대우능력개발원
DAEWOO DEVELOPMENT OF ABILITY

2025.07.03

Network Project

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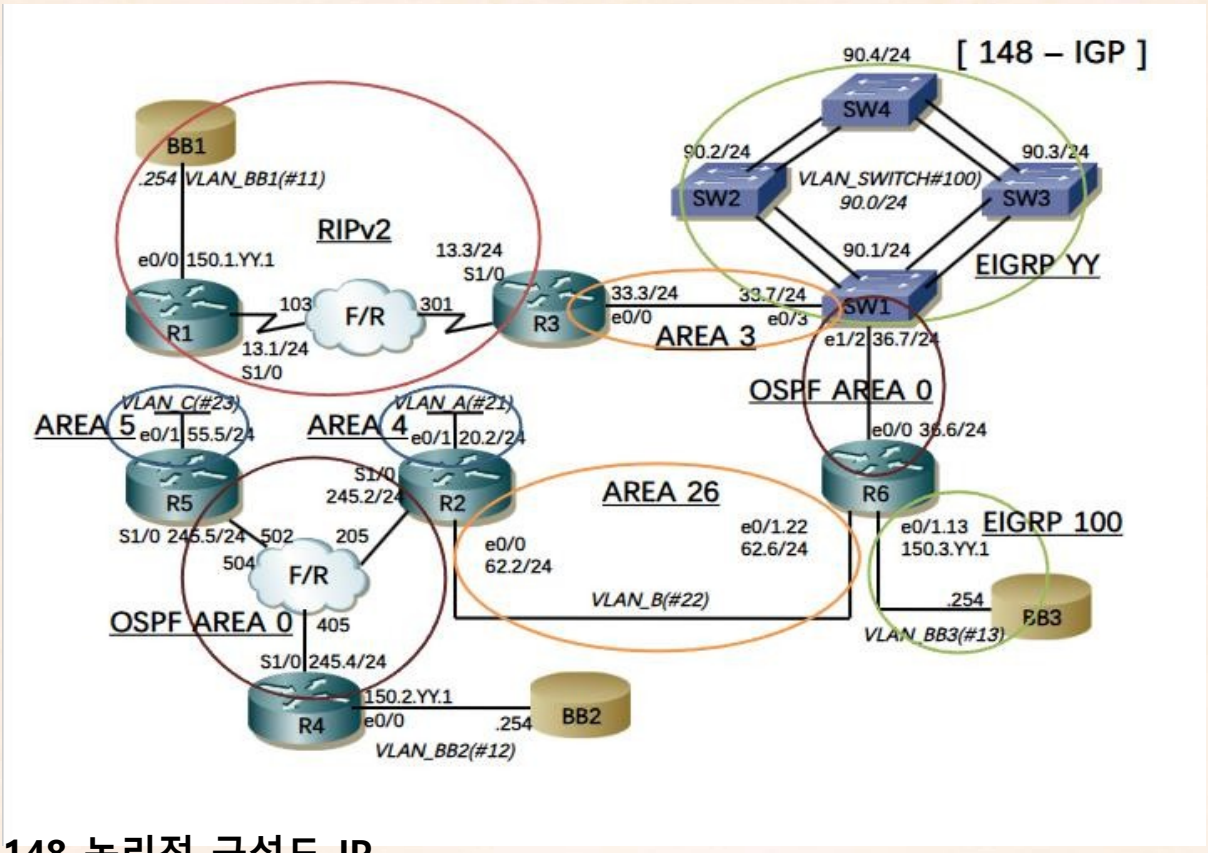
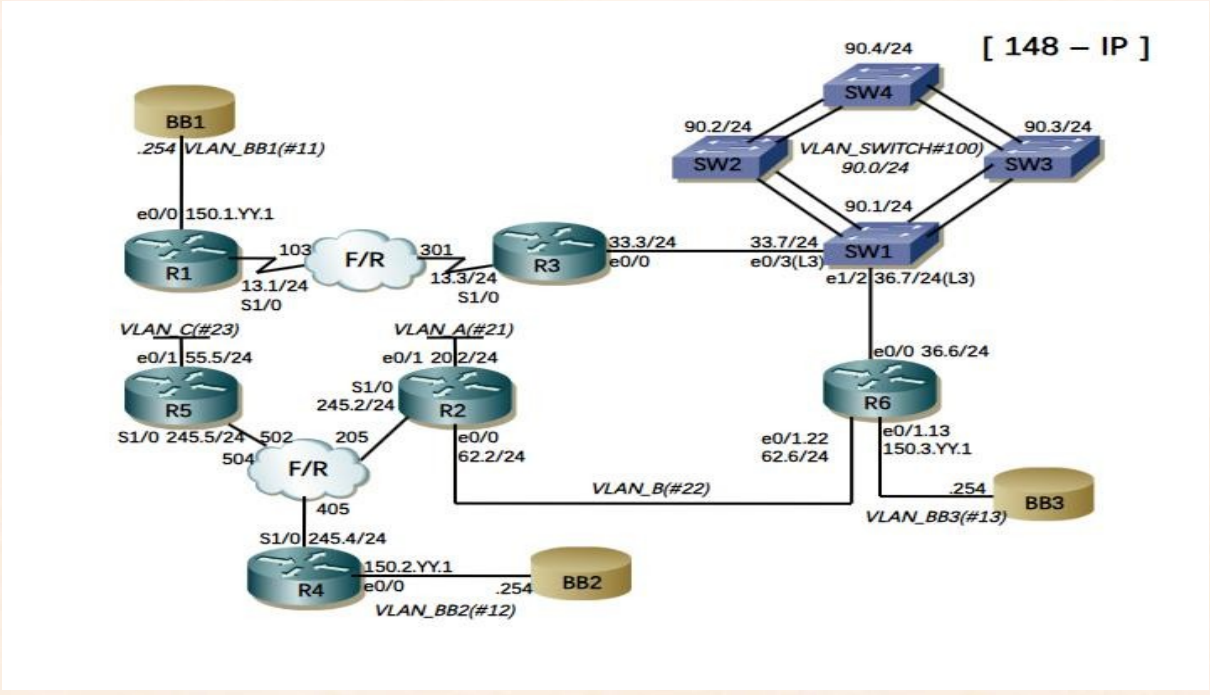
APEX

