip
Router(config-router)#network 133.133.8.0
```

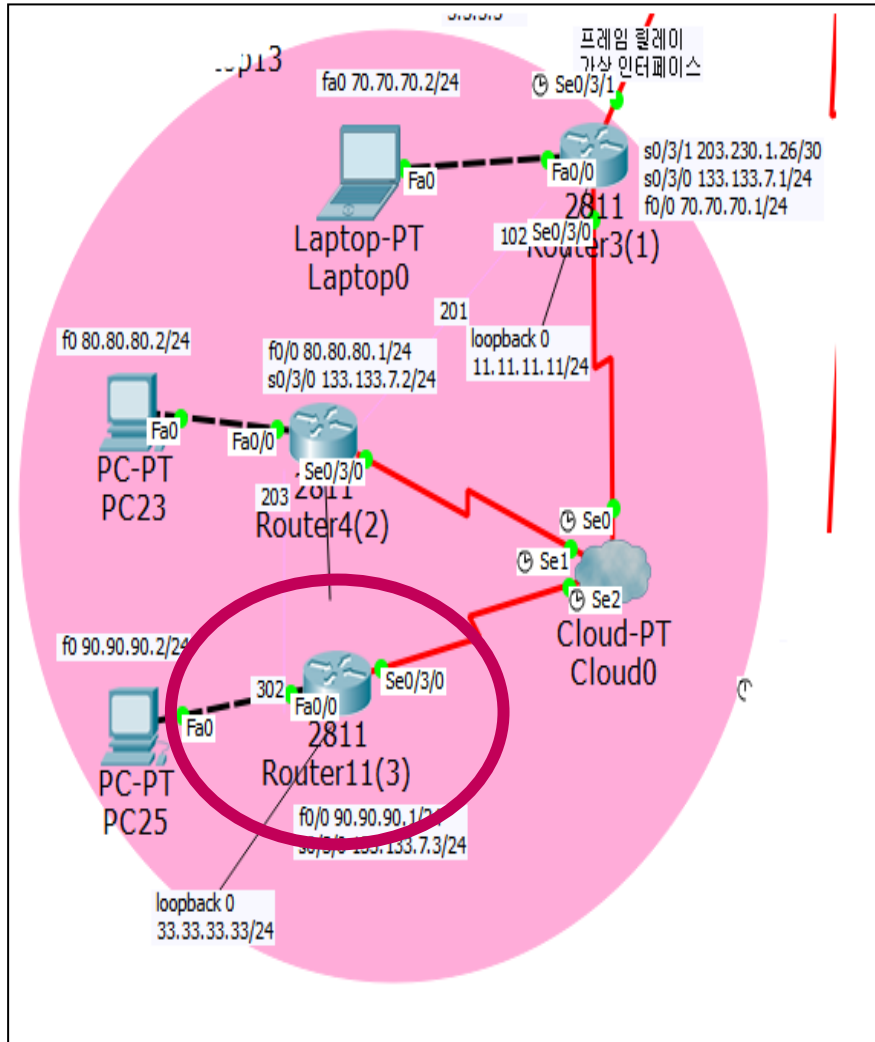
5. Frame-Relay

(가상인터페이스를 이용한 연결)



Frame-Relay

Router11(3)



가상인터페이스 설정

```
Router(config-router)#int s0/3/0
Router(config-if)#ip add 133.133.8.3 255.255.255.0
Router(config-if)#encapsulation frame-relay
Router(config-if)#frame-relay map ip 133.133.8.2 302
broadcast
Router(config-if)#frame-relay map ip 133.133.7.1 302
broadcast
%Address already in map
Router(config-if)#no shutdown
```

RIP 설정

```
Router(config-if)#router rip
Router(config-router)#no network 133.133.7.0
Router(config-router)#network 133.133.8.0
```

5. Frame-Relay

(가상인터페이스를 이용한 연결)



Frame-Relay

PING 테스트

트

```
PC>ping 90.90.90.2

Pinging 90.90.90.2 with 32 bytes of data:

Reply from 90.90.90.2: bytes=32 time=7ms TTL=125
Reply from 90.90.90.2: bytes=32 time=5ms TTL=125
Reply from 90.90.90.2: bytes=32 time=5ms TTL=125
Reply from 90.90.90.2: bytes=32 time=27ms TTL=125

Ping statistics for 90.90.90.2:
    Packets: Sent = 4, Received = 4, Lost = 0 (0%
loss),
    Approximate round trip times in milli-seconds:
        Minimum = 5ms, Maximum = 27ms, Average = 11ms
```

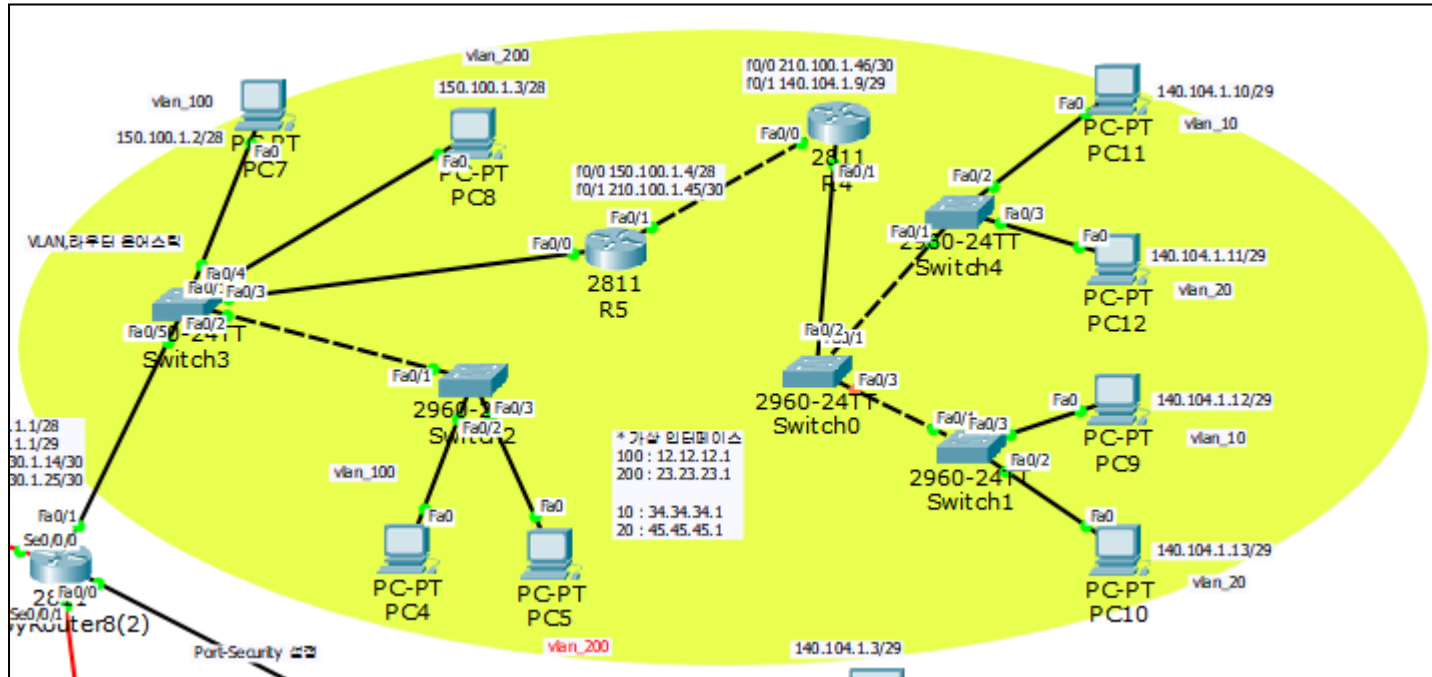
Laptop0 -> PC25 PING 성공
(Router3(I)->RouterII(3))

- 스플릿 호라이즌 문제를 해결할 수 있다.
- 전체 연결 성공!!

6. VLAN

- 내부에서 권한이 없는 사용자가 제약없이 특정 장치에 접속 가능하다.
- 브로드캐스트 도메인을 분할하여 브로드캐스트 트래픽으로 인한 장비들의 성능저하를 막기 위해서 만들어졌다.
- 서로 다른 VLAN에 속한 장치들은 통신이 불가능하여 보안에 도움이 된다. 서로 다른 VLAN이 통신하기 위해서는 라우터나 L3 스위치가 필요하다.
- 스위치의 모든 포트는 기본 VLAN 1번에 속해 있다.

6. VLAN



6. VLAN



Switch2-VLAN 설정

