

파이오링크 BS9700 백본스위치 운영자 교육

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파이오링크 TIFRONT사업실

CONTENTS

I 백본스위치 이론 교육

- 01 기본 관리
- 02 VLAN
- 03 Spanning-Tree
- 04 LAG(Link Aggregation Group)
- 05 SNMP Portocol
- 06 SYSLOG
- 07 Mirroring
- 08 L3 기능 (Static Routing, VRRP)

II 백본스위치 장애처리 교육

- 01 하드웨어 장애처리
- 02 Looping 장애 처리
- 03 OS 장애 처리

III Network Trend 설명

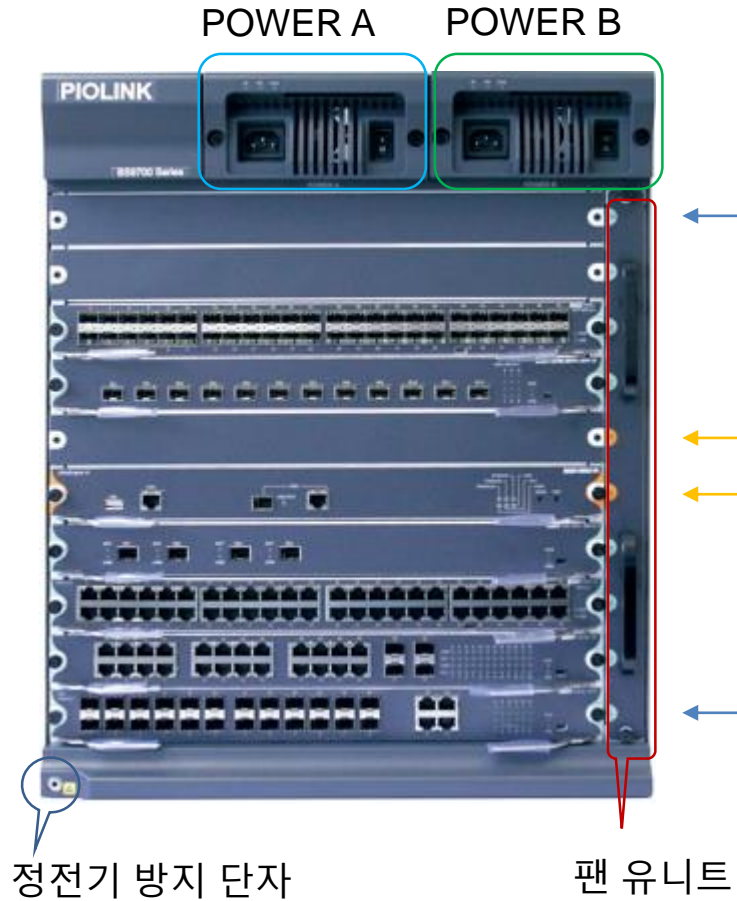
- 01 보안적합성 & 보안기능 시험

IV QnA

백본스위치 이론 교육

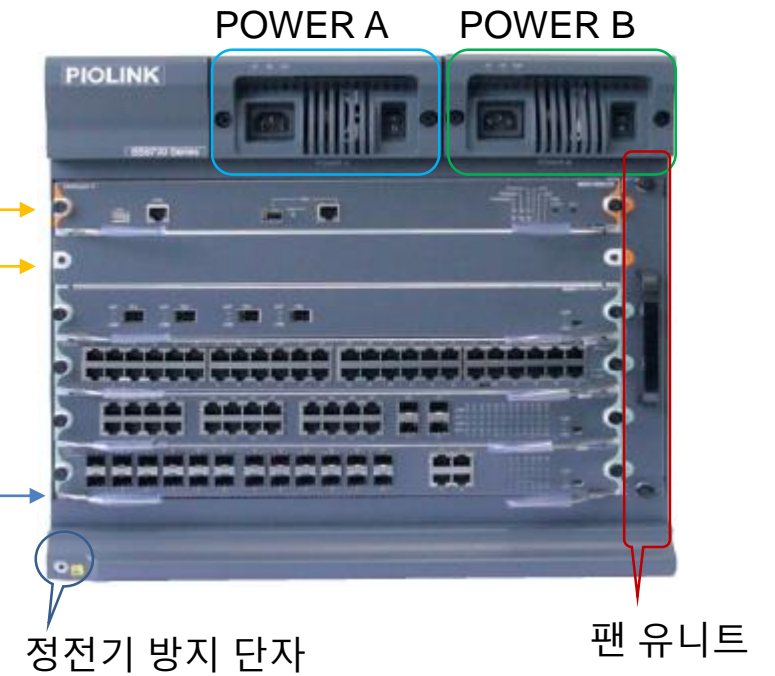
백본스위치 이론 교육

BS9700 Chassis Layout



- BS9710 Chassis -

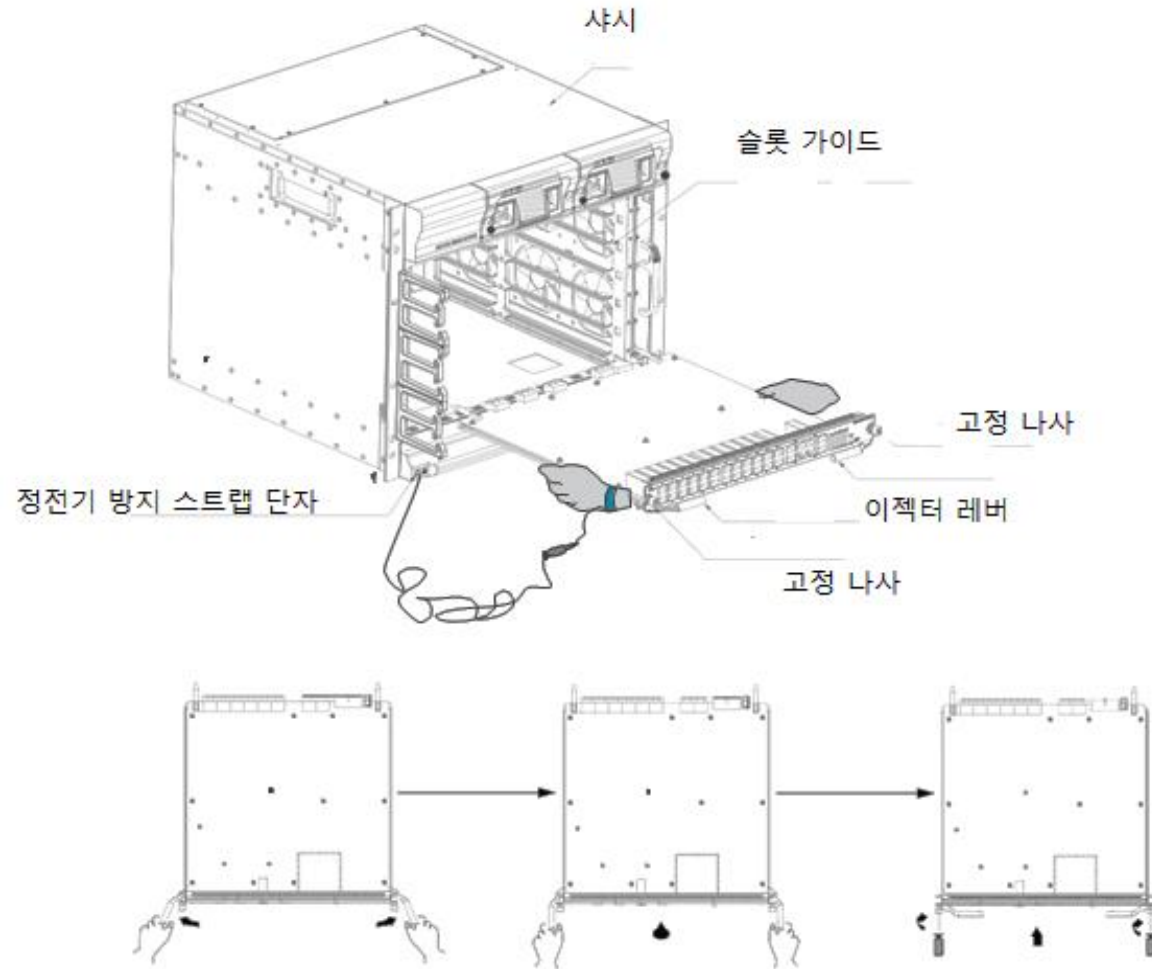
슬롯번호	용도	예시
10	Line Card	-
9	Line Card	-
8	Line Card	48SFP
7	Line Card	12TE
6	MSU	-
5	MSU	MSU-VI
4	Line Card	4TE
3	Line Card	48TP
2	Line Card	24TP
1	Line Card	24SFP