목차

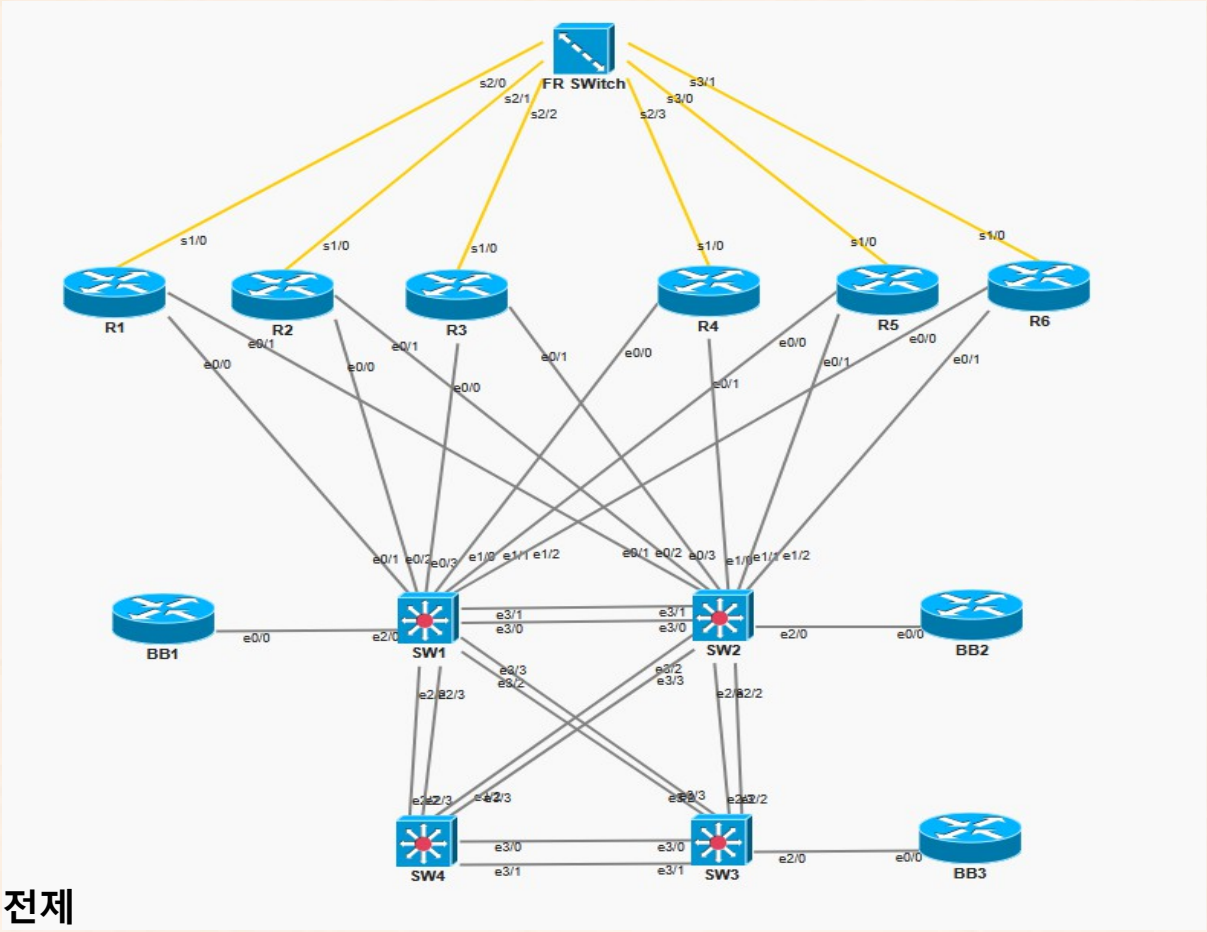
148 논리적 구성도 IGP



148 논리적 구성도 IP



148 물리적 구성도



전제

Y = 14
VLAN_CUSTOMER1(CUSTOMAER_A) 50
VLAN_CUSTOMER2(CUSTOMAER_B) 79
VLAN A 21= 14.14.20.0/24
VLAN B 22= 14.14.62.0/24
VLAN C 23= 14.14.55.0/24
VLAN Switches 100= 14.14.90.0/24
VLAN BB1 11
VLAN BB1 12
VLAN BB3 13

FR

-R1-R3 = 14.14.13.0/24
-R2-R4-R5 = 14.14.245.0/24
BB1 = 150.1.14.254/24
BB2 = 150.2.14.254/24
BB3 = 150.3.14.254/24
loopback = 14.14.X.X/24 (X=router number)

인터페이스 설정 및 세부 설정

1. frame relay 구성 후 자기 자신의 ip address 로 ping 이 되게 설정

```
APEX-R1(config-if)#interface s1/0
APEX-R1(config-if)#encapsulation frame-relay
APEX-R1(config-if)#no frame-relay inverse-arp
APEX-R1(config-if)#no shutdown
APEX-R1(config-if)#interface  s1/0.103  point-to-point
APEX-R1(config-subif)#ip address 14.14.13.1 255.255.255.0
APEX-R1(config-subif)#frame-relay interface-dlci 103

APEX-R2(config-if)#interface s1/0
APEX-R2(config-if)#encapsulation frame-relay
APEX-R2(config-if)#no frame-relay inverse-arp
APEX-R2(config-if)#no shutdown
APEX-R2(config-if)#interface s1/0.245 multipoint
APEX-R2(config-subif)#ip address 14.14.245.2 255.255.255.0
APEX-R2(config-subif)#frame-relay map ip 14.14.245.5 205 broadcast
APEX-R2(config-subif)#frame-relay map ip 14.14.245.4 205 broadcast

APEX-R3(config-if)#interface s1/0
APEX-R3(config-if)#encapsulation frame-relay
APEX-R3(config-if)#no frame-relay inverse-arp
APEX-R3(config-if)#no shutdown
APEX-R3(config-if)#interface  s1/0.301  point-to-point
APEX-R3(config-subif)#ip address 14.14.13.3 255.255.255.0
APEX-R3(config-subif)#frame-relay interface-dlci 301
APEX-R3(config-fr-dlci)#no shutdown

APEX-R4(config-if)#interface s1/0
APEX-R4(config-if)#encapsulation frame-relay
APEX-R4(config-if)#no frame-relay inverse-arp
APEX-R4(config-if)#ip address 14.14.245.4 255.255.255.0
APEX-R4(config-if)#frame map ip 14.14.245.5 405 broad
APEX-R4(config-if)#frame map ip 14.14.245.2 405 broad
APEX-R4(config-if)#frame map ip 14.14.245.4 405
```

