네트워크 팀 프로젝트

3조 Shell Work

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목 차

1. 물리적 구성도

2. 논리적 구성도

Ⅰ. 142-IP

Ⅱ.142-IGP

3. 기본 설정

4. 문제

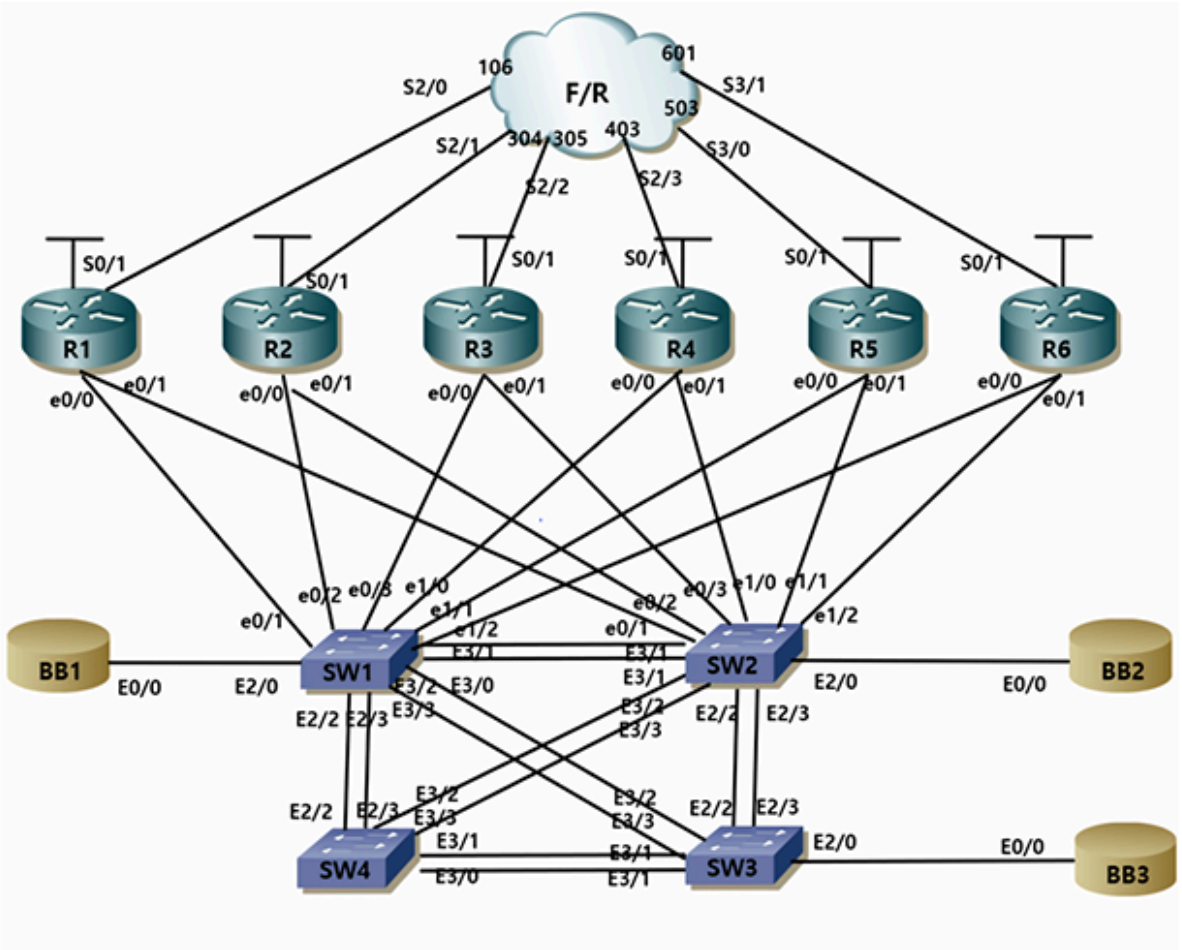
Ⅰ. Bridging and Switching

Ⅱ. IP IGP Protocols

Ⅲ. IOS/IP Features

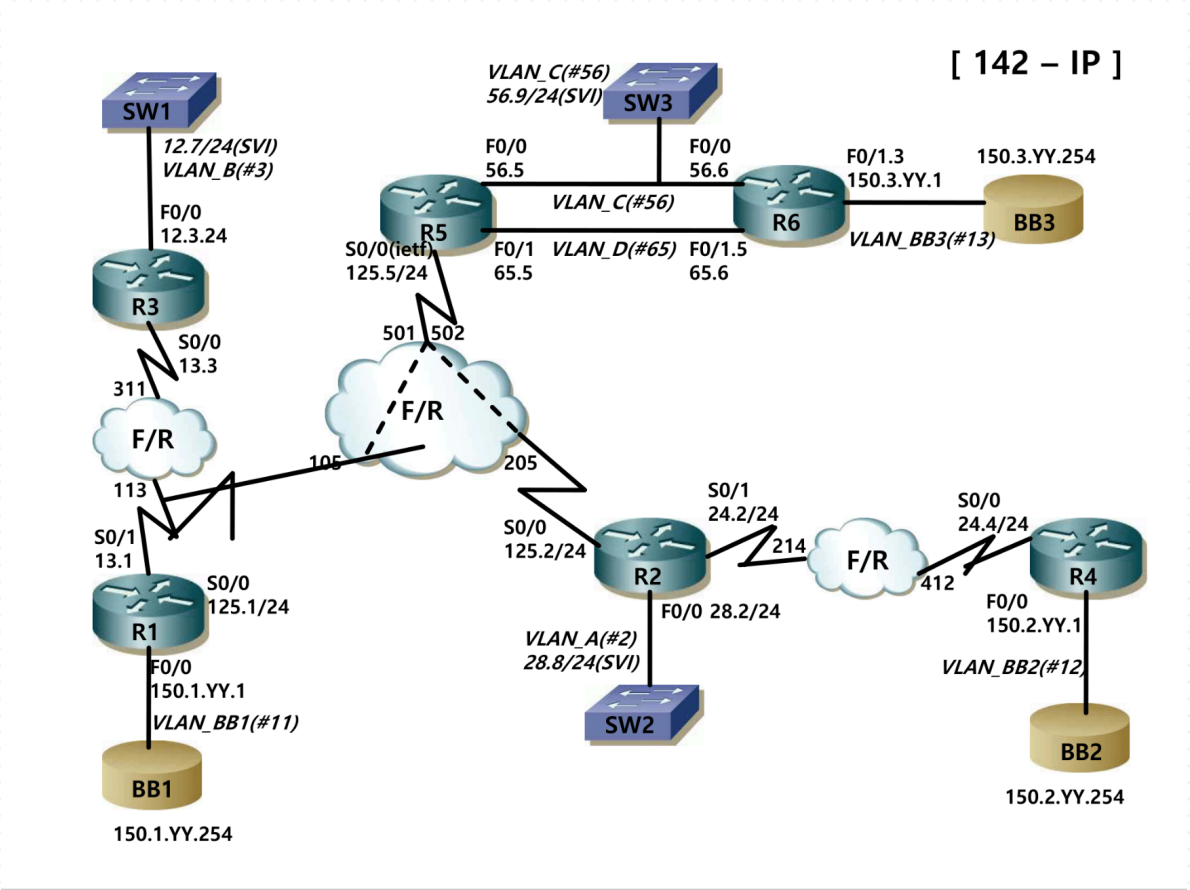
Ⅵ.Security

1. 물리적 구성도

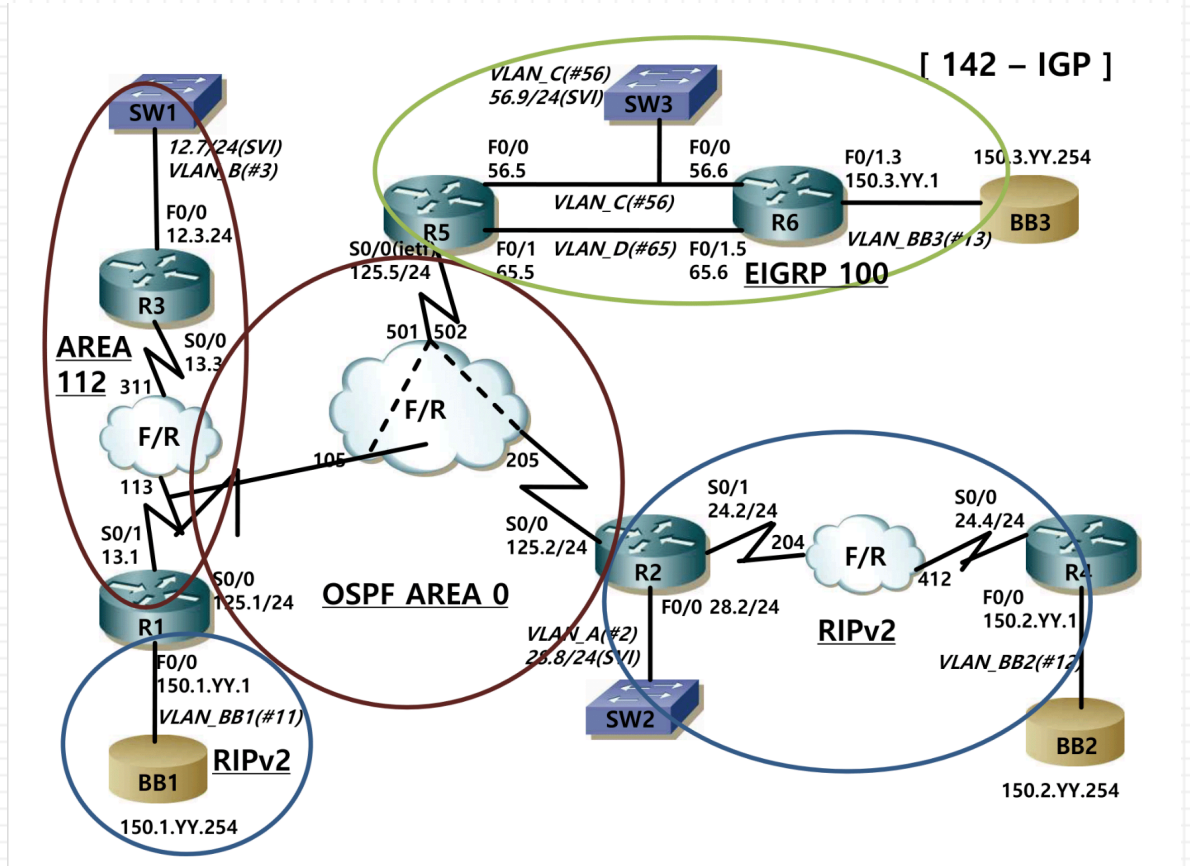

F/R
106
601
503
403
304
305
S2/0
S2/1
S2/2
S2/3
S3/1
S3/0
R1
R2
R3
R4
R5
R6
S0/1
e0/0
e0/1
SW1
SW2
SW3
SW4
BB1
BB2
BB3
E0/0
E2/0
E2/2
E2/3
E3/0
E3/1
E3/2
E3/3
e1/0
e1/1
e1/2
e0/2
e0/3

2. 논리적 구성도

Ⅰ. IP



Ⅱ. IGP



3. 기본 설정

IOS 12.4
Doc CD : you have access to cisco.com/univercd
All configuration guides and master indexes are there
Tools : notepad and calculator are available

0. Address Allocation
use class B address range YY.YY.X.0/16. YY is your rack number
YY is your rack number, X is your router number
(YY는 조 번호, X 는 각 해당하는 라우터번호)
Ex (If your Rack number is 03, Lo0 is 3.3.3.3 and Rack number is 07, Lo0 is 7.7.7.7)

Note (## VLAN 이름과 넘버는 바뀔 수 있습니다)

VLAN ID	VLAN 이름	네트워크 주소
VLAN 2	VLAN_A	**3.3**.28.0/24
VLAN 3	VLAN_B	**3.3**.13.0/24
VLAN 56	VLAN_C	**3.3**.56.0/24
VLAN 65	VLAN_D	**3.3**.65.0/24
VLAN 11	VLAN_BB1	150.1.**3**.0/24
VLAN 12	VLAN_BB2	150.2.**3**.0/24
VLAN 13	VLAN_BB3	150.3.**3**.0/24

- FrameRelay : YY.YY.125.0/24 (R2-R3-R5)
  YY.YY.24.0/24 (R2-R4) ㅍ
  YY.YY.13.0/24 (R1-R3)
- BB1 is 150.1.**3**.254/24
- BB2 is 150.2.**3**.254/24
- BB3 is 150.3.**3**.254/24