- BS9706 Chassis -

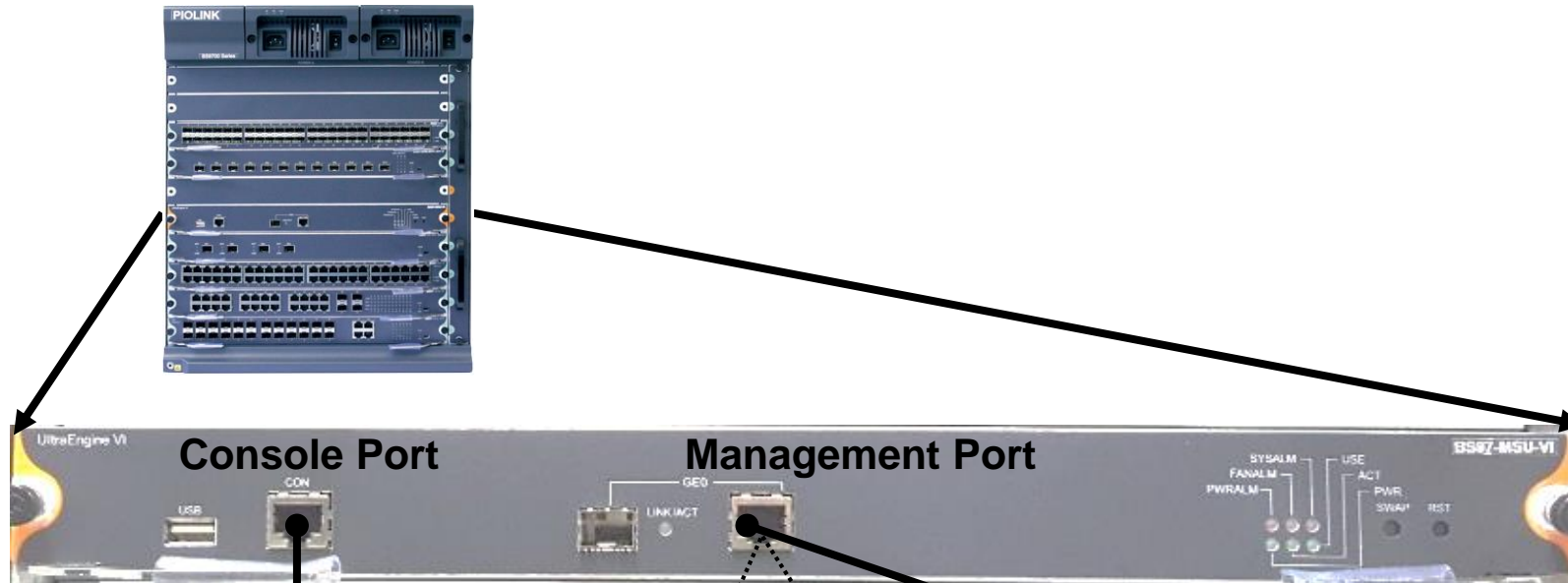
백본스위치 이론 교육

BS9700 Line Card 취급 방법



백본스위치 이론 교육

Management (Console 및 MGMT Port)



9600 Baud
8 data bits
1 stop
No parity
No flow control



```
Switch#config
Switch_config#interface gi5/0
Switch_config_g5/0#ip address 172.16.0.1 255.255.255.0
Switch_config_g5/0#exit
```