1. vtp version 2 만 사용, password 는 cisco

```
APEX-SW1(config-if-range)#vtp mode transparent
APEX-SW1(config)#vtp domain apex.com


APEX-SW1(config)#vtp password cisco
APEX-SW1(config)#vtp version 2
```

2. R6 - SW2 사이를 Trunk port 로 만들고, 필요한 VLAN 정보만 흘러다니도록 설정

```
APEX-R6(config-if)#interface e0/1
APEX-R6(config-if)#no shutdown
APEX-R6(config-if)#interface e0/1.22
APEX-R6(config-subif)#encapsulation dot1q 22
APEX-R6(config-subif)#ip address 14.14.62.6 255.255.255.0
APEX-R6(config-subif)#ip ospf message-digest-key 1 md5 apex
APEX-R6(config-subif)#interface e0/1.13
APEX-R6(config-subif)#encapsulation dot1q 13
APEX-R6(config-subif)#ip address 150.3.14.1 255.255.255.0

APEX-SW2(config-if)#int e1/2
APEX-SW2(config-if)#switchport trunk encapsulation dot1q
APEX-SW2(config-if)#switchport mode trunk
APEX-SW2(config-if)#switchport trunk allowed vlan 13,22
```

3. vlan 11,21 은 SW1 이 root-swi 가 되어❶ 하고, vlan 100 은 번호가 높은 스위치 SW4 가 root 가 된다.

```
APEX-SW1(config)#  spanning-tree  mode  mst

APEX-SW1(config)# spanning-tree mst configuration

APEX-SW1(config-mst)# revision 1

APEX-SW1(config-mst)#  instance  1  vlan  11,21

APEX-SW1(config-mst)#  instance  2  vlan  100



APEX-SW1(config)# spanning-tree mst 1 root primary



APEX-SW4(config)# spanning-tree mst 2 root primary
```

4. VLAN BB2 를 instance 3 으로 설정하여 SW2 가 root 가 되도록 하라.

```
APEX-SW4(config)#  spanning-tree  mode  mst

APEX-SW4(config)# spanning-tree mst configuration

APEX-SW4(config-mst)#  instance  3  vlan  12



APEX-SW2(config)# spanning-tree mst 3 root primary
```

5. SW3 에서 BB3 의 MAC 주소 정보를 500 초 동안 보여지게 하라.

```
APEX-SW3(config)#mac  address-table  aging-time  500  vlan  13
```

6. vlan 100: sw1=14.14.90.1 / sw2=14.14.90.2 / sw3=14.14.90.3 / sw4=14.14.90.4

```
APEX-SW1(config-if)#int vlan 100
APEX-SW1(config-if)#no  shutdown
APEX-SW1(config-if)#ip address 14.14.90.1 255.255.255.0


APEX-SW2(config-if)#int vlan 100
APEX-SW2(config-if)#no  shutdown
APEX-SW2(config-if)#ip address 14.14.90.2 255.255.255.0


APEX-SW3(config-if)#int vlan 100
APEX-SW3(config-if)#no  shutdown
APEX-SW3(config-if)#ip address 14.14.90.3 255.255.255.0


APEX-SW4(config-vlan)#int vlan 100
APEX-SW4(config-if)#no shutdown
APEX-SW4(config-if)#ip address 14.14.90.4 255.255.255.0
```

7. EtherChannel
   PAGP 나 LACP 와 같은 이더채널 네고 프로토콜 사용하지 말고 이더채널 설정하시오.(SW1~SW4 구간)

```
APEX-SW1(config)#  port-channel  load-balance  src-dst-ip
APEX-SW1(config)#  int  ran  e3/0-1
APEX-SW1(config-if)#channel-group  12  mode  on
APEX-SW1(config)# int ran e3/2-3
APEX-SW1(config-if)#channel-group  13  mode  on
```

```
APEX-SW2(config)#  port-channel  load-balance  src-dst-ip
APEX-SW2(config)#  int  ran  e3/0-1
APEX-SW2(config-if)#channel-group 21 mode on
APEX-SW2(config)# int ran e3/2-3
APEX-SW2(config-if)#channel-group  24  mode  on

APEX-SW3(config)#  port-channel  load-balance  src-dst-ip
APEX-SW3(config)#  int  ran  e3/0-1
APEX-SW3(config-if)#channel-group 34 mode on
APEX-SW3(config)# int ran e3/2-3
APEX-SW3(config-if)#channel-group  31  mode  on

APEX-SW4(config)#  port-channel  load-balance  src-dst-ip
APEX-SW4(config)#  int  ran  e3/0-1
APEX-SW4(config-if)#channel-group 43 mode on
APEX-SW4(config)# int ran e3/2-3
APEX-SW4(config-if)#channel-group  42  mode  on
```

IGP

8. IGP 구성시 router-id 를 사용하지 말것, ospf process number 는 rack number 로 설정
9. rip 설정 (+rip update 주소로 멀티캐스트, 브로드캐스트 사용하지 말 것
   +diagram 에 rip 과 관련이 없는 인터페이스로는 update 를 보내지 말 것

```
APEX-R1(config-subif)#router rip
APEX-R1(config-router)#ver 2
APEX-R1(config-router)#no auto
APEX-R1(config-router)#network 14.0.0.0
APEX-R1(config-router)#network 150.1.0.0
APEX-R1(config-router)#passive-interface default
APEX-R1(config-router)#neighbor 150.1.14.254
APEX-R1(config-router)#neighbor 14.14.13.1

APEX-R3(config-router)#router rip
APEX-R3(config-router)#ver 2
APEX-R3(config-router)#no auto
APEX-R3(config-router)#net 14.0.0.0
```