```
Switch(config)#vlan 10
Switch(config-vlan)#name vlan_10
Switch(config-vlan)#exit
Switch(config)#vlan 20
Switch(config-vlan)#name vlan_20
Switch(config-vlan)#exit
Switch(config)#vlan 100
Switch(config-vlan)#name vlan_100
Switch(config-vlan)#exit
Switch(config)#vlan 200
Switch(config-vlan)#name vlan_200
Switch(config-vlan)#exit
```

Switch2 - 각 포트에 VLAN 할당

```
Switch(config)#int f0/2
Switch(config-if)#switchport access vlan 100
Switch(config-if)#int f0/3
Switch(config-if)#switchport access vlan 200

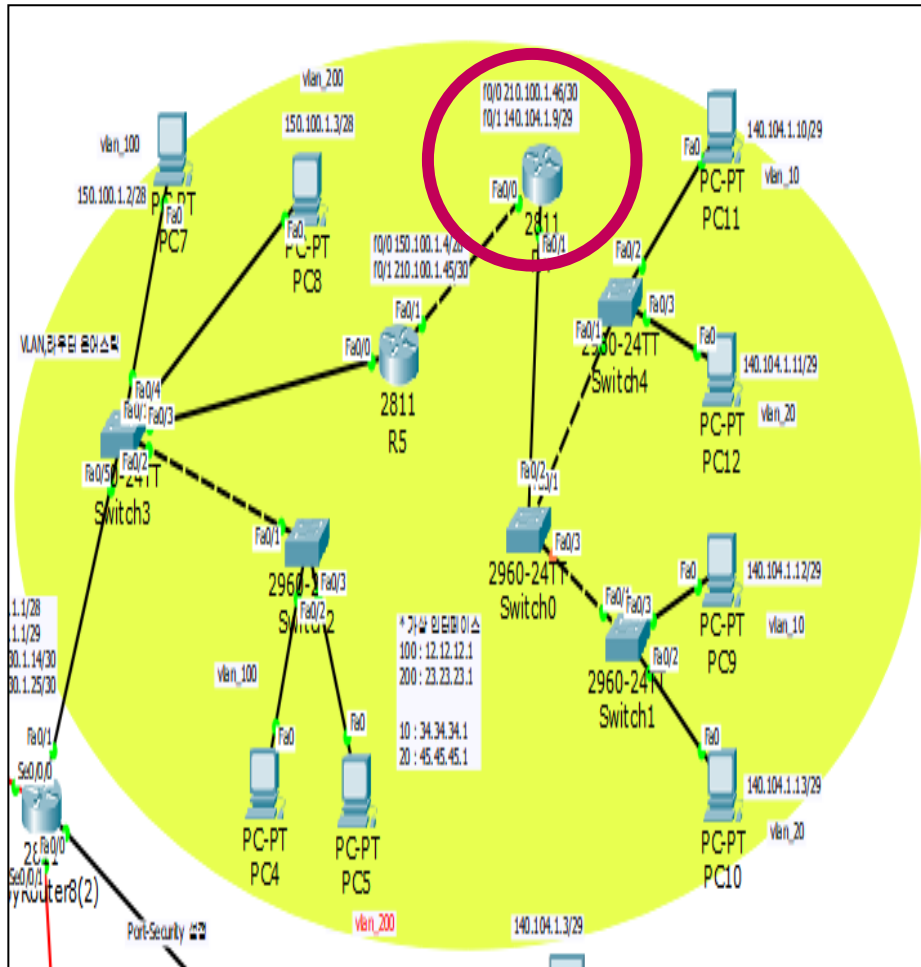
Switch(config-if)#int f0/1
Switch(config-if)#switchport mode trunk
```

하나의 회선으로 여러 개의 VLAN을 사용하기 위해 Trunk 설정을 해줍니다.

Switch 0, 3, 4에서도 같은 방법으로 VLAN을 설정해주고 할당해줍니다.

6. VLAN (라우터-온-어-스틱)

R4



R4에 가상인터페이스 설정

```
Router(config)#int f0/1
Router(config-if)#no shutdown
Router(config-if)#exit
Router(config)#int fa0/1.10
Router(config-subif)#
encapsulation dotIQ 10
Router(config-subif)#ip add 34.34.34.1
255.255.255.0
Router(config-subif)#exit
Router(config-subif)#int fa0/1.20
Router(config-subif)#
encapsulation dotIQ 20
Router(config-subif)#ip add 45.45.45.1
255.255.255.0
Router(config-subif)#exit
```

R5에도 같은 방법으로 설정해줍니다.

6. VLAN (라우터-온-어-스틱)



라우팅 테이블 확인

```
Router#show ip int brief
Interface                IP-Address      OK? Method Status        Protocol
FastEthernet0/0          unassigned      YES unset  up            up
FastEthernet0/0.10       unassigned      YES unset  up            up
FastEthernet0/0.20       unassigned      YES unset  up            up
FastEthernet0/0.100      12.12.12.1      YES manual  up            up
FastEthernet0/0.200      23.23.23.1      YES manual  up            up
FastEthernet0/1          unassigned      YES unset  up            up
FastEthernet0/1.10       34.34.34.1      YES manual  up            up
FastEthernet0/1.20       45.45.45.1      YES manual  up            up
FastEthernet0/1.100      unassigned      YES unset  up            up
FastEthernet0/1.200      unassigned      YES unset  up            up
Loopback0                 18.18.18.18     YES manual  up            up
Vlan1                     unassigned      YES unset  administratively down down
```

6. VLAN (라우터-온-어-스틱)



R5 OSPF 설정

```
Router(config)#int lo 0
Router(config-if)#ip add 19.19.19.19
255.255.255.0
Router(config)#router ospf 7
Router(config-router)#router-id 19.19.19.19
Router(config-router)#network 150.100.1.0
0.0.0.15 a 0
Router(config-router)#network 210.100.1.44
0.0.0.3 a 0
Router(config-router)#network 19.19.19.0
0.0.0.255 a 0
```

R4 OSPF 설정