- Loopback IP Address

Hostname	Loopback 0 interface IP Address	Hostname	Loopback 0 interface IP Address
Rack03R1	3.3.1.1/24	Rack03R6	3.3.6.6/24
Rack03R2	3.3.2.2/24	Rack03SW1	3.3.7.7/24
Rack03R3	3.3.3.3/24	Rack03SW2	3.3.8.8/24
Rack03R4	3.3.4.4/24	Rack03SW3	3.3.9.9/24
Rack03R5	3.3.5.5/24		

- Unless specified above, all interface else must be 24 bit mask addressing

4. 문제

Ⅰ. Bridging and Switching

1. Configure IP across your frame relay network

· The frame provided for you is fully meshed. However, you must only use PVC's indicated on Diagram user of any dynamic circuits is not permitted. Do not use sub-interface for the frame-relay links but use only on Hub and Spoke, Configure the frame-relay connections according to the Diagram. Use only DLCI numbers supplied, Ensure you can ping all frame relay interfaces. R2 and R4 are should be PPP over Frame-Relay and should sub-interface but Don't use IP unnumbered. (## 확인 : sh frame pvc , debug frame ppp , debug frame packet)

a. *R2,R4,R5 를 제외한 나머지 Router 에서는 Sub-interface 를 사용할 수 없다. R5 에서 multipoint sub-interface 로 구성하시오.*
b. *R2와 R4 사이의 Frame-relay link 는 PPP over Frame-relay 를 구성하라. R2와 R4는 PPP Over F/R 로 구성하되 먼저 Subinterface 를 생성하며 IP Unnumbered 를 사용할 수 없다. (또는 Subinterface 를 사용하지 않고 PPPover FR 을 설정하라고 출제되는 경우도 있음*

R1

```
int s1/0
encapsulation frame-relay
no frame-relay inv
no sh
int s1/0.125 m
ip add 3.3.125.1 255.255.255.0
frame-relay map ip 3.3.125.5 105 broadcast
frame-relay map ip 3.3.125.2 105 broadcast
int s1/0.13 p
ip add 3.3.13.1 255.255.255.0
frame-relay interface-dlci 103
int lo0
ip add 3.3.1.1 255.255.255.0
ip os net point-to-point
int e0/0
no shut
ip add 150.1.3.1 255.255.255.0
```

R2

```
int s1/0
encapsulation frame-relay
no frame-relay invers-arp
no shut
int s1/0.125 m
```

ip add 3.3.125.2 255.255.255.0
frame-relay map ip 3.3.125.5 205 broadcast
frame-relay map ip 3.3.125.1 205 broadcast

int s1/0.24 p
ip add 3.3.24.2 255.255.255.0
frame-relay interface-dlci 204
int e0/0
no sh
ip add 3.3.28.2 255.255.255.0
int lo0
ip add 3.3.2.2 255.255.255.0

R3
int s1/0
encapsulation frame-relay
no frame-relay invers-arp
no shut
int s1/0.13 p
ip add 3.3.13.3 255.255.255.0
frame interface-dlci 301
int e0/0
no shut
ip add 3.3.12.3 255.255.255.0
int lo0
ip add 3.3.3.3 255.255.255.0
ip os net point-to-p

R4
int s1/0
encapsulation frame-relay
no frame-relay invers-arp
no shut
int s1/0.24 p
ip add 3.3.24.4 255.255.255.0
frame-relay interface-dlci 402
int e0/0
no shut
ip add 150.2.3.1 255.255.255.0
int lo0
ip add 3.3.4.4 255.255.255.0

R5

```
int s1/0
encapsulation frame-relay
no frame-relay invers-arp
no shut
int s1/0.125 m
ip add 3.3.125.5 255.255.255.0
frame-relay map ip 3.3.125.1 501 broadcast
frame-relay map ip 3.3.125.2 502 broadcast
int e0/0
no shut
ip add 3.3.56.5 255.255.255.0
int e0/1
no shut
ip add 3.3.65.5 255.255.255.0
int lo0
ip add 3.3.5.5 255.255.255.0
```

R6

```
int e0/0
no shut
ip add 3.3.56.6 255.255.255.0
int e0/1
no shut
int e0/1.5
encapsulation dot1q 65
ip add 3.3.65.6 255.255.255.0
int e0/1.3
encapsulation dot1q 13
ip add 150.3.3.1 255.255.255.0
int lo0
ip add 3.3.6.6 255.255.255.0
```

2. Cat3550/3560 Switch Setup

2.1 VTP Configuration

SW1 (VTP Server)

```
vtp mode server
vtp domain VTP3
vtp pass cisco
```

SW2 - 3 (VTP Client)

```
vtp mode client
vtp domain VTP3
vtp pass cisco
```

2.2 Trunk Port

SW1

```
int ran e2/2 - 3
shut

int ran e3/0 - 3
sw tr en dot1q
sw mo tr
```

SW2 - 3

```
int ran e3/2 - 2
shut

int ran e3/0 - 1 , e2/2 - 3
sw tr en dot1q
sw mo tr
```

2.4 VLAN Configuration

SW1

```
vlan 11
name VLAN_BB1

vlan 2
name VLAN_A

vlan 3
name VLAN_B
```

```
vlan 12
name VLAN_BB2

vlan 13
name VLAN_BB3

vlan 56
name VLAN_C

vlan 65
name VLAN_D

int ran e0/1 , e2/0
sw mo acc
sw acc vl 11

int e0/3
sw mo acc
sw acc vl 3

int lo0
ip add 3.3.7.7 255.255.255.0

int vlan 3
ip add 3.3.12.7 255.255.255.0
no shut

int e0/2
sw mo acc
sw acc vl 2

int e1/0
sw mo acc
sw acc vl 12

int ran e1/1 - 2
sw mo acc
sw acc vl 56
```

SW2

```
int lo0
ip add 3.3.8.8 255.255.255.0

int vl 2
no sh
ip add 3.3.28.8 255.255.255.0

int e1/1
sw mo acc
sw acc vl 65

int e1/2
sw tr en dot1q
sw mo tr
sw tr all vl 65,13

int e2/0
sw mo acc
sw acc vl 12
```

SW3

```
int lo0
ip add 3.3.9.9 255.255.255.0

int vlan 56
no shut
ip add 3.3.56.9 255.255.255.0

int e2/0
sw mo acc
sw acc vl 13
```