10. sw1~sw4 에 eigrp14 를 설정하고 loopback0(sw1 제외)과 SVI 인터페이스를 포함할 것, summary 를 허용 안 할 것

```
APEX-SW1(config-if)#router  eigrp  14
APEX-SW1(config-router)#net 14.14.90.1  0.0.0.0
APEX-SW1(config-router)#no auto-summary


APEX-SW2(config-if)#router  eigrp  14
APEX-SW2(config-router)#net  14.14.8.8  0.0.0.0
APEX-SW2(config-router)#net 14.14.90.2 0.0.0.0
APEX-SW2(config-router)#no auto-summary


APEX-SW3(config-if)#router  eigrp  14
APEX-SW3(config-router)#net  14.14.9.9  0.0.0.0
APEX-SW3(config-router)#net 14.14.90.3 0.0.0.0
APEX-SW3(config-router)#no auto-summary


APEX-SW4(config-if)#router  eigrp  14
APEX-SW4(config-router)#net  14.14.10.10  0.0.0.0
APEX-SW4(config-router)#net 14.14.90.4 0.0.0.0
APEX-SW4(config-router)#no auto-summary
```

11. R6 와 BB3 에 eigrp 100 을 설정, BB3 은 R6 로 queries 를 보내지 말 것, summary 허용 안한다

```
APEX-R6(config-router)#router eigrp 100
APEX-R6(config-router)#no  auto-summary
APEX-R6(config-router)#network  150.3.14.1  0.0.0.0
APEX-R6(config-router)#redistribute ospf 1 metric 1544 2000 255 1 1500
```

OSPF

12. area 0 는 R2,R4,R5,SW1 이 포함되고 R5 가 DR 이 되어◐ 한다. 'ip ospf network'를 사용하지 말 것, ospf 인터페이스는 다른 모든 라우터에 보일것

```
APEX-SW1(config-router)#router  ospf  1

APEX-SW1(config-router)#net 14.14.36.7 0.0.0.0 a 0


APEX-R2(config-subif)#router  ospf  1
APEX-R2(config-router)#router-id  14.14.2.2
APEX-R2(config-router)#network  14.14.2.2  0.0.0.0  area  0
APEX-R2(config-router)#network  14.14.245.2  0.0.0.0  area  0
APEX-R2(config-router)#network  14.14.62.2  0.0.0.0  area  0

APEX-R4(config)#router  ospf  1
APEX-R4(config-router)#router-id  14.14.4.4
APEX-R4(config-router)#network  14.14.4.4  0.0.0.0  area  0
APEX-R4(config-router)#network  14.14.245.4  0.0.0.0  area  0

APEX-R5(config-if)#router  ospf  1
APEX-R5(config-router)#network  14.14.245.5  0.0.0.0  area  0

APEX-R6(config-subif)#router  ospf  1
APEX-R6(config-router)#network  14.14.36.6  0.0.0.0  area  0
APEX-R6(config-router)#network  14.14.6.6  0.0.0.0  area  0
```

13. area 3 은 R3, SW1 이 포함

```
APEX-R3(config-subif)#router ospf 1
APEX-R3(config-router)#network 14.14.3.3 0.0.0.0 area 3
APEX-R3(config-router)#network 14.14.33.3 0.0.0.0 area 3


APEX-SW1(config-router)#router ospf 1

APEX-SW1(config-router)#net 14.14.33.7 0.0.0.0 area 3
```

14. area 4 는 R2 가 포함, R2 에서 VLAN A 로 default 경로만 전달, area 4 에서는 VLAN A 로 intra 정보와 default 경로를 가지며 다른 external 경로를 전파하지 말 것

```
APEX-R2(config-subif)#router ospf 1
APEX-R2(config-router)#network 14.14.20.2 0.0.0.0 area 4
```

15. area 5 는 R5 가 포함. R5 에 VLAN C 로 intra 정보 O 와 intra 정보 O IA 가 보이고 extra O E1 E2 는 전파 안 될 것

```
APEX-R5(config-if)#router ospf 1
APEX-R5(config-router)#network 14.14.55.5 0.0.0.0 area 5
APEX-R5(config-router)#network 14.14.5.5 0.0.0.0 area 5
APEX-R5(config-router)#area 5 stub
```

재분배 (재분배는 모두 mutual 하게 할 것**)**

16. RIP 을 ospf 로 재분배

```
APEX-R3(config-router)#router rip
APEX-R3(config-router)#redistribute ospf 1 metric 3
```

17. SW1 에서 OSPF 를 EIGRP 14 에 재분배

```
APEX-SW1(config-if)#router eigrp 14
APEX-SW1(config-router)#redistribute ospf 1 metric 1 1 1 1 1
```

18. SW1 에서 EIGRP14 를 OSPF 에 재분배, VLAN Switches 에서 BB1 이 보여◐ 한다.

```
APEX-SW1(config-router)#router  ospf  1
APEX-SW1(config-router)#redistribute eigrp 14 subnets
```

OSPF – EIGRP 100

- On R6, redistribute EIGRP 100 on OSPF, however announced only the prefix 198.2.0.0(not/16) routes and 150.3.YY.0/24
- *EIGRP 100 => OSPF* 로 재분배 하라. *EIGRP 100* 은 *150.3.YY.0/24* 정보만 보냄.

```
APEX-R6(config-subif)#router ospf 1
APEX-R6(config-router)#redistribute eigrp 100 subnets
APEX-R6(config-router)#router eigrp 100
APEX-R6(config-router)#network 150.3.14.1 0.0.0.0
```

19. Loopback 어드레스는 라우팅 테이블에 /32 로 보여지면 안된다.(ip ospf network point-to-point)

```
APEX-SW1(config)#interface loopback 0
APEX-SW1(config-if)# ip ospf network point-to-point
APEX-SW2(config)#interface loopback 0
APEX-SW2(config-if)# ip ospf network point-to-point
APEX-SW3(config)#interface loopback 0
APEX-SW3(config-if)# ip ospf network point-to-point

APEX-SW4(config)#interface loopback 0
APEX-SW4(config-if)# ip ospf network point-to-point

APEX-R1(config)#interface loopback 0
APEX-R1(config-if)# ip ospf network point-to-point

APEX-R2(config)#interface loopback 0
APEX-R2(config-if)# ip ospf network point-to-point

APEX-R3(config)#interface loopback 0
APEX-R3(config-if)# ip ospf network point-to-point

APEX-R4(config)# interface loopback 0
APEX-R4(config-if)# ip ospf network point-to-point

APEX-R5(config)#interface loopback 0
APEX-R5(config-if)#ip ospf network point-to-point

APEX-R6(dhcp-config)#interface loopback 0
APEX-R6(config-if)#ip ospf network point-to-point
```