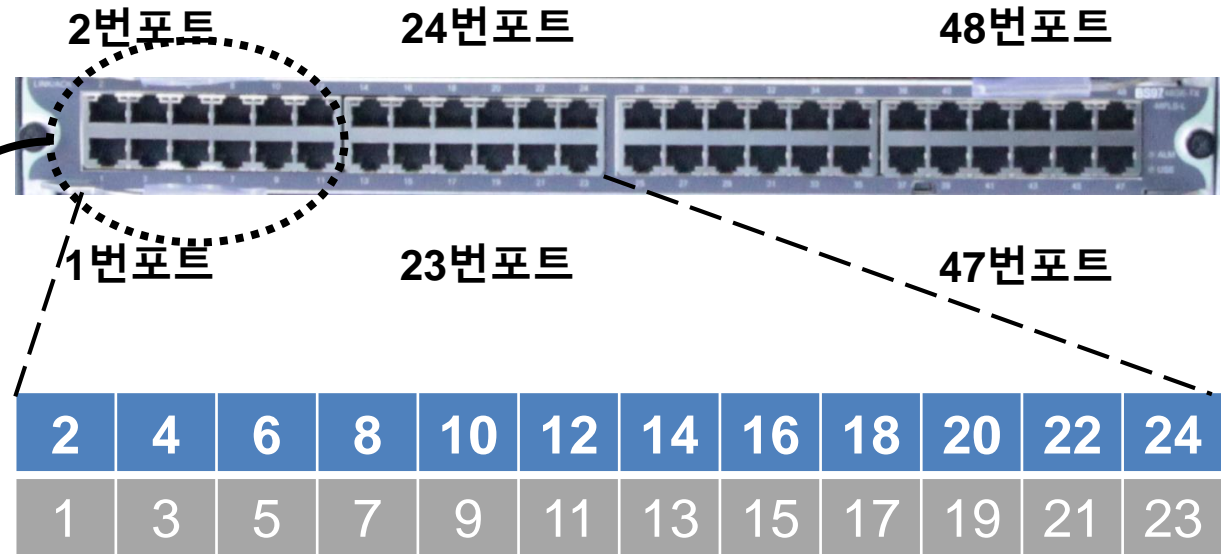


백본스위치 이론 교육

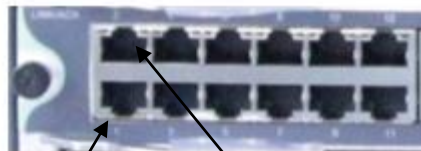
Number - port

Numbered from the bottom up
Left to right

Numbered from the bottom up
Left to right



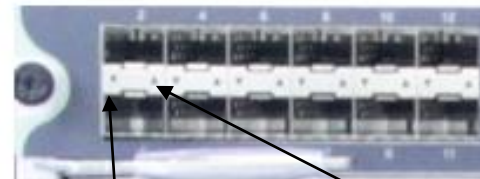
ex) BS9700-48T-E



아래 Port LED

위에 Port LED

ex) BS9700-48F-E

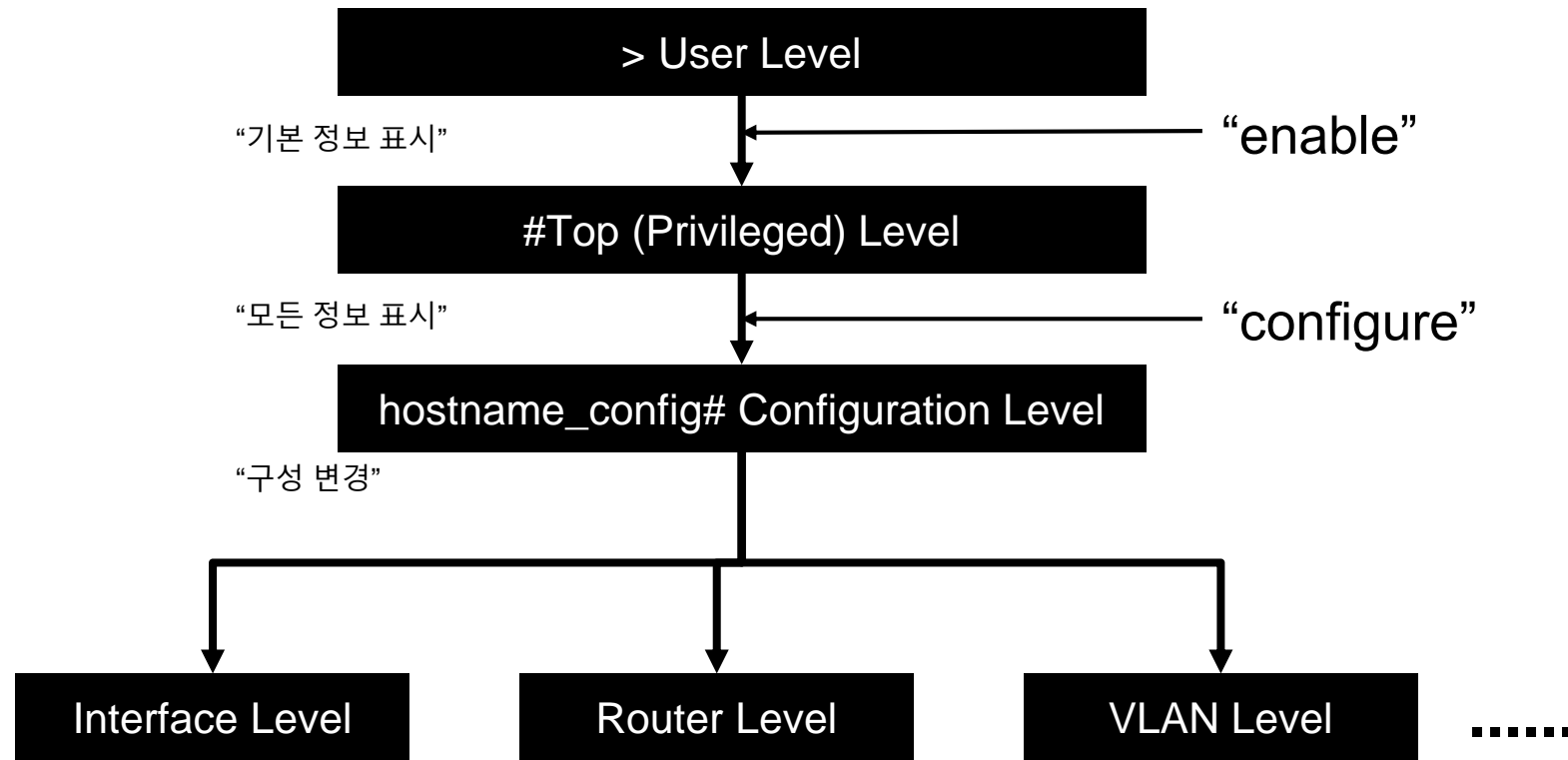


아래 Port LED

위 Port LED

백본스위치 이론 교육

CLI Command 구조



CLI Command는 Text 기반으로 운영되며, 계층적인 Tree 구조를 가지고 있다.

백본스위치 이론 교육

CLI Command 구조

User Level:

BS9710>?

connect	-- Open a outgoing connection
disconnect	-- Disconnect an existing
outgoing network connection	
enable	-- Turn on privileged commands
english	-- Help message in English
enter	-- Turn on privileged commands
exit	-- Exit / quit
help	-- Description of the interactive
help system	
history	-- Look up history
quit	-- Exit / quit
resume	-- Resume an active outgoing
network connection	
ssh	-- Open a ssh connection
su	-- Enter super user mode
telnet	-- Open a telnet connection
vFlash	-- Virtual flash
where	-- Display all outgoing telnet
connection	

Privilege Level:

BS9710#?

cd	-- Change directory
clear	-- Clear something
config	-- Enter configurative