```
Router(config)#int lo 0
Router(config-if)#ip add 18.18.18.18
255.255.255.0
Router(config)#router ospf 7
Router(config-router)#router-id 18.18.18.18
Router(config-router)#network 210.100.1.44
0.0.0.3 a 0
Router(config-router)#network 140.104.1.8
0.0.0.7 a 0
Router(config-router)#network 18.18.18.0
0.0.0.255 a 0
```

6. VLAN (라우터-온-어-스틱)



R10 OSPF 설정

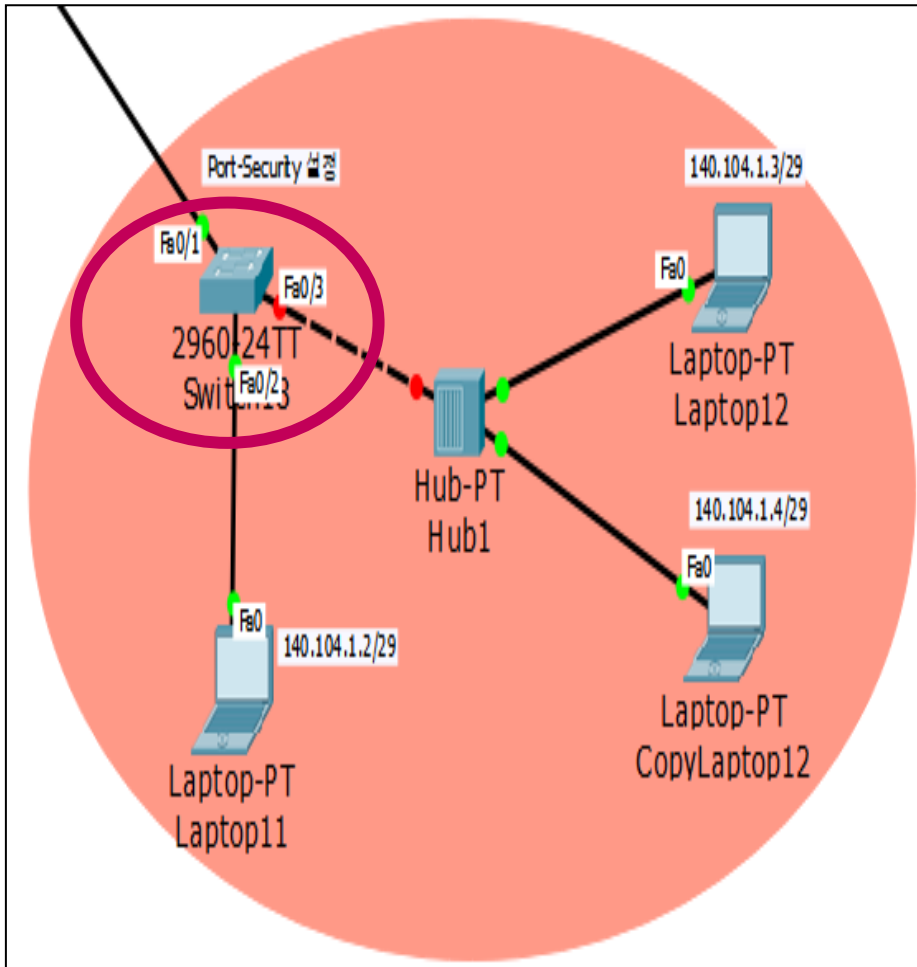
```
Router(config)#int lo 0
Router(config-if)#ip add 9.9.9.9 255.255.255.0
Router(config-if)#router ospf 7
Router(config-router)#router-id 9.9.9.9
Router(config-router)#network 9.9.9.0 0.0.0.255
area 0
Router(config-router)#network 203.230.1.24
0.0.0.3 a 0
Router(config-router)#network 150.100.1.16
0.0.0.15 a 0
```

7. Port-Security

- 특정 포트에 학습할 수 있는 MAC 주소의 수를 제한하여 허가된 MAC주소만 접속 가능하도록 설정하는 것이다.
- Port-Security를 설정하면 하나의 포트에 학습할 MAC주소의 수를 제한할 수 있기 때문에 Mac Flooding Attack을 방어할 수 있다.

7. Port-Security

SwitchI8



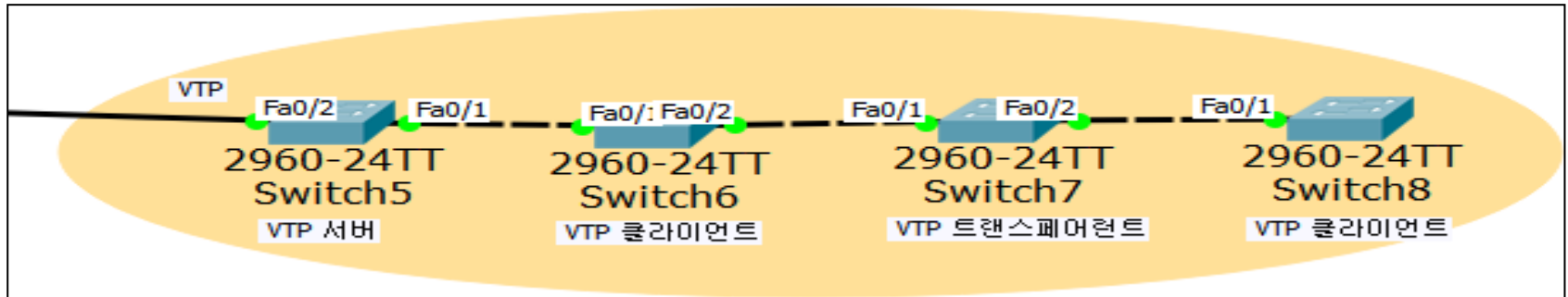
Port-Security 설정

```
Switch(config)#int f0/3
Switch(config-if)#switchport mode access
Switch(config-if)#switchport port-security
Switch(config-if)#switchport port-security maximum 1h
Switch(config-if)#switchport port-security violation
shutdown
```

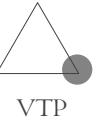

8. VTP (VLAN Trunking Protocol)

- 규모가 큰 네트워크에서 VLAN의 생성, 수정, 삭제 등의 관리를 쉽게 할 수 있도록 하는 프로토콜이다.
- 스위치마다 일일이 VLAN을 설정하지 않아도 네트워크 전체에 일관성 있는 VLAN 설정이 가능하다.
- VTP가 동작하기 위해서는 스위치 사이에 반드시 트렁크 설정이 되어있어야 한다.
- VTP는 VLAN 정보만을 전달하고 포트의 설정까지 전달하지는 않는다.

8. VTP



8. VTP



Switch5 - VTP 서버 설정

```
Switch(config)#vtp version 2
Switch(config)#vtp mode server
Switch(config)#vtp domain infocomm
Switch(config)#vtp password infocomm
Switch(config)#int f0/1
Switch(config-if)#switchport mode trunk
```

Switch6 - VTP 클라이언트 설정

```
Switch(config)#vtp version 2
Switch(config)#vtp mode client
Switch(config)#vtp domain infocomm
Switch(config)#vtp password infocomm
Switch(config)#int range f0/1-2
Switch(config-if-range)#switchport mode trunk
```

Switch7 - VTP 트랜스페어런트 설정

```
Switch(config)#vtp version 2
Switch(config)#vtp mode transparent
Switch(config)#vtp domain infocomm
Switch(config)#vtp password infocomm
Switch(config)#int range f0/1-2
Switch(config-if-range)#switchport mode trunk
```

Switch8 - VTP 클라이언트 설정

```
Switch(config)#vtp version 2
Switch(config)#vtp mode client
Switch(config)#vtp domain infocomm
Switch(config)#vtp password infocomm
Switch(config)#int f0/1
Switch(config-if)#switchport mode trunk
```

이 때 VTP가 동작하기 위해서는 Mode 이외의 모든 설정 값이 일치하여야 한다.

8. VTP



VLAN 설정

Switch5 - 서버

```
Switch(config-if)#vlan 10
Switch(config-vlan)#name vlan_10
Switch(config-vlan)#exit
Switch(config)#vlan 20
Switch(config-vlan)#name vlan_20
Switch(config-vlan)#exit
Switch(config)#vlan 70
Switch(config-vlan)#name infocomm
Switch(config-vlan)#exit
```

```
Switch#show vlan
```

VLAN	Name	Status	Ports
1	default	active	Fa0/2, Fa0/3, Fa0/4, Fa0/5 Fa0/6, Fa0/7, Fa0/8, Fa0/9 Fa0/10, Fa0/11, Fa0/12, Fa0/13 Fa0/14, Fa0/15, Fa0/16, Fa0/17 Fa0/18, Fa0/19, Fa0/20, Fa0/21 Fa0/22, Fa0/23, Fa0/24, Gig0/1 Gig0/2
10	vlan_10	active	
20	vlan_20	active	
70	infocomm	active	

VLAN이 설정된 것을 확인할 수 있다.

8. VTP



Switch6 – 클라이언트

```
Switch(config)#vlan 50
VTP VLAN configuration not allowed when device is in CLIENT mode.
Switch(config)#do show vlan
```

VLAN	Name	Status	Ports
1	default	active	Fa0/3, Fa0/4, Fa0/5, Fa0/6 Fa0/7, Fa0/8, Fa0/9, Fa0/10 Fa0/11, Fa0/12, Fa0/13, Fa0/14 Fa0/15, Fa0/16, Fa0/17, Fa0/18 Fa0/19, Fa0/20, Fa0/21, Fa0/22 Fa0/23, Fa0/24, Gig0/1, Gig0/2
10	vlan_10	active	
20	vlan_20	active	
70	infocomm	active	

```
Switch(config-if)#vlan 30
VTP VLAN configuration not allowed when device is in CLIENT mode.
Switch(config)#do show vlan
```

VLAN	Name	Status	Ports
1	default	active	Fa0/2, Fa0/3, Fa0/4, Fa0/5 Fa0/6, Fa0/7, Fa0/8, Fa0/9 Fa0/10, Fa0/11, Fa0/12, Fa0/13 Fa0/14, Fa0/15, Fa0/16, Fa0/17 Fa0/18, Fa0/19, Fa0/20, Fa0/21 Fa0/22, Fa0/23, Fa0/24, Gig0/1 Gig0/2
10	vlan_10	active	
20	vlan_20	active	
70	infocomm	active	

VLAN이 적용되지 않았다.

Switch8 – 클라이언트

8. VTP



VLAN 설정

Switch7 - 트랜스페어런트

```
Switch(config)#vlan 100
Switch(config-vlan)#name vlan_100
Switch(config-vlan)#exit
Switch(config)#vlan 200
Switch(config-vlan)#name vlan_200
Switch(config-vlan)#exit
```