DHCP

- Configure R6 to provide the following parameters for DHCP clients on VLAN_B:
- Make sure all IP addresses that are not used yet in the subnet are available.
- Allow the subnet as 24bit mask / ・ DNS servers are 150.100.1.50 and 150.100.1.51
- Domain name is cisco.com / 할당된 정보는 영구히 사용할 수 있게 하라.
- For the Default gateway, ensure that if R6 is down. R2 will be the Default Gateway for hosts.

```
APEX-R6(config)#ip dhcp excluded-address 14.14.62.6

APEX-R6(config)#ip dhcp excluded-address 14.14.62.2

APEX-R6(config)#ip dhcp pool DHCP

APEX-R6(config)#network   14.14.62.0   255.255.255.0

APEX-R6(dhcp-config)#dns-server 150.100.1.50 150.100.1.51

APEX-R6(dhcp-config)#domain-name apex.com

APEX-R6(dhcp-config)#lease infinit

APEX-R6(dhcp-config)#default-router   14.14.62.6   14.14.62.2
```

OSPF Authentication

- Area 0 에 가장 강력한 인증을 적용하여라.(text 말고 md5 / area 0 인증)

```
APEX-SW1(config-subif)#router ospf 1
APEX-SW1(config-router)#area 0 authentication message-digest
APEX-SW1(config)# int e1/2
APEX-SW1(config-if)# ip ospf message-digest-key 1 md5 apex

APEX-R2(config-subif)#router ospf 1
APEX-R2(config-router)#area 0 authentication message-digest
APEX-R2(config-router)# area 26 virtual-link 14.14.6.6 message-digest-key 1 md5 cisco
APEX-R2(config)#interface s1/0
APEX-R2(config-router)# ip ospf message-digest-key 1 md5 apex


APEX-R4(config-subif)#router ospf 1
APEX-R4(config-router)#area 0 authentication message-digest
APEX-R4(config)#interface s1/0
APEX-R4(config-router)# ip ospf message-digest-key 1 md5 apex

APEX-R5(config-subif)#router ospf 1
APEX-R5(config-router)#area 0 authentication message-digest
APEX-R5(config-if)#interface s1/0
APEX-R5(config-router)# ip ospf message-digest-key 1 md5 apex

APEX-R6(config-subif)#router ospf 1
APEX-R6(config-router)#area 0 authentication message-digest
APEX-R6(config-router)# area 26 virtual-link 14.14.2.2 message-digest-key 1 md5 cisco
APEX-R6(config)#interface e0/0
APEX-R6(config-if)#ip ospf message-digest-key 1 md5 apex
```

결과

1. Protocols

```
SW1#show ip protocols
*** IP Routing is NSF aware ***

Routing Protocol is "eigrp 14"
  Outgoing update filter list for all interfaces is not set
  Incoming update filter list for all interfaces is not set
  Default networks flagged in outgoing updates
  Default networks accepted from incoming updates
  Redistributing: ospf 1
  EIGRP-IPv4 Protocol for AS(14)
    Metric weight K1=1, K2=0, K3=1, K4=0, K5=0
    NSF-aware route hold timer is 240
    Router-ID: 14.14.7.7
    Topology : 0 (base)
      Active Timer: 3 min
      Distance: internal 90 external 170
      Maximum path: 4
      Maximum hopcount 100
      Maximum metric variance 1

  Automatic Summarization: disabled
  Maximum path: 4
  Routing for Networks:
    14.14.90.1/32
  Routing Information Sources:
    Gateway         Distance      Last Update
    14.14.90.2              90      00:28:30
    14.14.90.3              90      00:28:30
    14.14.90.4              90      00:28:30
  Distance: internal 90 external 170
```

```
R2#show ip protocols
*** IP Routing is NSF aware ***

Routing Protocol is "ospf 1"
  Outgoing update filter list for all interfaces is not set
  Incoming update filter list for all interfaces is not set
  Router ID 14.14.2.2
  It is an area border router
  Number of areas in this router is 3. 2 normal 1 stub 0 nssa
  Maximum path: 4
  Routing for Networks:
    14.14.2.2 0.0.0.0 area 0
    14.14.20.2 0.0.0.0 area 4
    14.14.62.2 0.0.0.0 area 26
    14.14.245.2 0.0.0.0 area 0
  Routing Information Sources:
    Gateway         Distance      Last Update
    14.14.4.4            110      00:06:51
    14.14.5.5            110      00:06:51
    14.14.3.3            110      00:31:37
    14.14.7.7            110      00:31:27
    14.14.6.6            110      00:31:27
  Distance: (default is 110)
```

```
R3#show ip protocols
*** IP Routing is NSF aware ***

Routing Protocol is "ospf 1"
  Outgoing update filter list for all interfaces is not set
  Incoming update filter list for all interfaces is not set
  Router ID 14.14.3.3
  It is an autonomous system boundary router
  Redistributing External Routes from,
    rip, includes subnets in redistribution
  Number of areas in this router is 1. 1 normal 0 stub 0 nssa
  Maximum path: 4
  Routing for Networks:
    14.14.3.3 0.0.0.0 area 3
    14.14.33.3 0.0.0.0 area 3
  Routing Information Sources:
    Gateway         Distance      Last Update
    14.14.6.6            110      00:31:24
    14.14.7.7            110      00:29:08
  Distance: (default is 110)

Routing Protocol is "rip"
  Outgoing update filter list for all interfaces is not set
  Incoming update filter list for all interfaces is not set
  Sending updates every 30 seconds, next due in 25 seconds
  Invalid after 180 seconds, hold down 180, flushed after 240
  Redistributing: ospf 1, rip
  Default version control: send version 2, receive version 2
    Interface             Send  Recv  Triggered RIP  Key-chain
    Ethernet0/0           2     2
    Serial1/0.301         2     2
    Loopback0             2     2
  Automatic network summarization is not in effect
  Maximum path: 4
  Routing for Networks:
    14.0.0.0
  Routing Information Sources:
    Gateway         Distance      Last Update
  Distance: (default is 120)
```

```
R6#show ip protocols
*** IP Routing is NSF aware ***

Routing Protocol is "ospf 1"
  Outgoing update filter list for all interfaces is not set
  Incoming update filter list for all interfaces is not set
  Router ID 14.14.6.6
  It is an area border and autonomous system boundary router
  Redistributing External Routes from,
    eigrp 100, includes subnets in redistribution
  Number of areas in this router is 2. 2 normal 0 stub 0 nssa
  Maximum path: 4
  Routing for Networks:
    14.14.6.6 0.0.0.0 area 0
    14.14.36.6 0.0.0.0 area 0
    14.14.62.6 0.0.0.0 area 26
  Routing Information Sources:
    Gateway         Distance      Last Update
    14.14.5.5            110      00:29:34
    14.14.4.4            110      00:29:34
    14.14.2.2            110      00:31:44
    14.14.3.3            110      00:06:59
    14.14.7.7            110      00:06:59
  Distance: (default is 110)
```