- 결과

SW1

```
VLAN Name                             Status    Ports
---- -------------------------------- --------- -------------------------
1    default                          active    Et0/0, Et1/3, Et2/1, Et2/2
                                                Et2/3
2    VLAN_A                           active    Et0/2
3    VLAN_B                           active    Et0/3
11   VLAN_BB1                         active    Et0/1, Et2/0
12   VLAN_BB2                         active    Et1/0
13   VLAN_BB3                         active
56   VLAN_C                           active    Et1/1, Et1/2
65   VLAN_D                           active
```

SW2

```
VLAN Name                             Status    Ports
---- -------------------------------- --------- -------------------------
1    default                          active    Et0/0, Et0/1, Et0/2, Et0/3
                                                Et1/0, Et1/3, Et2/1, Et3/2
                                                Et3/3
2    VLAN_A                           active
3    VLAN_B                           active
11   VLAN_BB1                         active
12   VLAN_BB2                         active    Et2/0
13   VLAN_BB3                         active
56   VLAN_C                           active
65   VLAN_D                           active    Et1/1
```

SW3

```
VLAN Name                             Status    Ports
---- -------------------------------- --------- -------------------------
1    default                          active    Et0/0, Et0/1, Et0/2, Et0/3
                                                Et1/0, Et1/1, Et1/2, Et1/3
                                                Et2/1, Et3/0, Et3/1
2    VLAN_A                           active
3    VLAN_B                           active
11   VLAN_BB1                         active
12   VLAN_BB2                         active
13   VLAN_BB3                         active    Et2/0
56   VLAN_C                           active
65   VLAN_D                           active
```

2.5 STP Root Configuration -> MSTP

STP에서 사용하는 VLAN 정보중에 아래 조건에 맞게 구성을 하시오.

a. Topology 1 : VLAN_A(#2) , VLAN_C(#56) , VLAN_BB2(#12)

b. Topology 2 : VLAN_B(#3) , VLAN_D(#65) , VLAN_BB1(#11) , VLAN_BB3(#13)

c. Topology 1 에 대해서 SW1이 root 가 되도록 하고 Topology 2 에 대해서는 SW2가 root가 되돌고 설정을 하는데 서로에 대한 backup 도 설정을 하라.

SW1 - 3

```
spanning-tree mode mst
spanning-tree mst configuration
name CCIE
revision 1
instance 1 vlan 2,12,56
instance 2 vlan 3,11,13,65
```

SW1

```
spanning-tree mst 1 root primary
spanning-tree mst 2 root secondary
```

SW2

```
spanning-tree mst 2 root primary
spanning-tree mst 1 root secondary
```

- 결과

SW1

```
SW1(config-if)#do show spanning-tree mst configuration
Name      [CCIE]
Revision  1     Instances configured 3

Instance  Vlans mapped
--------  ----------------------------------------
0         1,4-10,14-55,57-64,66-4094
1         2,12,56
2         3,11,13,65
-------------------------------------------------------
```

SW2

```
SW2(config)#do show spanning-tree mst configuration
Name      [CCIE]
Revision  1     Instances configured 3

Instance  Vlans mapped
--------  ----------------------------------------
0         1,4-10,14-55,57-64,66-4094
1         2,12,56
2         3,11,13,65
-------------------------------------------------------
```

SW3

```
SW3(config)#do show spanning-tree mst configuration
Name      [CCIE]
Revision  1     Instances configured 3

Instance  Vlans mapped
--------  ----------------------------------------
0         1,4-10,14-55,57-64,66-4094
1         2,12,56
2         3,11,13,65
---------------------------------------------------
```

[추가1] STP Load balancing

SW1과 SW2의 fa0/23 , fa0/24 의 trunk link 에 대해서 아래와 같은 조건을 만족하도록 구성하시오. 짝수 VLAN은 fa0/23 을 통해서, 홀수 VLAN은 fa0/24 에 대해서만 허용하는데 Load Balancing 이 가능하도록 하시오.

SW1 - 2

int e3/0
spanning-tree mst 1 port-priority 64
int e3/1
spanning-tree mst 2 port-priority 64

- 결과

SW1

```
SW1#show spanning-tree mst 2

###### MST2    vlans mapped:   3,11,13,65
Bridge        address aabb.cc00.0700  priority      28674 (28672 sysid 2)
Root          address aabb.cc00.0800  priority      24578 (24576 sysid 2)
              port    Et3/1           cost          2000000   rem hops 19

Interface        Role Sts Cost      Prio.Nbr Type
---------------- ---- --- --------- -------- --------------------------------
Et0/1            Desg FWD 2000000   128.2    Shr
Et0/3            Desg FWD 2000000   128.4    Shr
Et2/0            Desg FWD 2000000   128.65   Shr
Et3/0            Altn BLK 2000000   128.97   Shr
Et3/1            Root FWD 2000000    64.98   Shr
Et3/2            Desg FWD 2000000   128.99   Shr
Et3/3            Desg FWD 2000000   128.100  Shr
```

SW2

```
SW2#show spanning-tree mst 2

##### MST2    vlans mapped:   3,11,13,65
Bridge        address aabb.cc00.0800  priority      24578 (24576 sysid 2)
Root          this switch for MST2

Interface        Role Sts Cost      Prio.Nbr Type
---------------- ---- --- --------- -------- --------------------------------
Et1/1            Desg FWD 2000000   128.34   Shr
Et1/2            Desg FWD 2000000   128.35   Shr
Et2/2            Desg FWD 2000000   128.67   Shr
Et2/3            Desg FWD 2000000   128.68   Shr
Et3/0            Desg FWD 2000000   128.97   Shr
Et3/1            Desg FWD 2000000    64.98   Shr
```

[추가3] STP tuning

SW3에서 현재 fa0/20 이 blocking 상태인데 SW1에서 설정하여 SW3에서 fa0/20 이 forwarding 상태로 되게 설정.