```
Switch(config)#do show vlan
```

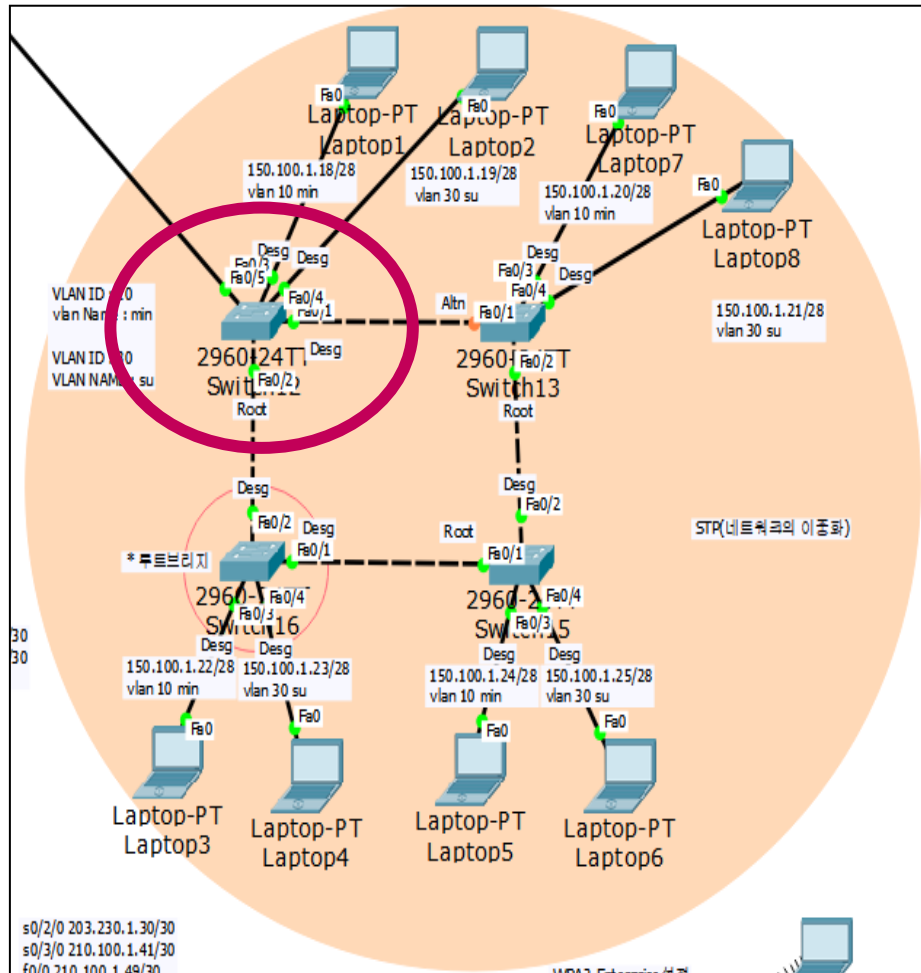
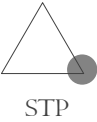
VLAN Name	Status	Ports
1 default	active	Fa0/3, Fa0/4, Fa0/5, Fa0/6 Fa0/7, Fa0/8, Fa0/9, Fa0/10 Fa0/11, Fa0/12, Fa0/13, Fa0/14 Fa0/15, Fa0/16, Fa0/17, Fa0/18 Fa0/19, Fa0/20, Fa0/21, Fa0/22 Fa0/23, Fa0/24, Gig0/1, Gig0/2
100 vlan_100	active	
200 vlan_200	active	

→ 서버에서 설정한 VLAN은 적용되지 않는다.

8. STP (Spanning Tree Protocol)

- 네트워크 이중화
: 데이터의 통로를 두 개 이상 만드는 구성방법이다. 하지만 플러딩이 발생하고 2계층 스위치 루프가 발생한다.
- 프레임 플러딩과 루프 발생을 방지하기 위한 프로토콜이다.
- 모든 스위치에서 기본적으로 동작한다.

8. STP



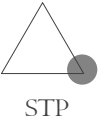
VLAN 설정

```
Switch12(config)#interface FastEthernet0/3
Switch12(config-if)#exit
Switch12(config)#vlan 10
Switch12(config-vlan)#name min
Switch12(config-vlan)#exit
Switch12(config)#vlan 30
Switch12(config-vlan)#name su
Switch12(config-vlan)#exit
```

```
Switch12(config)#interface FastEthernet0/3
Switch12(config-if)#switchport access vlan 10
Switch12(config-if)#exit
Switch12(config)#interface FastEthernet0/4
Switch12(config-if)#switchport access vlan 30
Switch12(config-if)#exit
Switch12(config)#interface FastEthernet0/1
Switch12(config-if)#switchport mode trunk
```

다른 스위치에도 같은 방법으로 설정해줍니다.

8. STP



루트브리지 선출 확인

```
Switch12(config)#do show spanning-tree
VLAN0001
Spanning tree enabled protocol ieee
Root ID    Priority    32769
           Address    0006.2A83.C80D
           Cost      19
           Port      2(FastEthernet0/2)
           Hello Time 2 sec Max Age 20 sec Forward Delay 15 sec

Bridge ID  Priority    32769 (priority 32768 sys-id-ext 1)
           Address    0090.2B2E.52BB
           Hello Time 2 sec Max Age 20 sec Forward Delay 15 sec
           Aging Time 20

Interface  Role Sts Cost      Prio.Nbr Type
-----
Fa0/1      Desg FWD 19        128.1    P2p
Fa0/3      Desg FWD 19        128.3    P2p
Fa0/2      Root FWD 19        128.2    P2p
Fa0/4      Desg FWD 19        128.4    P2p
```

```
Switch13(config)#do show spanning-tree
VLAN0001
Spanning tree enabled protocol ieee
Root ID    Priority    32769
           Address    0006.2A83.C80D
           Cost      38
           Port      2(FastEthernet0/2)
           Hello Time 2 sec Max Age 20 sec Forward Delay 15 sec

Bridge ID  Priority    32769 (priority 32768 sys-id-ext 1)
           Address    0090.0CB8.B6CA
           Hello Time 2 sec Max Age 20 sec Forward Delay 15 sec
           Aging Time 20

Interface  Role Sts Cost      Prio.Nbr Type
-----
Fa0/1      Altn BLK 19        128.1    P2p
Fa0/2      Root FWD 19        128.2    P2p
Fa0/3      Desg FWD 19        128.3    P2p
Fa0/4      Desg FWD 19        128.4    P2p
```

```
Switch16(config)#do show spanning-tree
VLAN0001
Spanning tree enabled protocol ieee
Root ID    Priority    32769
           Address    0006.2A83.C80D
           This bridge is the root
           Hello Time 2 sec Max Age 20 sec Forward Delay 15 sec

Bridge ID  Priority    32769 (priority 32768 sys-id-ext 1)
           Address    0006.2A83.C80D
           Hello Time 2 sec Max Age 20 sec Forward Delay 15 sec
           Aging Time 20

Interface  Role Sts Cost      Prio.Nbr Type
-----
Fa0/1      Desg FWD 19        128.1    P2p
Fa0/2      Desg FWD 19        128.2    P2p
Fa0/3      Desg FWD 19        128.3    P2p
Fa0/4      Desg FWD 19        128.4    P2p
```

```
Switch15(config)#do show spanning-tree
VLAN0001
Spanning tree enabled protocol ieee
Root ID    Priority    32769
           Address    0006.2A83.C80D
           Cost      19
           Port      1(FastEthernet0/1)
           Hello Time 2 sec Max Age 20 sec Forward Delay 15 sec

Bridge ID  Priority    32769 (priority 32768 sys-id-ext 1)
           Address    0010.1197.C829
           Hello Time 2 sec Max Age 20 sec Forward Delay 15 sec
           Aging Time 20