mode	
connect	-- Open a outgoing
connection	
copy	-- Copy configuration or
image data	
CtrlRelay	-- CtrlRelay
date	-- Set system date
debug	-- Debugging functions
delete	-- Delete a file
diagnosis	-- Enter diagnosis
mode	
dir	-- List files in flash
memory	
disconnect	-- Disconnect an
existing outgoing network connection	
enable	-- Turn on privileged
commands	

CONFIG Level:

BS9710_config#?

aaa	-- AAA configuration
alias	-- Define alias for command
arp	-- ARP Configuration
backup-link-group	-- Create backup
group	
banner	-- Set login banner
bfd	-- BFD configuration
commands	
boot	-- Modify system boot
parameters	
bvss	-- Bvss mangment
configuration	
chinese	-- Help message in
Chinese	
connect	-- Open a outgoing
connection	
cos	-- Configure cos
cpu	-- CPU configuration
subcommands	
BS9710_config#interface gigaEthernet 1/1	
BS9710_config_g1/1#	

운영 모드가 변경 될 때 Prompt가 변경된다.(> -- # -- config#)

백본스위치 이론 교육

CLI 메뉴 이동 및 단축 명령어

- › **Manu 이동 “Ctrl+z” “exit”**
 - exit: 한 단계 이전 Level로 이동
 - Ctrl+z 또는 : Top Level로 바로 이동
- › **“?”로 도움말 얻기**
 - 현재 사용 가능한 명령어 확인
 - “show int?” 유사한 명령어 확인 시에도 유용
- › **단축 명령어**
 - 다른 명령어와 구분 할 수 있는 최소의 명령어