SW1

int e3/3

spanning-tree mst 1 port-priority 64

- 결과

```
SW3(config-if)#do show spanning-tree mst 1

##### MST1    vlans mapped:   2,12,56
Bridge        address aabb.cc00.0900  priority      32769 (32768 sysid 1)
Root          address aabb.cc00.0700  priority      24577 (24576 sysid 1)
              port    Et3/3           cost          2000000   rem hops 19

Interface        Role Sts Cost      Prio.Nbr Type
---------------- ---- --- --------- -------- --------------------------------
Et2/2            Altn BLK 2000000   128.67   Shr
Et2/3            Altn BLK 2000000   128.68   Shr
Et3/2            Altn BLK 2000000   128.99   Shr
Et3/3            Root FWD 2000000    64.100  Shr
```

2.7 Mac Table Aging Time (show mac-address aging-time vlan Z)

· Delete Mac address in MAC Table if not use for 30 min on VLAN_B(or VLAN_BB2)

SW1 ~ SW3

mac-address-table aging-time 1800 vlan 3

- 결과

SW1

```
SW1(config)#do sh mac address-table aging-time vlan 3
Global Aging Time:  300
Vlan    Aging Time
----    ----------
   3    1800
```

SW2

```
SW2(config)#do sh mac address-table aging-time vlan 3
Global Aging Time:  300
Vlan    Aging Time
----    ----------
   3    1800
```

SW3

```
SW3(config)#do sh mac address-table aging-time vlan 3
Global Aging Time:  300
Vlan    Aging Time
----    ----------
   3    1800
```

· SWX 에서 switch port는 모든 STP status를 거친다. Fa0/12 port에 대해서 이 시간을 16초 이하(미만)으로 구성하라

SW1 - 3

spanning-tree mst max-age 6

spanning-tree mst forward-time 4

2.8 Mac Address Table

· Mac Address Table on SW2, Configure your network to show the following when you issue the conmmand.

* show mac-address-table dynamic vlan 56

Vlan	Mac Address	Type	Ports
56	0001.0001.0001	Dynamic	Fa0/23
56	0002.0002.0002	Dynamic	Fa0/23

R5

int e0/0

mac-address 0001.0001.0001

R6

int e0/0

mac-address 0002.0002.0002

II . IP IGP Protocols

After finishing each question below, ensure that all interfaces are visible on all routers. And you can't use the static route or default route if not specified in the question. (Do not use “router-id” in IGP)
*BGP는router-id사용

1.RIP

1.1 Configure RIPv2 between R1 and BB1

· BB1 is broadcasting routes of 199.172.x.0, where x is ranged from 1 to 16.
However you only need 199.172.8.0, 199.172.9.0, 199.172.10.0, 199.172.11.0 routes.
Do not use “auto-summary”command.

R1
router rip
ver 2
no auto-summary
network 150.1.0.0
distribute-list FROMBB1 in e0/0

ip access-list standard FROMBB1
permit 199.172.8.0 0.0.3.0

BB1
router rip
version 2
no auto-summary
network 150.1.0.0

[변형] · BB1에서 199.172.X.0(1~16) 정보가 들어 오고 있는데 그 중 199.172.8.0~11.0 , 150.1.YY.0 만 OSPF 재분배 하도록 하시오. 이 설정은 가장 간결한 설정으로 해결해야 한다. Auto-summary 를 사용해서는 안된다. Prefix-list 를 사용하시오.

R1
router rip
version 2
no auto-summary
network 150.1.0.0
router ospf 1
redistribute rip subnets route-map NET_RIP
route-map NET_RIP

match ip address prefix-list NET_RIP

ip prefix-list NET_RIP permit 150.1.3.0/24
ip prefix-list NET_RIP permit 199.172.8.0/22 ge 24 le 24

1.2 Configure RIPv2 between R2 and R4 , SW2

· Don’t allowed advertisement on interface that don’t show up on diagram.
· R2,R4 및 SW2에서 VLAN_A의 IP address 를 YY.YY.28.8/24 로 설정하고 RIP을 구성하시오.

R2

router rip
version 2
no auto-summary
network 3.0.0.0

R4

router rip
version 2
no auto-summary
network 3.0.0.0

SW2

ip routing
int vlan 2
ip add 3.3.28.8 255.255.255.0

router rip
version 2
no auto-summary
network 3.0.0.0

BB2

router rip

version 2

no auto-summary

network 3.0.0.0

- 결과

BB2

```
Router#sh 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
       i - IS-IS, su - IS-IS summary, 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, H - NHRP, l - LISP
       + - replicated route, % - next hop override

Gateway of last resort is not set

      3.0.0.0/24 is subnetted, 6 subnets
R        3.3.2.0 [120/2] via 150.2.3.1, 00:00:03, Ethernet0/0
R        3.3.4.0 [120/1] via 150.2.3.1, 00:00:03, Ethernet0/0
R        3.3.8.0 [120/3] via 150.2.3.1, 00:00:03, Ethernet0/0
R        3.3.24.0 [120/1] via 150.2.3.1, 00:00:03, Ethernet0/0
R        3.3.28.0 [120/2] via 150.2.3.1, 00:00:03, Ethernet0/0
R        3.3.125.0 [120/2] via 150.2.3.1, 00:00:03, Ethernet0/0
      150.2.0.0/16 is variably subnetted, 2 subnets, 2 masks
C        150.2.3.0/24 is directly connected, Ethernet0/0
L        150.2.3.254/32 is directly connected, Ethernet0/0
```

1.4 RIP Routing Table (즉, EIGRP>OSPF>RIP 재분배 하시오)– OSPF, EIGRP 설정 후

· On R4, configure your network to show the following

- 3.3.5.0 (120/4) 설정 - 3.3.6.0 (120/4) ## R4의 라우팅 테이블에 metric 값에 맞게

R5

router ospf 1

redistribute eigrp 100 subnets

R2

router rip

redistribute ospf 1 metric 4

- 결과

R4

```
R4#sh 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
       i - IS-IS, su - IS-IS summary, 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, + - replicated route

Gateway of last resort is not set

      3.0.0.0/8 is variably subnetted, 18 subnets, 2 masks
R        3.3.1.0/24 [120/4] via 3.3.24.2, 00:00:05, Serial1/0.24
R        3.3.2.0/24 [120/1] via 3.3.24.2, 00:00:05, Serial1/0.24
R        3.3.3.0/24 [120/4] via 3.3.24.2, 00:00:05, Serial1/0.24
C        3.3.4.0/24 is directly connected, Loopback0
L        3.3.4.4/32 is directly connected, Loopback0
R        3.3.5.0/24 [120/4] via 3.3.24.2, 00:00:05, Serial1/0.24
R        3.3.6.0/24 [120/4] via 3.3.24.2, 00:00:05, Serial1/0.24
R        3.3.7.7/32 [120/4] via 3.3.24.2, 00:00:05, Serial1/0.24
```

(변형) · R5,R6의 Loopback 0 가 R4에서 metric 3 으로 보이게 하라. 단, R4에서 설정하시오.