2. VLAN

```
SW2#show vlan brief

VLAN Name                             Status    Ports
---- -------------------------------- --------- -------------------------------
1    default                          active    Et0/0, Et0/1, Et0/3, Et1/0
                                                Et1/3, Et2/1, Et2/2, Et2/3
                                                Et3/0, Et3/1
10   VLAN0010                         active
11   VLAN_BB1                         active
12   VLAN_BB2                         active    Et2/0
13   VLAN_BB3                         active
20   VLAN0020                         active
21   VLAN_A                           active    Et0/2
22   VLAN_B                           active
23   VLAN_C                           active    Et1/1
30   VLAN0030                         active
40   VLAN0040                         active
50   VLAN_CUSTOMER1                   active
60   VLAN0060                         active
79   VLAN_CUSTOMER2                   active
100  VLAN_SWITCH                      active
1002 fddi-default                     act/unsup
1003 trcrf-default                    act/unsup
1004 fddinet-default                  act/unsup

VLAN Name                             Status    Ports
---- -------------------------------- --------- -------------------------------
1005 trbrf-default                    act/unsup
```

```
SW1#show vlan brief

VLAN Name                             Status    Ports
---- -------------------------------- --------- -------------------------------
1    default                          active    Et0/0, Et0/1, Et1/1, Et1/3
                                                Et2/0, Et2/1, Et2/2, Et2/3
                                                Et3/2, Et3/3
10   VLAN0010                         active
11   VLAN_BB1                         active
12   VLAN_BB2                         active    Et1/0
13   VLAN_BB3                         active
20   VLAN0020                         active
21   VLAN_A                           active
22   VLAN_B                           active    Et0/2
23   VLAN_C                           active
30   VLAN0030                         active
40   VLAN0040                         active
50   VLAN_CUSTOMER1                   active
60   VLAN0060                         active
79   VLAN_CUSTOMER2                   active
90   VLAN0090                         active
100  VLAN_SWITCH                      active
1002 fddi-default                     act/unsup
1003 trcrf-default                    act/unsup
1004 fddinet-default                  act/unsup
1005 trbrf-default                    act/unsup
```

```
SW1#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
       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

      14.0.0.0/8 is variably subnetted, 21 subnets, 2 masks
O        14.14.2.0/24 [110/21] via 14.14.36.6, 00:09:22, Ethernet1/2
O        14.14.3.0/24 [110/11] via 14.14.33.3, 00:10:15, Ethernet0/3
O        14.14.4.0/24 [110/85] via 14.14.36.6, 00:07:17, Ethernet1/2
O IA     14.14.5.0/24 [110/85] via 14.14.36.6, 00:07:17, Ethernet1/2
O        14.14.6.0/24 [110/11] via 14.14.36.6, 00:09:37, Ethernet1/2
C        14.14.7.0/24 is directly connected, Loopback0
L        14.14.7.7/32 is directly connected, Loopback0
D        14.14.8.0/24 [90/130816] via 14.14.90.2, 00:10:55, Vlan100
D        14.14.9.0/24 [90/130816] via 14.14.90.3, 00:09:29, Vlan100
D        14.14.10.0/24 [90/130816] via 14.14.90.4, 00:10:28, Vlan100
O E2     14.14.13.0/24 [110/20] via 14.14.33.3, 00:10:15, Ethernet0/3
O IA     14.14.20.0/24 [110/30] via 14.14.36.6, 00:09:22, Ethernet1/2
C        14.14.33.0/24 is directly connected, Ethernet0/3
L        14.14.33.7/32 is directly connected, Ethernet0/3
C        14.14.36.0/24 is directly connected, Ethernet1/2
L        14.14.36.7/32 is directly connected, Ethernet1/2
O IA     14.14.55.0/24 [110/94] via 14.14.36.6, 00:07:17, Ethernet1/2
O IA     14.14.62.0/24 [110/20] via 14.14.36.6, 00:09:36, Ethernet1/2
C        14.14.90.0/24 is directly connected, Vlan100
L        14.14.90.1/32 is directly connected, Vlan100
O        14.14.245.0/24 [110/84] via 14.14.36.6, 00:07:17, Ethernet1/2
      150.3.0.0/24 is subnetted, 1 subnets
O E2     150.3.14.0 [110/20] via 14.14.36.6, 00:09:37, Ethernet1/2
```

```
SW2#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
       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

      14.0.0.0/8 is variably subnetted, 21 subnets, 2 masks
D EX     14.14.2.0/24 [170/2170112] via 14.14.90.1, 00:11:18, Vlan100
D EX     14.14.3.0/24 [170/2170112] via 14.14.90.1, 00:12:11, Vlan100
D EX     14.14.4.0/24 [170/2170112] via 14.14.90.1, 00:09:13, Vlan100
D EX     14.14.5.0/24 [170/2170112] via 14.14.90.1, 00:09:13, Vlan100