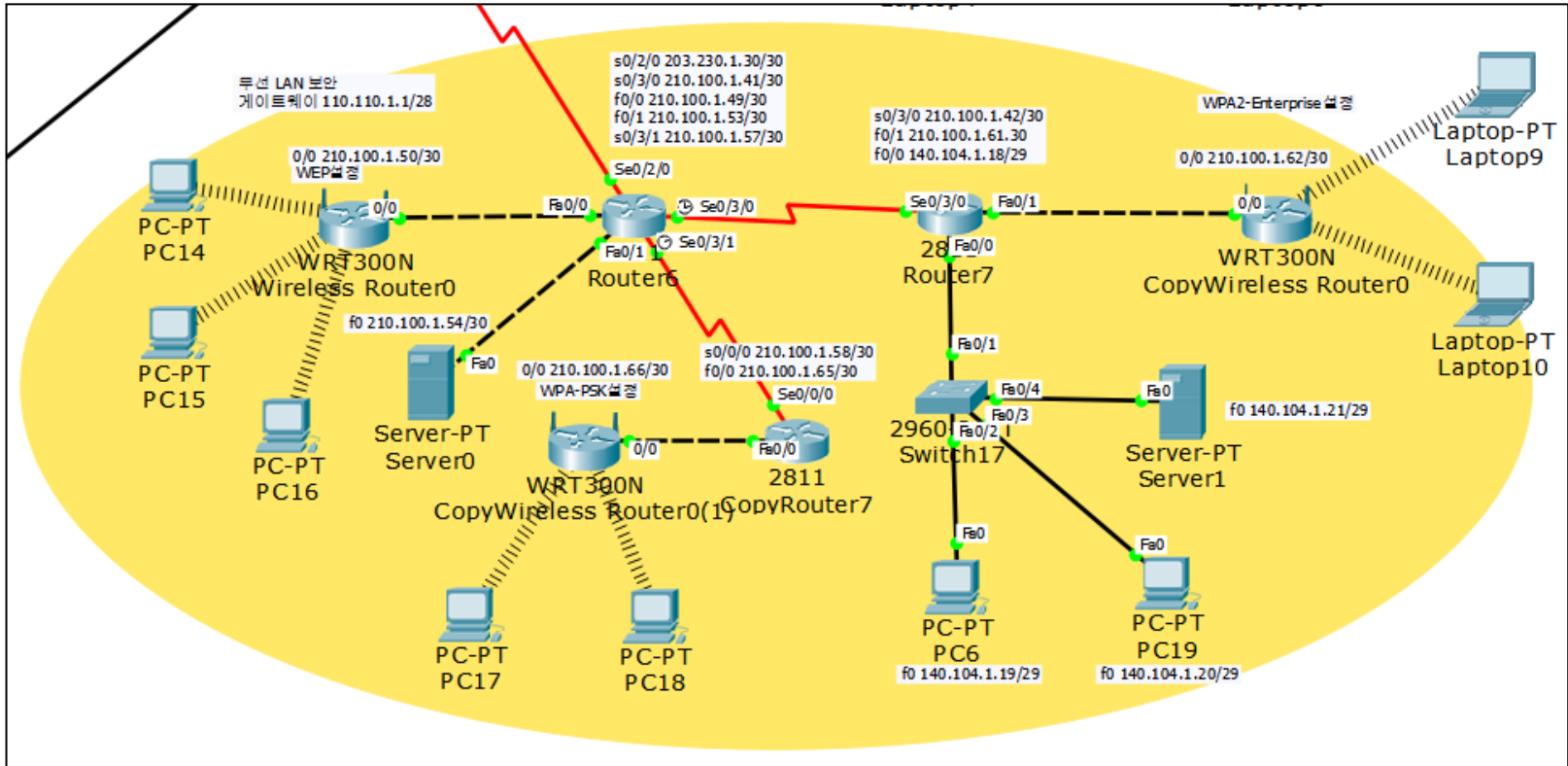
Interface  Role Sts Cost      Prio.Nbr Type
-----
Fa0/1      Root FWD 19        128.1    P2p
Fa0/4      Desg FWD 19        128.4    P2p
Fa0/3      Desg FWD 19        128.3    P2p
Fa0/2      Desg FWD 19        128.2    P2p
```

→ Switch16이 루트브리지로 선출된 것을 알 수 있다.

9. 무선 LAN (Wireless LAN)

- 무선 연결이기 때문에 편리하고 이동성, 사용의 유연성을 제공한다.
- 무선랜 보안에 사용되는 암호화 키 값의 추출 가능성이 있고 정보의 누출 가능성이 있다.

9. 무선 LAN



9. 무선 LAN

EIGRP 설

경

Router6