R5

router ospf 1

redistribute eigrp 100 subnets

R2

router rip

redistribute ospf 1 metric 1

R4

router rip

offset-list 10 in 2 s1/0

access-list 10 permit 3.3.5.0

access-list 10 permit 3.3.6.0

- 결과

R4

```
R4#sh 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
       i - IS-IS, su - IS-IS summary, 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, + - replicated route

Gateway of last resort is not set

      3.0.0.0/8 is variably subnetted, 18 subnets, 2 masks
R        3.3.1.0/24 [120/1] via 3.3.24.2, 00:00:19, Serial1/0.24
R        3.3.2.0/24 [120/1] via 3.3.24.2, 00:00:19, Serial1/0.24
R        3.3.3.0/24 [120/1] via 3.3.24.2, 00:00:19, Serial1/0.24
C        3.3.4.0/24 is directly connected, Loopback0
L        3.3.4.4/32 is directly connected, Loopback0
R        3.3.5.0/24 [120/3] via 3.3.24.2, 00:00:19, Serial1/0.24
R        3.3.6.0/24 [120/3] via 3.3.24.2, 00:00:19, Serial1/0.24
R        3.3.7.7/32 [120/1] via 3.3.24.2, 00:00:19, Serial1/0.24
```

2. OSPF

2.1 Configuration OSPF AREA 0 (Loopback - /24 로 광고하자)

· Create OSPF area 0 with R1, R2, and R5. Use NBMA network type related commands. All router should be able to ping routers int OSPF domain after completing configuration.
· 구성도를 참조하여 R1,R2,R5 OSPF area 0 로 구성하라. NBMA network type 관련 명령 어를 사용하라.

R1
router os 1
router-id 5.5.1.1
net 5.5.125.1 0.0.0.0 a 0
net 5.5.1.1 0.0.0.0 a 0

R2
router ospf 1
router-id 5.5.2.2
net 5.5.125.2 0.0.0.0 a 0
net 5.5.2.2 0.0.0.0 a 0

R5
router os 1
router-id 5.5.5.5
net 5.5.125.5 0.0.0.0 a 0
net 5.5.5.5 0.0.0.0 a 0
nei 5.5.125.1
nei 5.5.125.2

2.2 Configuration OSPF AREA 112 (Loopback /24로 광고되게하시오)

· Create area 112 with R1, R3, SW1 and make the OSPF network type point to point at R1 and make the OSPF network type point to multipoint at R3. Add VLAN_B(#3) to area 112.
· R1과 R3 사이에 Serial Link 를 AREA 112 로 구성하라. SW1의 VLAN_A 의 IP 주소를 Y.Y.12.7/24 로 설정하고 R3의 f0/0 과 함께 OSPF 설정하라. OSPF network type 은 R1에 서 Point-to-point 를 사용하고 R3에서는 Point-to-Multipoint 사용.
· SW1에서 VLAN_B 의 IP address 를 YY.YY.12.7/24 를 설정하고 R3의 fa0/0 과 함께 OSPF 에 포함하라.
· 또한 SW1에 Loopback1(YY.YY.15.7/24)도 OSPF에 포함하시오.

R1
router os 1
net 5.5.13.1 0.0.0.0 a 112
int s1/0.13 p
ip os net point-to-p

R3

```
router os 1
net 5.5.13.3 0.0.0.0 a 112
net 5.5.12.3 0.0.0.0 a 112
net 5.5.3.3 0.0.0.0 a 112
int s1/0.13 p
ip os net point-to-m
```

SW1

```
int vl 3
no sh
ip add 5.5.12.7 255.255.255.0
int lo1
ip add 5.5.15.7 255.255.255.0
ip routing
router os 1
net 5.5.12.7 0.0.0.0 a 112
net 5.5.7.7 0.0.0.0 a 112
net 5.5.15.7 0.0.0.0 a 112
```

3. EIGRP

3.1 EIGRP 100 Configuration

· Limit the EIGRP on both FastEthernet interface on R5 and all attached interface on R6.(SW3 추가)
Do not use passive-interface.
· SW3에 VLAN_C(#56) ip address 를 YY.Yy.56.9/24 를 설정을 하고 eigrp 에 포함하여라.

R5

```
router eigrp 100
no auto-summary
network 3.3.56.5 0.0.0.0
network 3.3.65.5 0.0.0.0
```

R6

```
router eigrp 100
no auto-summary
network 3.3.56.6 0.0.0.0
network 3.3.65.6 0.0.0.0
network 150.3.3.1 0.0.0.0
network 3.3.6.6 0.0.0.0
```

SW3

```
ip routing
router eigrp 100
no auto-summary
network 3.3.56.9 0.0.0.0
network 3.3.9.9 0.0.0.0
```

3.2 EIGRP 100 Adavance Configuration

· Ensure all other routers ignore all routes but 198.198.z.0/24 and 4.1.1.0/24 from BB3. (z=1~255)
And also, do not inform any topology change to over the BB3.
You also need to let other routers on your network see routes listed above.

R6

```
router eigrp 100
distribute-list prefix FROM_BB3 in e0/1.3
distribute-list prefix TO_BB3 out e0/1.3
exit
ip prefix-list FROM_BB3 permit 198.198.0.0/16 ge 24 le 24
ip prefix-list FROM_BB3 permit 4.1.1.0/24
ip prefix-list TO_BB3 deny 0.0.0.0/0 le 32
```

- 결과

```
Router#show ip route eigrp
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
       i - IS-IS, su - IS-IS summary, 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, H - NHRP, l - LISP
       + - replicated route, % - next hop override

Gateway of last resort is not set
```

3.4 EIGRP Authentication (Security 문제로 이동)

· Use MD5 authentication on VLAN_C

R5

```
key chain EIGRP_AUTH_KEY
key 1
key-string cisco
exit
exit
interface e0/0
ip authentication mode eigrp 100 md5
ip authentication key-chain eigrp 100 EIGRP_AUTH_KEY
```

R6

```
key chain EIGRP_AUTH_KEY
key 1
key-string cisco
exit
exit
interface e0/0
ip authentication mode eigrp 100 md5
ip authentication key-chain eigrp 100 EIGRP_AUTH_KEY
```