D EX     14.14.6.0/24 [170/2170112] via 14.14.90.1, 00:11:33, Vlan100
D EX     14.14.7.0/24 [170/2170112] via 14.14.90.1, 00:12:50, Vlan100
C        14.14.8.0/24 is directly connected, Loopback0
L        14.14.8.8/32 is directly connected, Loopback0
D        14.14.9.0/24 [90/130816] via 14.14.90.3, 00:11:23, Vlan100
D        14.14.10.0/24 [90/130816] via 14.14.90.4, 00:12:24, Vlan100
D EX     14.14.13.0/24 [170/2170112] via 14.14.90.1, 00:12:11, Vlan100
C        14.14.20.0/24 is directly connected, Vlan21
L        14.14.20.8/32 is directly connected, Vlan21
D EX     14.14.33.0/24 [170/2170112] via 14.14.90.1, 00:12:50, Vlan100
D EX     14.14.36.0/24 [170/2170112] via 14.14.90.1, 00:12:50, Vlan100
C        14.14.55.0/24 is directly connected, Vlan23
L        14.14.55.8/32 is directly connected, Vlan23
D EX     14.14.62.0/24 [170/2170112] via 14.14.90.1, 00:11:32, Vlan100
C        14.14.90.0/24 is directly connected, Vlan100
L        14.14.90.2/32 is directly connected, Vlan100
D EX     14.14.245.0/24 [170/2170112] via 14.14.90.1, 00:11:18, Vlan100
      150.3.0.0/24 is subnetted, 1 subnets
D EX     150.3.14.0 [170/2170112] via 14.14.90.1, 00:11:33, Vlan100
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
       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

      14.0.0.0/8 is variably subnetted, 20 subnets, 2 masks
C        14.14.1.0/24 is directly connected, Loopback0
L        14.14.1.1/32 is directly connected, Loopback0
R        14.14.2.0/24 [120/3] via 14.14.13.3, 00:00:05, Serial1/0.103
R        14.14.3.0/24 [120/1] via 14.14.13.3, 00:00:05, Serial1/0.103
R        14.14.4.0/24 [120/3] via 14.14.13.3, 00:00:05, Serial1/0.103
R        14.14.5.0/24 [120/3] via 14.14.13.3, 00:00:05, Serial1/0.103
R        14.14.6.0/24 [120/3] via 14.14.13.3, 00:00:05, Serial1/0.103
R        14.14.7.0/24 [120/3] via 14.14.13.3, 00:00:05, Serial1/0.103
R        14.14.8.0/24 [120/3] via 14.14.13.3, 00:00:05, Serial1/0.103
R        14.14.9.0/24 [120/3] via 14.14.13.3, 00:00:05, Serial1/0.103
R        14.14.10.0/24 [120/3] via 14.14.13.3, 00:00:05, Serial1/0.103
C        14.14.13.0/24 is directly connected, Serial1/0.103
L        14.14.13.1/32 is directly connected, Serial1/0.103
R        14.14.20.0/24 [120/3] via 14.14.13.3, 00:00:06, Serial1/0.103
R        14.14.33.0/24 [120/1] via 14.14.13.3, 00:00:06, Serial1/0.103
R        14.14.36.0/24 [120/3] via 14.14.13.3, 00:00:06, Serial1/0.103
R        14.14.55.0/24 [120/3] via 14.14.13.3, 00:00:06, Serial1/0.103
R        14.14.62.0/24 [120/3] via 14.14.13.3, 00:00:06, Serial1/0.103
R        14.14.90.0/24 [120/3] via 14.14.13.3, 00:00:06, Serial1/0.103
R        14.14.245.0/24 [120/3] via 14.14.13.3, 00:00:06, Serial1/0.103
      150.1.0.0/16 is variably subnetted, 2 subnets, 2 masks
C        150.1.14.0/24 is directly connected, Ethernet0/0
L        150.1.14.1/32 is directly connected, Ethernet0/0
      150.3.0.0/24 is subnetted, 1 subnets
R        150.3.14.0 [120/3] via 14.14.13.3, 00:00:06, Serial1/0.103
```

```
R6#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
       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

      14.0.0.0/8 is variably subnetted, 20 subnets, 2 masks
O        14.14.2.0/24 [110/11] via 14.14.62.2, 00:13:42, Ethernet0/1.22
O IA     14.14.3.0/24 [110/21] via 14.14.36.7, 00:13:52, Ethernet0/0
O        14.14.4.0/24 [110/75] via 14.14.62.2, 00:11:33, Ethernet0/1.22
O IA     14.14.5.0/24 [110/75] via 14.14.62.2, 00:11:33, Ethernet0/1.22
C        14.14.6.0/24 is directly connected, Loopback0
L        14.14.6.6/32 is directly connected, Loopback0
O IA     14.14.7.0/24 [110/11] via 14.14.36.7, 00:13:52, Ethernet0/0
O E2     14.14.8.0/24 [110/20] via 14.14.36.7, 00:13:52, Ethernet0/0
O E2     14.14.9.0/24 [110/20] via 14.14.36.7, 00:13:42, Ethernet0/0
O E2     14.14.10.0/24 [110/20] via 14.14.36.7, 00:13:52, Ethernet0/0
O E2     14.14.13.0/24 [110/20] via 14.14.36.7, 00:13:52, Ethernet0/0
O IA     14.14.20.0/24 [110/20] via 14.14.62.2, 00:13:42, Ethernet0/1.22
O IA     14.14.33.0/24 [110/20] via 14.14.36.7, 00:13:54, Ethernet0/0
C        14.14.36.0/24 is directly connected, Ethernet0/0
L        14.14.36.6/32 is directly connected, Ethernet0/0
O IA     14.14.55.0/24 [110/84] via 14.14.62.2, 00:11:35, Ethernet0/1.22
C        14.14.62.0/24 is directly connected, Ethernet0/1.22
L        14.14.62.6/32 is directly connected, Ethernet0/1.22
O E2     14.14.90.0/24 [110/20] via 14.14.36.7, 00:13:54, Ethernet0/0
O        14.14.245.0/24 [110/74] via 14.14.62.2, 00:11:35, Ethernet0/1.22
      150.3.0.0/16 is variably subnetted, 2 subnets, 2 masks
C        150.3.14.0/24 is directly connected, Ethernet0/1.13
L        150.3.14.1/32 is directly connected, Ethernet0/1.13
```