```
Router(config)#router eigrp 7
Router(config-router)#network 203.230.1.28
Router(config-router)#network 210.100.1.40
Router(config-router)#network 210.100.1.48
Router(config-router)#network 210.100.1.52
Router(config-router)#network 210.100.1.56
Router(config-router)#no auto-summary
```

CopyRouter7

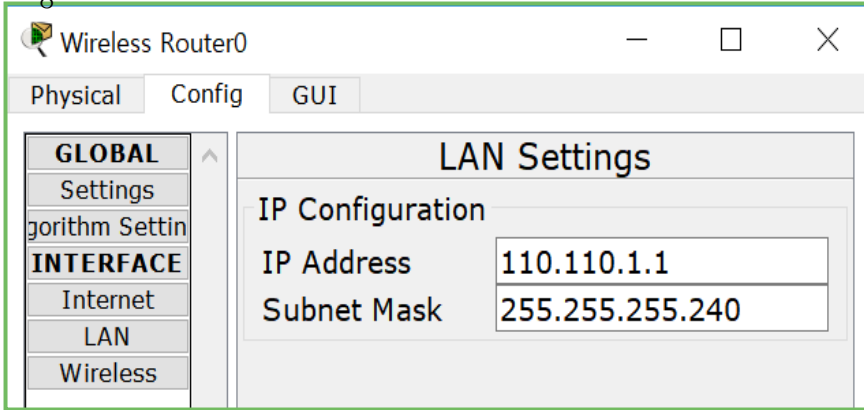
```
Router(config)#router eigrp 7
Router(config-router)#network 210.100.1.56
Router(config-router)#network 210.100.1.64
Router(config-router)#no auto-summary
```

Router7

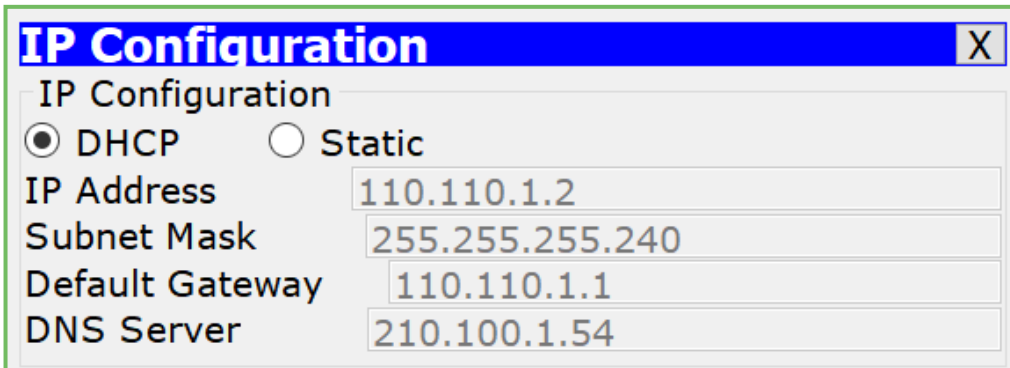
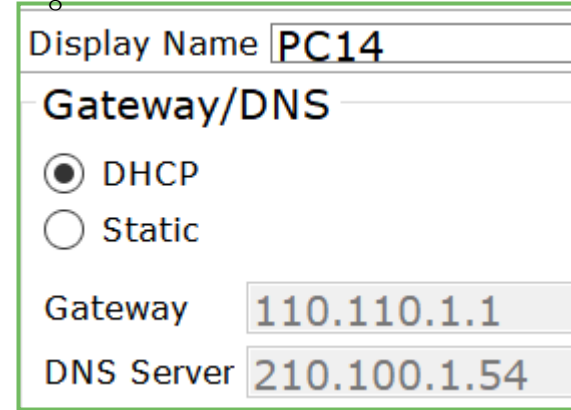
```
Router(config)#router eigrp 7
Router(config-router)#network 210.100.1.40
Router(config-router)#network 210.100.1.60
Router(config-router)#network 140.104.1.16
Router(config-router)#no auto-summary
```

9. 무선 LAN

무선 LAN 설정



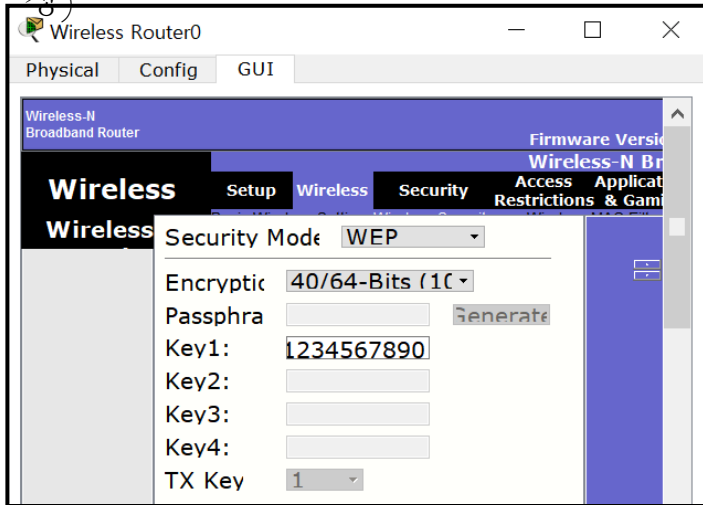
PC 게이트웨이, DNS 서버 설정



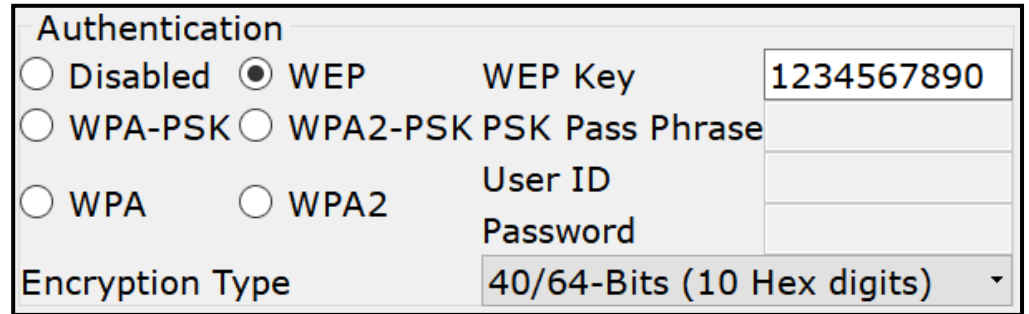
PC는 DHCP 서버로부터 IP주소를 자동으로 받아온다.

9. 무선 LAN

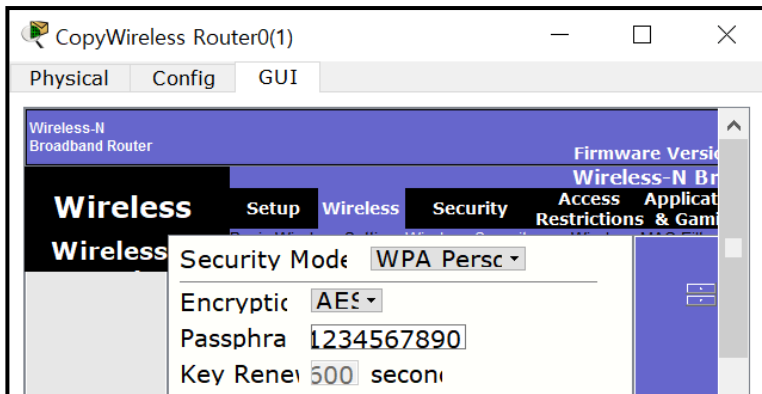
WEP설정 (무선라우터 설정)



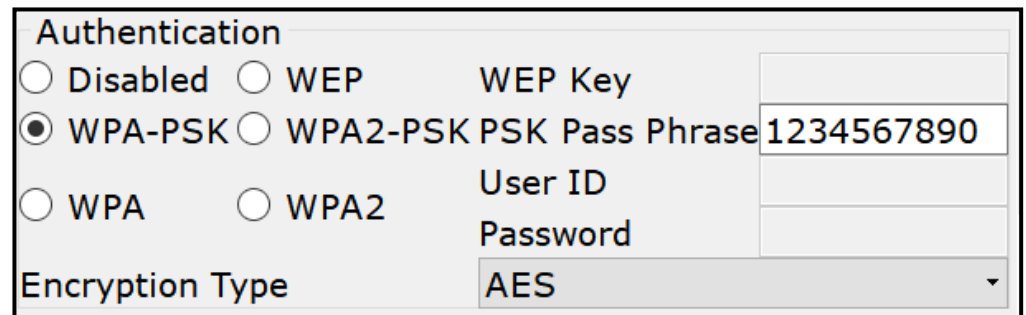
WEP설정 (PC 설정)



WPA-PSK설정 (무선라우터 설정)

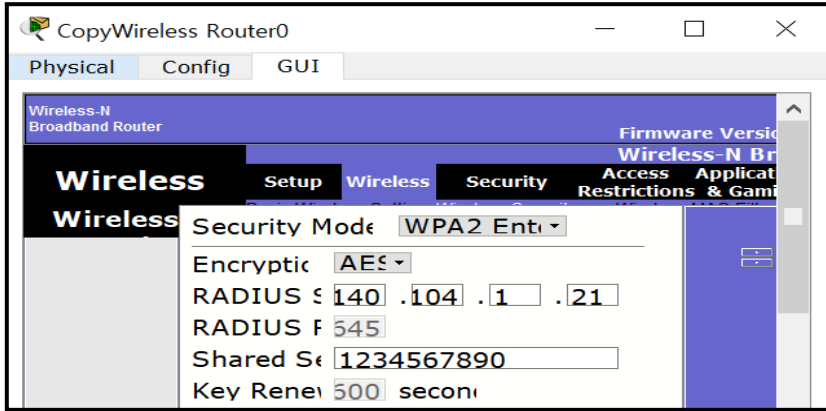


WPA-PSK설정 (PC 설정)

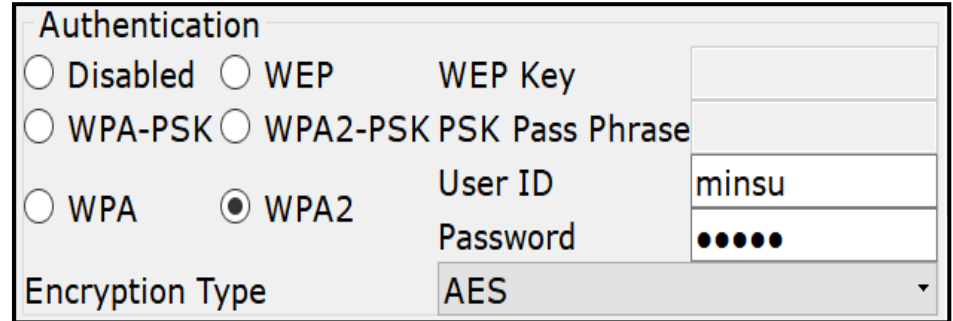


9. 무선 LAN

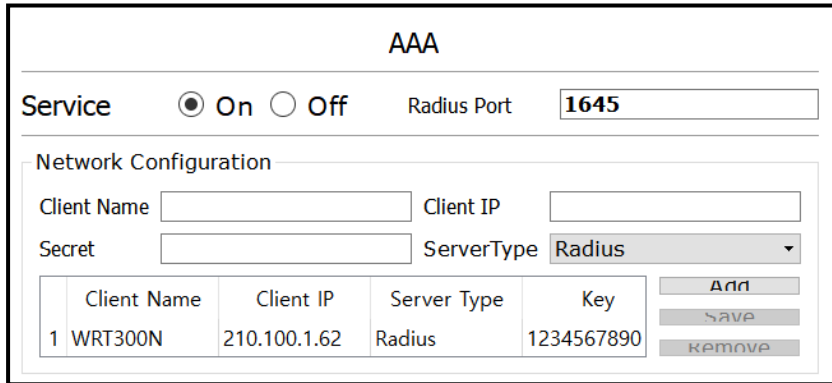
WPA2-Enterprise 설정 (무선라우터 설정)



WPA2-Enterprise 설정 (PC 설정)

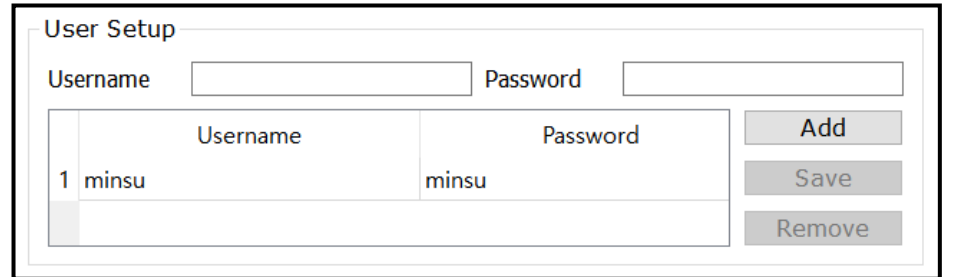


WPA2-Enterprise 설정 (AAA 서버 설정)



→ AAA 서비스를 사용 할 무선 라우터를 등록해줍니다.

WPA2-Enterprise 설정 (AAA 서버 설정)

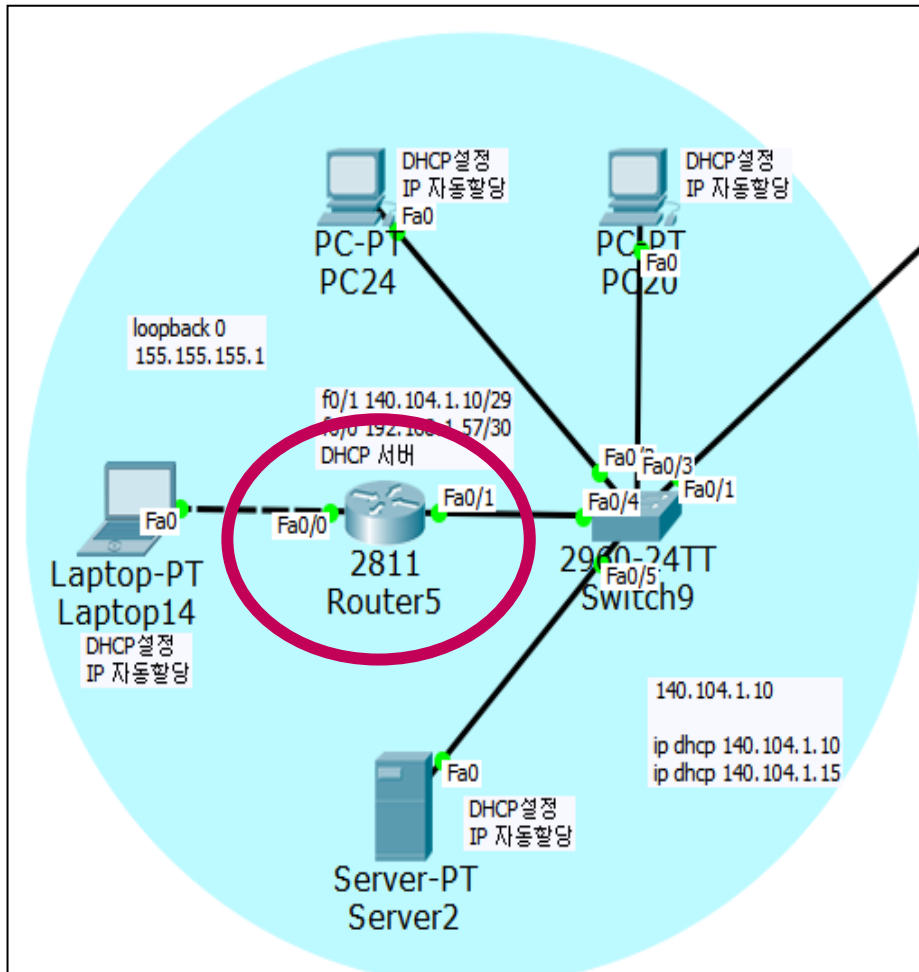


→ AAA 서비스를 사용 할 사용자를 등록해줍니다.

10. DHCP

- 동적 호스트 구성 프로토콜이다.
- TCP/IP 통신을 실행하기 위해 필요한 설정정보를 자동적으로 할당하고 관리하기 위한 통신 규약이다.
- 필요한 기기에 주소를 자동 할당하도록 하여 관리의 편리성을 향상시키고 할당만 하고 쓰이지 않는 주소를 줄여주어서 IP주소의 가용성을 향상시켜준다.

10. DHCP (라우터를 DHCP 서버로 구성)



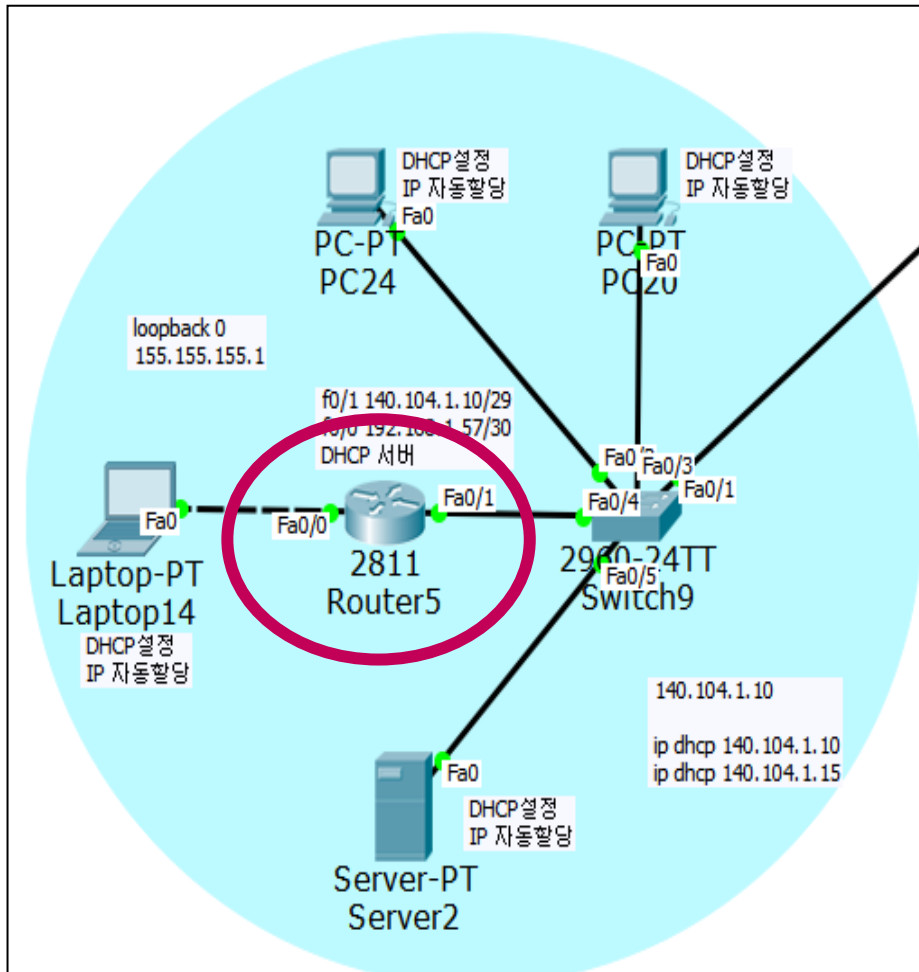
라우터의 IP주소 설정