SW3

```
key chain EIGRP_AUTH_KEY
key 1
key-string cisco
exit
exit
interface vlan 56
ip authentication mode eigrp 100 md5
ip authentication key-chain eigrp 100 EIGRP_AUTH_KEY
```

- 결과

R5

```
R5#show ip eigrp neighbors
EIGRP-IPv4 Neighbors for AS(100)
H   Address                 Interface       Hold Uptime   SRTT   RTO  Q  Seq
                                            (sec)         (ms)       Cnt Num
2   3.3.65.6                Et0/1            12 01:36:15    5   200  0  40
1   3.3.56.6                Et0/0            12 01:36:23    6   200  0  41
0   3.3.56.9                Et0/0            11 01:36:24    9   200  0  13
```

R6

```
R6#show ip eigrp neighbors
EIGRP-IPv4 Neighbors for AS(100)
H   Address                 Interface       Hold Uptime   SRTT   RTO  Q  Seq
                                            (sec)         (ms)       Cnt Num
3   150.3.3.254             Et0/1.3          10 01:38:00    8   200  0  9
2   3.3.65.5                Et0/1.5          13 01:38:10    7   200  0  29
1   3.3.56.5                Et0/0            12 01:38:19    5   200  0  28
0   3.3.56.9                Et0/0            12 01:38:19    7   200  0  13
```

SW3

```
SW3#show ip eigrp neighbors
EIGRP-IPv4 Neighbors for AS(100)
H   Address                 Interface       Hold Uptime   SRTT   RTO  Q  Seq
                                            (sec)         (ms)       Cnt Num
1   3.3.56.6                Vl56             10 01:38:59    9   100  0  41
0   3.3.56.5                Vl56             13 01:38:59    8   100  0  28
```

4. Redistribution

4.1 Redistribution (RIP <-> OSPF)

· Redistribute between RIP and OSPF.
However ensure that you only able to see 150.1.0.0/16, 199.172.8.0/24, 199.172.9.0/24, 199.172.10.0/24, 199.172.11.0/24 routes from other routers.
Do not send out your network routes to BB1.

R1

```
router rip
redistribute ospf 1 metric 3
distribute-list denyWHOLE out e0/0
ip access-list standard denyWHOLE
deny any

router ospf 1
redistribute rip subnets route-map RIP_TO_OSPF
route-map RIP_TO_OSPF permit 10
match ip address RIP_ROUTES
ip access-list standard RIP_ROUTES
permit 150.1.0.0 0.0.255.255
permit 199.172.8.0 0.0.3.255
```

4.2 Redistribution (RIP<->OSPF)

R2

```
router ospf 1
redistribute rip subnets

router rip
redistribute ospf 1 metric 4
```

4.3 Redistribution (EIGRP<->OSPF)

R5

```
router ospf 1
redistribute eigrp 100 subnets
router eigrp 100
redistribute ospf 1 metric 1544 2000 255 1 1500
```

- 결과

R3

- 재분배 전

```
      3.0.0.0/8 is variably subnetted, 7 subnets, 2 masks
C        3.3.3.0/24 is directly connected, Loopback0
L        3.3.3.3/32 is directly connected, Loopback0
O        3.3.7.7/32 [110/11] via 3.3.12.7, 01:04:42, Ethernet0/0
C        3.3.12.0/24 is directly connected, Ethernet0/0
L        3.3.12.3/32 is directly connected, Ethernet0/0
C        3.3.13.0/24 is directly connected, Serial1/0.13
L        3.3.13.3/32 is directly connected, Serial1/0.13
```

- 재분배 후

```
      3.0.0.0/8 is variably subnetted, 16 subnets, 2 masks
O        3.3.1.0/24 [110/65] via 3.3.13.1, 02:11:58, Serial1/0.13
O E2     3.3.2.0/24 [110/20] via 3.3.13.1, 01:33:20, Serial1/0.13
C        3.3.3.0/24 is directly connected, Loopback0
L        3.3.3.3/32 is directly connected, Loopback0
O E2     3.3.4.0/24 [110/20] via 3.3.13.1, 01:33:20, Serial1/0.13
O E2     3.3.5.0/24 [110/20] via 3.3.13.1, 01:33:20, Serial1/0.13
O E2     3.3.6.0/24 [110/20] via 3.3.13.1, 01:33:20, Serial1/0.13
C        3.3.12.0/24 is directly connected, Ethernet0/0
L        3.3.12.3/32 is directly connected, Ethernet0/0
C        3.3.13.0/24 is directly connected, Serial1/0.13
L        3.3.13.3/32 is directly connected, Serial1/0.13
O E2     3.3.24.0/24 [110/20] via 3.3.13.1, 01:33:20, Serial1/0.13
O E2     3.3.28.0/24 [110/20] via 3.3.13.1, 01:33:20, Serial1/0.13
O E2     3.3.56.0/24 [110/20] via 3.3.13.1, 01:33:20, Serial1/0.13
O E2     3.3.65.0/24 [110/20] via 3.3.13.1, 01:33:20, Serial1/0.13
O IA     3.3.125.0/24 [110/128] via 3.3.13.1, 02:11:58, Serial1/0.13
      150.1.0.0/24 is subnetted, 1 subnets
O E2     150.1.3.0 [110/20] via 3.3.13.1, 01:33:42, Serial1/0.13
      150.2.0.0/24 is subnetted, 1 subnets
O E2     150.2.3.0 [110/20] via 3.3.13.1, 01:33:20, Serial1/0.13
      150.3.0.0/24 is subnetted, 1 subnets
O E2     150.3.3.0 [110/20] via 3.3.13.1, 01:33:20, Serial1/0.13
```

R6

- 재분배 전

```
      3.0.0.0/8 is variably subnetted, 8 subnets, 2 masks
D        3.3.5.0/24 [90/409600] via 3.3.65.5, 01:04:04, Ethernet0/1.5
                    [90/409600] via 3.3.56.5, 01:04:04, Ethernet0/0
C        3.3.6.0/24 is directly connected, Loopback0
L        3.3.6.6/32 is directly connected, Loopback0
D        3.3.9.0/24 [90/409600] via 3.3.56.9, 01:03:58, Ethernet0/0
C        3.3.56.0/24 is directly connected, Ethernet0/0
L        3.3.56.6/32 is directly connected, Ethernet0/0
C        3.3.65.0/24 is directly connected, Ethernet0/1.5
L        3.3.65.6/32 is directly connected, Ethernet0/1.5
      150.3.0.0/16 is variably subnetted, 2 subnets, 2 masks
C        150.3.3.0/24 is directly connected, Ethernet0/1.3
L        150.3.3.1/32 is directly connected, Ethernet0/1.3
```