4. Trunk 설정 STP 설정

```
SW3#show interfaces trunk

Port        Mode             Encapsulation  Status        Native vlan
Et3/2       on               802.1q         trunking      1
Et3/3       on               802.1q         trunking      1
Po34        on               802.1q         trunking      1

Port        Vlans allowed on trunk
Et3/2       1-4094
Et3/3       1-4094
Po34        1-4094

Port        Vlans allowed and active in management domain
Et3/2       1,10-13,20-23,30,40,50,60,79,100
Et3/3       1,10-13,20-23,30,40,50,60,79,100
Po34        1,10-13,20-23,30,40,50,60,79,100

Port        Vlans in spanning tree forwarding state and not pruned
Et3/2       1,10-13,20-23,30,40,50,60,79,100
Et3/3       1,10-13,20-23,30,40,50,60,79,100
Po34        1,10-13,20-23,30,40,50,60,79,100
```

5. STP 설정

```
SW4#show spanning-tree

MST0
  Spanning tree enabled protocol mstp
  Root ID    Priority    32768
             Address     aabb.cc00.0800
             Cost        1000000
             Port        515 (Port-channel42)
             Hello Time   2 sec  Max Age 20 sec  Forward Delay 15 sec

  Bridge ID  Priority    32768  (priority 32768 sys-id-ext 0)
             Address     aabb.cc00.0a00
             Hello Time   2 sec  Max Age 20 sec  Forward Delay 15 sec

Interface           Role Sts Cost      Prio.Nbr Type
------------------- ---- --- --------- -------- ----------------------
Et0/0               Desg FWD 2000000   128.1    Shr
Et0/1               Desg FWD 2000000   128.2    Shr
Et0/2               Desg FWD 2000000   128.3    Shr
Et0/3               Desg FWD 2000000   128.4    Shr
Et1/0               Desg FWD 2000000   128.33   Shr
Et1/1               Desg FWD 2000000   128.34   Shr
Et1/2               Desg FWD 2000000   128.35   Shr
Et1/3               Desg FWD 2000000   128.36   Shr
Et2/0               Desg FWD 2000000   128.65   Shr
Et2/1               Desg FWD 2000000   128.66   Shr
Po43                Desg FWD 1000000   128.514  Shr
Po42                Root FWD 1000000   128.515  Shr Bound(RSTP)
```

```
MST1
  Spanning tree enabled protocol mstp
  Root ID    Priority    32769
             Address     aabb.cc00.0a00
             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     aabb.cc00.0a00
             Hello Time   2 sec  Max Age 20 sec  Forward Delay 15 sec

Interface           Role Sts Cost      Prio.Nbr Type
------------------- ---- --- --------- -------- ----------------------
Po43                Desg FWD 1000000   128.514  Shr
Po42                Mstr FWD 1000000   128.515  Shr Bound(RSTP)
```

```
MST2
  Spanning tree enabled protocol mstp
  Root ID    Priority    24578
             Address     aabb.cc00.0a00
             This bridge is the root
             Hello Time   2 sec  Max Age 20 sec  Forward Delay 15 sec

  Bridge ID  Priority    24578  (priority 24576 sys-id-ext 2)
             Address     aabb.cc00.0a00
             Hello Time   2 sec  Max Age 20 sec  Forward Delay 15 sec

Interface           Role Sts Cost      Prio.Nbr Type
------------------- ---- --- --------- -------- --------------------------------
Po43                Desg FWD 1000000   128.514  Shr
Po42                Mstr FWD 1000000   128.515  Shr Bound(RSTP)


MST3
  Spanning tree enabled protocol mstp
  Root ID    Priority    32771
             Address     aabb.cc00.0a00
             This bridge is the root
             Hello Time   2 sec  Max Age 20 sec  Forward Delay 15 sec

  Bridge ID  Priority    32771  (priority 32768 sys-id-ext 3)
             Address     aabb.cc00.0a00
             Hello Time   2 sec  Max Age 20 sec  Forward Delay 15 sec

Interface           Role Sts Cost      Prio.Nbr Type
------------------- ---- --- --------- -------- --------------------------------
Po43                Desg FWD 1000000   128.514  Shr
Po42                Mstr FWD 1000000   128.515  Shr Bound(RSTP)
```

6. DHCP 설정

```
R6#show running-config | section dhcp
ip dhcp excluded-address 14.14.62.6
ip dhcp excluded-address 14.14.62.2
ip dhcp pool DHCP
   network 14.14.62.0 255.255.255.0
   dns-server 150.100.1.50 150.100.1.51
   domain-name apex.com
   default-router 14.14.62.6 14.14.62.2
   lease infinite
```

7. EtherChannel 설정

```
SW1#show etherchannel summary
*Jul  3 05:07:02.631: %SYS-5-CONFIG_I: Configured from console by console
SW1#show etherchannel summary
Flags:  D - down        P - bundled in port-channel
        I - stand-alone s - suspended
        H - Hot-standby (LACP only)
        R - Layer3      S - Layer2
        U - in use      f - failed to allocate aggregator

        M - not in use, minimum links not met
        u - unsuitable for bundling
        w - waiting to be aggregated
        d - default port


Number of channel-groups in use: 2
Number of aggregators:           2

Group  Port-channel  Protocol    Ports
------+-------------+-----------+-----------------------------------------------
12     Po12(SU)         -       Et3/0(P)    Et3/1(P)
13     Po13(SD)         -       Et3/2(D)    Et3/3(D)
```

```
SW4#show etherchannel summary
Flags:  D - down         P - bundled in port-channel
        I - stand-alone s - suspended
        H - Hot-standby (LACP only)
        R - Layer3       S - Layer2
        U - in use       f - failed to allocate aggrega

        M - not in use, minimum links not met
        u - unsuitable for bundling
        w - waiting to be aggregated
        d - default port


Number of channel-groups in use: 2
Number of aggregators:           2

Group  Port-channel  Protocol    Ports
------+-------------+-----------+-----------------------
42     Po42(SU)         -       Et3/2(P)    Et3/3(P)
43     Po43(SU)         -       Et3/0(P)    Et3/1(P)
```

8. OSPF 인증 설정

```
R2#show running-config | section router ospf
router ospf 1
 router-id 14.14.2.2
 log-adjacency-changes
 area 0 authentication message-digest
 area 4 stub no-summary
 area 26 virtual-link 14.14.6.6 message-digest-key 1 md5 cisco
 network 14.14.2.2 0.0.0.0 area 0
 network 14.14.20.2 0.0.0.0 area 4
 network 14.14.62.2 0.0.0.0 area 26
 network 14.14.245.2 0.0.0.0 area 0
```

```
SW1#show running-config | section router ospf
router ospf 1
 area 0 authentication message-digest
 redistribute eigrp 14 subnets
 network 14.14.7.7 0.0.0.0 area 3
 network 14.14.33.7 0.0.0.0 area 3
 network 14.14.36.7 0.0.0.0 area 0
```

대우능력개발원
DAEWOO DEVELOPMENT OF ABILITY

2025.07.03

감사합니다.