```
Router(config)#interface FastEthernet0/1
Router(config-if)#ip address 140.104.1.10
255.255.255.248
Router(config-if)#no shutdown
```

라우터에서 DHCP 서버 설정

```
Router(config)#ip dhcp excluded-address 140.104.1.10
Router(config)#ip dhcp excluded-address 140.104.1.15
Router(config)#ip dhcp pool minsu
Router(dhcp-config)#network 140.104.1.8
255.255.255.248
Router(dhcp-config)#dns-server 88.88.88.88
Router(dhcp-config)#default-router 140.104.1.10
Router(dhcp-config)#exit
```

10. DHCP (라우터를 DHCP 서버로 구성)



EIGRP 설정

```

Router(config)#router eigrp 7
Router(config-router)#network 140.104.1.8
Router(config-router)#network 192.168.1.56
Router(config-router)#no auto-summary
    
```

10. DHCP (라우터를 DHCP 서버로 구성)



IP 자동설정 결과 확인

Global Settings

Display Name:

Interfaces:

Gateway/DNS

DHCP Static

Gateway:

DNS Server:

IP Configuration [X]

Interface:

IP Configuration

DHCP Static

IP Address:

Subnet Mask:

Default Gateway:

DNS Server:

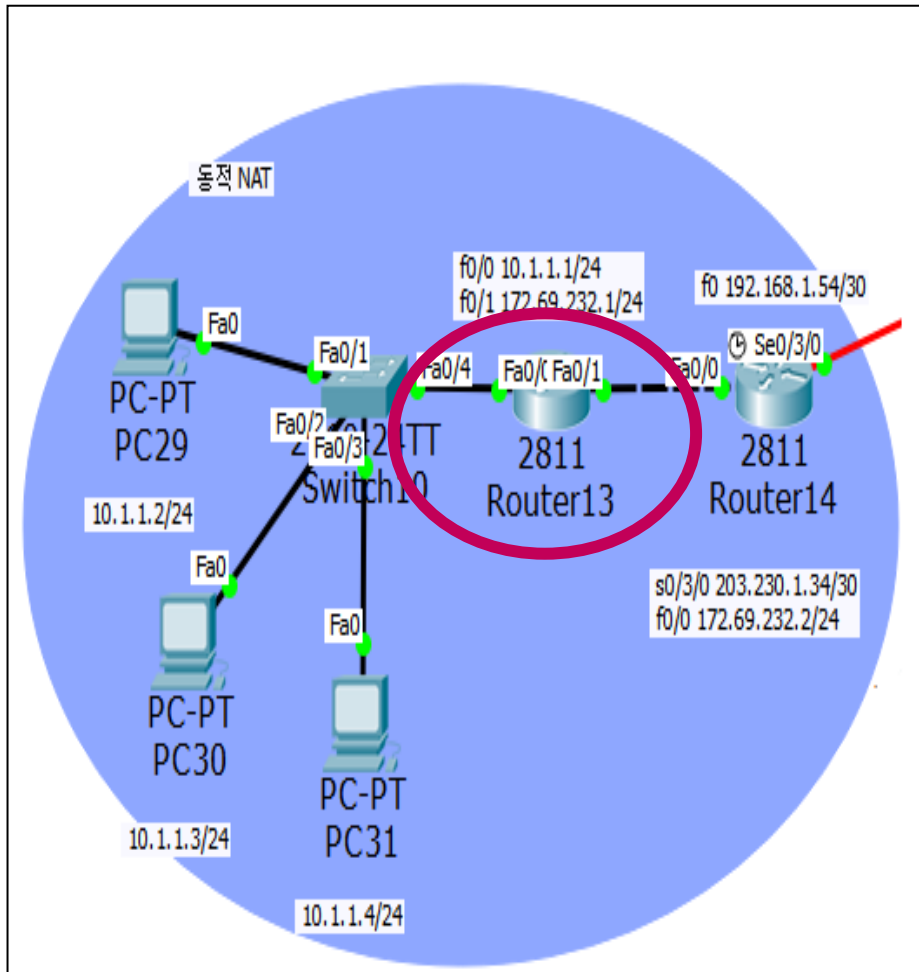
라우터에서 주소할당 현황 보