- 재분배 후

```
      3.0.0.0/8 is variably subnetted, 16 subnets, 2 masks
D EX     3.3.1.0/24 [170/2195456] via 3.3.65.5, 01:34:12, Ethernet0/1.5
                    [170/2195456] via 3.3.56.5, 01:34:12, Ethernet0/0
D EX     3.3.2.0/24 [170/2195456] via 3.3.65.5, 01:34:12, Ethernet0/1.5
                    [170/2195456] via 3.3.56.5, 01:34:12, Ethernet0/0
D EX     3.3.3.0/24 [170/2195456] via 3.3.65.5, 01:34:12, Ethernet0/1.5
                    [170/2195456] via 3.3.56.5, 01:34:12, Ethernet0/0
D EX     3.3.4.0/24 [170/2195456] via 3.3.65.5, 01:34:12, Ethernet0/1.5
                    [170/2195456] via 3.3.56.5, 01:34:12, Ethernet0/0
D        3.3.5.0/24 [90/409600] via 3.3.65.5, 01:42:09, Ethernet0/1.5
                    [90/409600] via 3.3.56.5, 01:42:09, Ethernet0/0
C        3.3.6.0/24 is directly connected, Loopback0
L        3.3.6.6/32 is directly connected, Loopback0
D EX     3.3.12.0/24 [170/2195456] via 3.3.65.5, 01:34:13, Ethernet0/1.5
                     [170/2195456] via 3.3.56.5, 01:34:13, Ethernet0/0
D EX     3.3.13.0/24 [170/2195456] via 3.3.65.5, 01:34:13, Ethernet0/1.5
                     [170/2195456] via 3.3.56.5, 01:34:13, Ethernet0/0
D EX     3.3.24.0/24 [170/2195456] via 3.3.65.5, 01:34:13, Ethernet0/1.5
                     [170/2195456] via 3.3.56.5, 01:34:13, Ethernet0/0
D EX     3.3.28.0/24 [170/2195456] via 3.3.65.5, 01:34:13, Ethernet0/1.5
                     [170/2195456] via 3.3.56.5, 01:34:13, Ethernet0/0
C        3.3.56.0/24 is directly connected, Ethernet0/0
L        3.3.56.6/32 is directly connected, Ethernet0/0
C        3.3.65.0/24 is directly connected, Ethernet0/1.5
L        3.3.65.6/32 is directly connected, Ethernet0/1.5
D EX     3.3.125.0/24 [170/2195456] via 3.3.65.5, 01:34:13, Ethernet0/1.5
                      [170/2195456] via 3.3.56.5, 01:34:13, Ethernet0/0
      150.1.0.0/24 is subnetted, 1 subnets
D EX     150.1.3.0 [170/2195456] via 3.3.65.5, 01:34:13, Ethernet0/1.5
                   [170/2195456] via 3.3.56.5, 01:34:13, Ethernet0/0
      150.2.0.0/24 is subnetted, 1 subnets
D EX     150.2.3.0 [170/2195456] via 3.3.65.5, 01:34:13, Ethernet0/1.5
                   [170/2195456] via 3.3.56.5, 01:34:13, Ethernet0/0
      150.3.0.0/16 is variably subnetted, 2 subnets, 2 masks
C        150.3.3.0/24 is directly connected, Ethernet0/1.3
L        150.3.3.1/32 is directly connected, Ethernet0/1.3
```

III. IOS/IP Features

1. NAT

・Secondary IP address 1YY.0.0.1/24 is assigned on Loopback 0 of R1. Configure dynamic IP address translation to 1YY.0.0.0/24 for IP address with YY.YY.0.0 and enable them to be able to PING networks on BB1 from all routers on your network.

Don’t advertise Secondary IP address (1YY.0.0.1) to OSPF network

・R1의 Loopback 0 에 1YY.0.0.1/24 로 secondary IP 가(직접 할당하라고함)있다. Dynamic NAT를 수행하여 YY.YY.0.0 이 1YY.0.0.0/24 로 변화되도록 당신의 관리하에 있는 모든 router 와 switch 에서 BB1과 통신이 가능하도록 하라. Secondary IP 로 지정한 네트워크 는 OSPF로 전달하지 않는다.(1YY.0.0.0/24 => 3.YY.0.0/24 변형 가능)

R1

```
int lo0
ip add 13.0.0.1 255.255.255.0 secondary
router rip
net 13.0.0.0
no auto-summary

access-list 30 permit 3.3.0.0 0.0.255.255
ip nat pool NAT 13.0.0.2 13.0.0.254 netmask 255.255.255.0
ip nat inside source list  30 pool NAT

int e0/0
ip nat outside
int s1/0.125
ip nat inside
int s1/0.13
ip nat inside
```

- 결과

```
R1#sh ip nat translations
Pro Inside global      Inside local       Outside local      Outside global
--- 13.0.0.5           3.3.125.5          ---                ---
```

2. Preferred Gateway

· Make R5 and R6 to be default gateway for hosts on VLAN_D.(or VLAN_C) Do use VRRP (YY.YY.65.100). Ensure R5 to become a primary gateway and R6 as a secondary. And use VRRP authentication

R5

```
int e0/1
vrrp 1 ip 5.5.65.100
 vrrp 1 authentication md5 key-string cisco
 vrrp 1 preempt
 vrrp 1 pri 200
```

R6

```
int e0/1
vrrp 1 ip 5.5.65.100
vrrp 1 authentication md5 key-string cisco
vrrp 1 preempt
 vrrp 1 pri 100
```

VI.Security

1. IP Fragment Attack

· Configure an appropriate ACL on R2 to prevent Fragment attacks from BB2 to WEB server (10.1.YY.5)

· R4는 Backbone2 로부터 IP Fragment 공격을 받고 있다. 이 packet 들의 공격 대상은 10.1.YY.5 의 web 서버이다. 모든 fragment packet 을 폐기 할 수 있도록 하여 이를 해결 하도록 하라.

R4

```
ip access-list extend Fragment
 deny tcp any host 10.1.3.5 fragment
permit ip any any
 int e0/0 ip access-group Fragmnet in
```

감사합니다