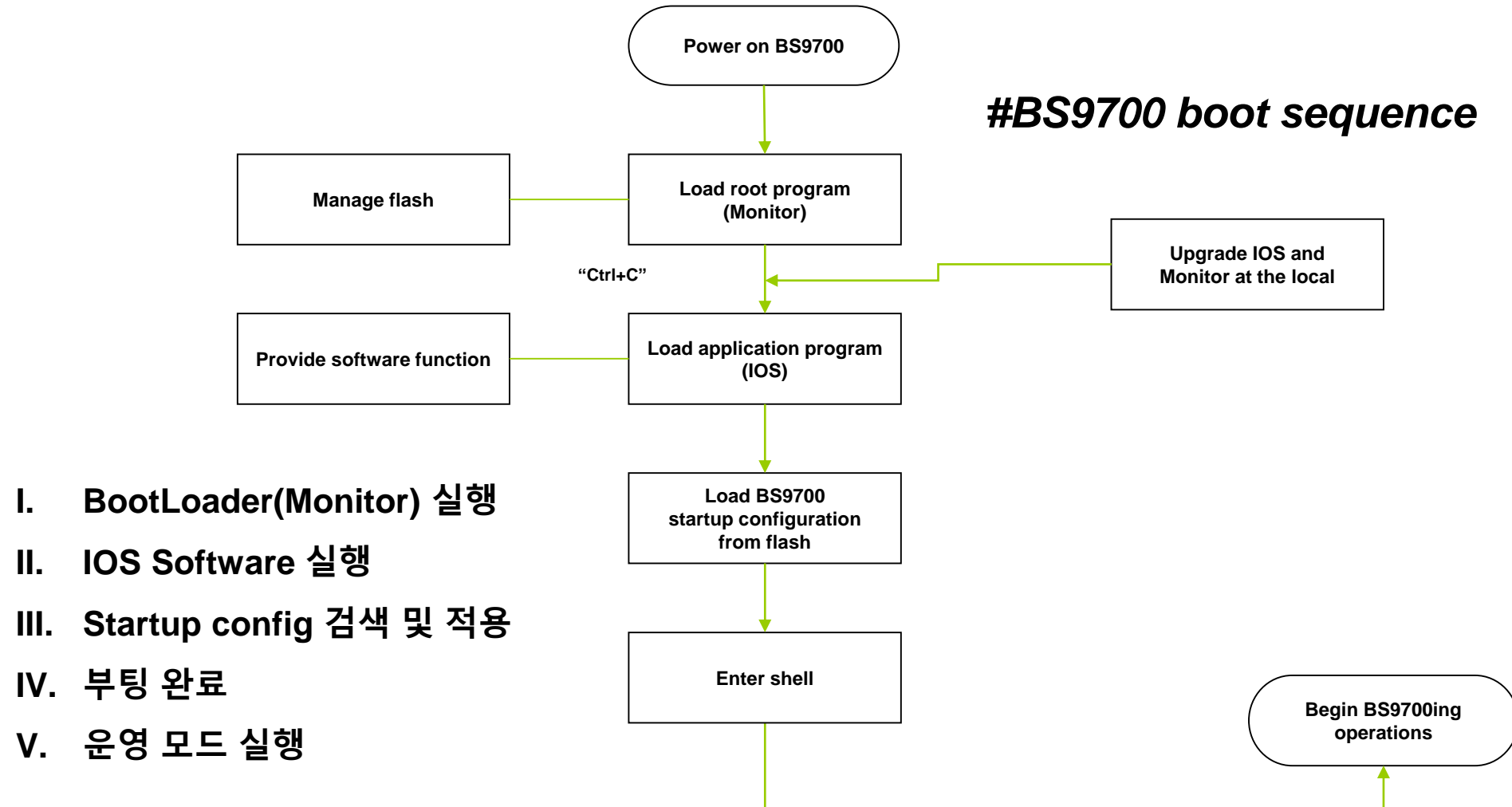
전체 명령어	단축 명령어
show	sh
configure terminal	conf
show running-config	show run
interface	int
show logging	sh log

```
BS9710>enable
BS9710#conf
BS9710_config#int gi1/1
BS9710_config_g1/1#exit
BS9710_config#exit
BS9710#conf
BS9710_config#
BS9710_config#int gi1/1
BS9710_config_g1/1#^Z
BS9710#
```

```
BS9710#show ?
aaa                -- Show AAA information
aggregator-group   -- Link Aggregation
information
alias              -- Alias for command
arp                -- ARP table
backup             -- Display backup interfaces
information
backup-link-group   -- Backup link group
bfd                -- Show BFD
Information
BS9710#show aaa ?
users              -- Show AAA user information
privilege          -- Show AAA current user privilege level
```