```
Router(config)#do show ip dhcp binding
IP address      Client-ID/
                Hardware address      Lease expiration      Type
140.104.1.11   0001.C935.C116                --                    Automatic
140.104.1.13   0001.6470.6C48                --                    Automatic
140.104.1.12   00D0.58BC.9449                --                    Automatic
```

II. NAT

- 사설주소를 사용하는 장치가 공중네트워크와 통신하고자 할 때 사설 IP주소를 공인 IP주소로 변환해 주는 기술이다.
- 내부 네트워크에서는 사설 IP주소를 사용하고, 외부 네트워크로 나가는 경우 공인 IP주소로 변환돼서 나가게 하는 기술이다.
- 장점 : 공인 IP주소 사용을 줄여서 주소비용을 절감할 수 있다.
네트워크의 보안성을 향상시켜준다.
단점 : 패킷 처리에 지연 발생할 수 있다.
패킷 추적이 어렵다.

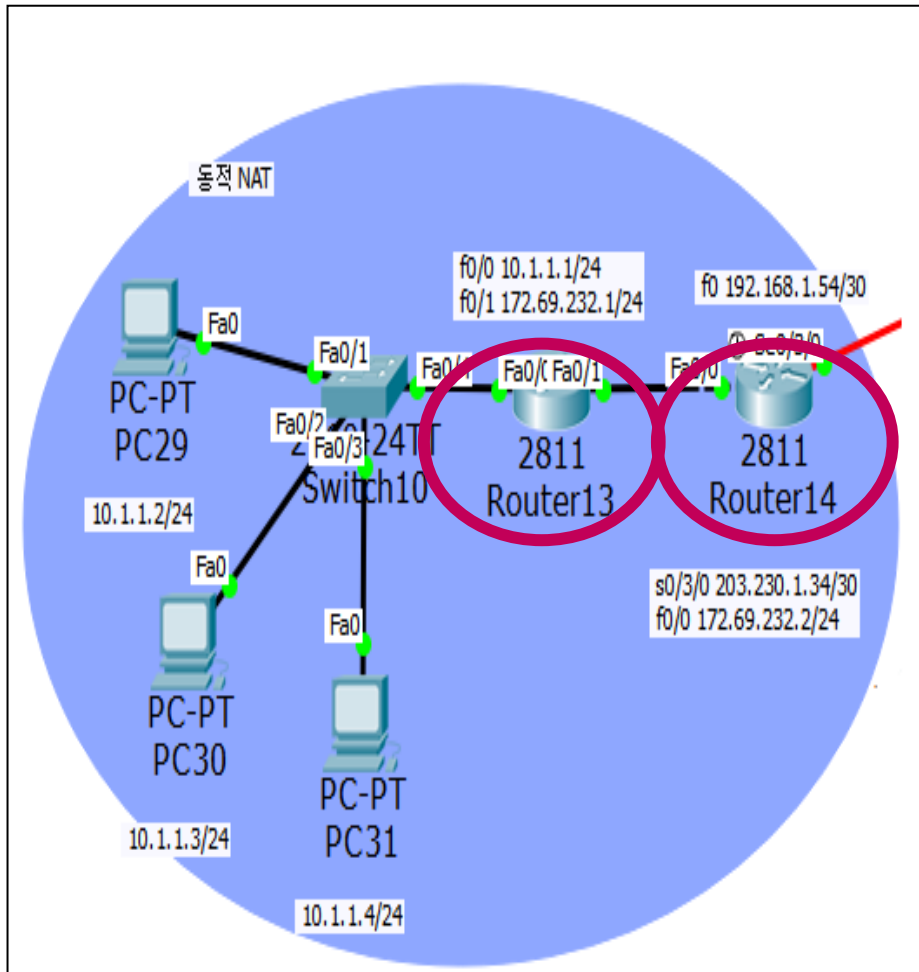
II. NAT (동적 NAT)



Router13 설정

```
Router(config)#ip nat pool minusu 172.69.232.209
172.69.232.222 netmask 255.255.255.0
Router(config)#access-list I permit 10.1.1.0 0.0.0.255
Router(config)#ip nat inside source list I pool minusu
Router(config)#int f0/0
Router(config-if)#ip nat inside
Router(config-if)#exit
Router(config)#int f0/1
Router(config-if)#ip nat outside
Router(config-if)#end
```

II. NAT (동적 NAT)



Router13 EIGRP 설정

```
Router(config)#router eigrp 7
Router(config-router)#network 10.1.1.0
Router(config-router)#network 172.69.232.0
Router(config-router)#no auto-summary
```

Router14 EIGRP 설정

```
Router(config)#router eigrp 7
Router(config-router)#network 203.230.1.32
Router(config-router)#network 172.69.232.0
Router(config-router)#no auto-summary
```

II. NAT (동적 NAT)



PC29에서의 PING 결

과
PC>ping 172.69.232.1

Router I3으로 연결 확인

```
Pinging 172.69.232.1 with 32 bytes of data:

Reply from 172.69.232.1: bytes=32 time=1ms TTL=255
Reply from 172.69.232.1: bytes=32 time=1ms TTL=255
Reply from 172.69.232.1: bytes=32 time=0ms TTL=255
Reply from 172.69.232.1: bytes=32 time=21ms TTL=255

Ping statistics for 172.69.232.1:
    Packets: Sent = 4, Received = 4, Lost = 0 (0%
loss),
Approximate round trip times in milli-seconds:
    Minimum = 0ms, Maximum = 21ms, Average = 5ms
```

PC>ping 172.69.232.2

Router I4로의 연결확인(동적 NAT 설정 전)

```
Pinging 172.69.232.2 with 32 bytes of data:

Request timed out.
Request timed out.
Reply from 172.69.232.2: bytes=32 time=0ms TTL=254
Reply from 172.69.232.2: bytes=32 time=0ms TTL=254

Ping statistics for 172.69.232.2:
    Packets: Sent = 4, Received = 2, Lost = 2 (50%
loss),
Approximate round trip times in milli-seconds:
    Minimum = 0ms, Maximum = 0ms, Average = 0ms
```

II. NAT (동적 NAT)



PC>ping 172.69.232.2

Router I4로의 연결확인(동적 NAT 설정 후)

```
Pinging 172.69.232.2 with 32 bytes of data:
Reply from 172.69.232.2: bytes=32 time=32ms TTL=254
Reply from 172.69.232.2: bytes=32 time=0ms TTL=254
Reply from 172.69.232.2: bytes=32 time=0ms TTL=254
Reply from 172.69.232.2: bytes=32 time=0ms TTL=254

Ping statistics for 172.69.232.2:
    Packets: Sent = 4, Received = 4, Lost = 0 (0%
loss),
Approximate round trip times in milli-seconds:
    Minimum = 0ms, Maximum = 32ms, Average = 8ms
```

RouterI3에서 변환된 IP 주소 확인

```
Router#show ip nat translations
Pro  Inside global      Inside local        Outside local       Outside global
icmp 172.69.232.209:10  10.1.1.2:10        172.69.232.2:10    172.69.232.2:10
icmp 172.69.232.209:11 10.1.1.2:11        172.69.232.2:11    172.69.232.2:11
icmp 172.69.232.209:12 10.1.1.2:12        172.69.232.2:12    172.69.232.2:12
icmp 172.69.232.209:5   10.1.1.2:5         172.69.232.2:5     172.69.232.2:5
icmp 172.69.232.209:6   10.1.1.2:6         172.69.232.2:6     172.69.232.2:6
icmp 172.69.232.209:7   10.1.1.2:7         172.69.232.2:7     172.69.232.2:7
icmp 172.69.232.209:8   10.1.1.2:8         172.69.232.2:8     172.69.232.2:8
icmp 172.69.232.209:9   10.1.1.2:9         172.69.232.2:9     172.69.232.2:9
```

다른 PC에서도 같은 방법으로 연결 확인 후 Router에서 변환된 IP주소를 확인 할 수 있다.



감사합니다.