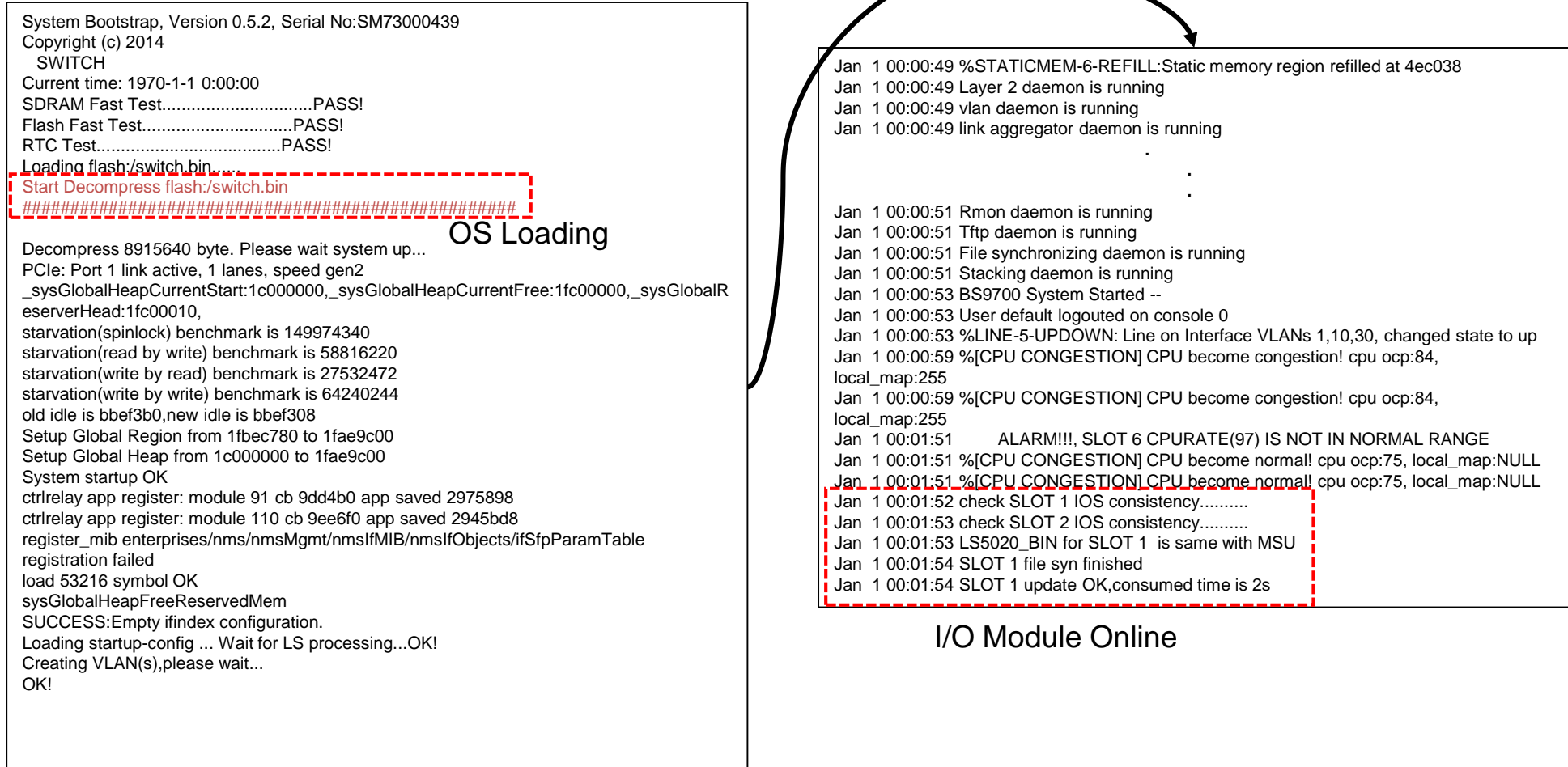
백본스위치 이론 교육

Booting Process



백본스위치 이론 교육

Booting Process



시스템 부팅 시 위와 같은 절차로 진행된다.

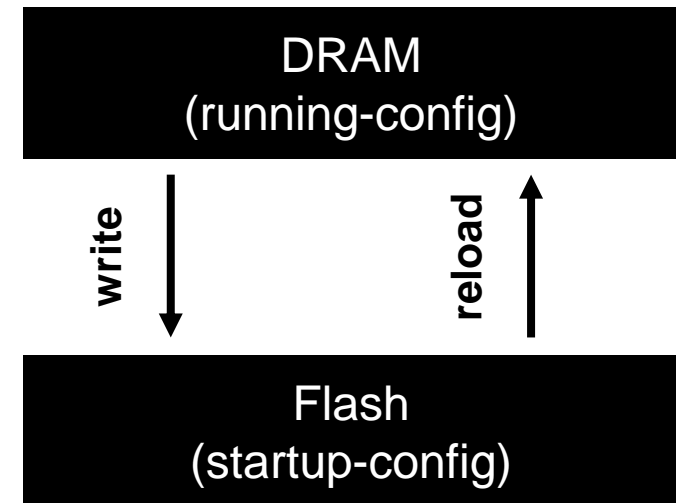
백본스위치 이론 교육

Configuration 파일

- › **Configuration 파일**
 - show running-config
 - show configuration(startup-config)
- › **Save Configuration 파일**
 - write
- › **Reset the system**
 - Reload
 - redundancy reload shelf (MSU 이중화시)

BS9700#write
Saving current configuration...
OK!

BS9700_config#reboot
Do you want to reboot the Switch(y/n)?



백본스위치 이론 교육

Configuration 파일

View running-config subcommand

```
BS9700#show running-config ?
interface      -- Interface current configuration
range-interface -- Interface range current configuration
non-interface  -- Current global configuration
routing-interface -- Routing interface current configuration
slot           -- Current configuration for the slot
partial-running -- Pending configurations for the absent slots
pending        -- Pending configurations for the absent
components
  bvss-config   -- Current bvss configuration
  |             -- Output modifiers
  <cr>
```

View routing-interface

```
BS9700#show running-config routing-interface
interface VLAN1
ip address 192.168.211.99 255.255.255.0
no ip directed-broadcast
!
interface VLAN10
ip address 1.1.1.2 255.255.255.252
no ip directed-broadcast
!
interface VLAN30
ip address 1.1.3.1 255.255.255.252
no ip directed-broadcast
!
interface Null0
!
BS9700#
---MORE---
```

필터 기능을 사용하여 Running-config에서 특정 정보만 필터 하여 확인한다.

백본스위치 이론 교육

운영 Software 버전

```
BS9700#show version
Internetwork Operating System Software
Switch Series Software, Version 4.1.2C Build 64191, RELEASE SOFTWARE
Copyright (c) 2014
Compiled: 2019-6-21 16:33:2 by SYS, Image text-base: 0x108000
ROM: System Bootstrap, Version 0.5.2, hardware version: 2
Serial num: SM73000439, ID num: SM73000439
System image file is "flash:/switch.bin"
SWITCH RISC
524288K bytes of memory, 65536K bytes of flash
Base ethernet MAC Address: fc:fa:f7:44:6f:b0
BOARD num: 11000277 PCB version: 2
CPLD version: A BOARD type: VI
snmp info:
  product_ID: 124  system_ID: 1.3.6.1.4.1.3320.1.124.0
BS9700 uptime is 0:00:49:50, The current time: 2019-8-5 14:50:23
Reboot history information:
  No. 1: System is rebooted by power-on
  No. 2: System is rebooted by command at 2019-8-5 14:37:28, uptime
```

현재 운영 중인 S/W, H/W(DRAM/Flash) 및 Uptime 정보를 확인 한다.

백본스위치 이론 교육

Show cpu (cpu-util)

BS9700#show cpu-util

Slot[1]

cpu util threshold is 90%
current cpu util is 6%
Status:Normal

Slot[2]

cpu util threshold is 90%
current cpu util is 2%
Status:Normal

Slot[6]

cpu util threshold is 90%
current cpu util is 3%
Status:Normal

BS9700#show cpu

CPU utilization for one second: 4%; one minute: 3%;
five minutes: 3%

1sec/1min/5min 평균 부하

Slot 별 CPU 사용률

백본스위치 이론 교육

Show interface brief

BS9700#show interface brief						
Port	Description	Status	Vlan	Duplex	Speed	Type
g6/0		down		full	1000Mb	Giga-Combo-FIBER
g1/1		down	1	auto	auto	Giga-TX
g1/2		down	1	auto	auto	Giga-TX
g1/3		down	1	auto	auto	Giga-TX
g1/4		down	1	auto	auto	Giga-TX
g1/5		down	1	auto	auto	Giga-TX
g1/6		down	1	auto	auto	Giga-TX
g1/7		down	1	auto	auto	Giga-TX
g1/8		down	1	auto	auto	Giga-TX
g1/9		down	1	auto	auto	Giga-TX
g1/10		down	1	auto	auto	Giga-TX
g1/11		down	1	auto	auto	Giga-TX
g1/12		down	1	auto	auto	Giga-TX
g1/13		up	1	full	1000Mb	Giga-TX
g1/14		down	1	auto	auto	Giga-TX
g1/15		down	1	auto	auto	Giga-TX
g1/16		down	1	auto	auto	Giga-TX
g1/17		down	1	auto	auto	Giga-TX
--More--						

Link 상태
Up/Down

Port Type
Giga-Combo-FIBER/
Giga-TX

Speed 상태
10/100/1000/
10000(10G)

Duplex 상태
Auto/Full/Half

PVID = Default VLAN

Description 기록

백본스위치 이론 교육

Show interface *interfacetype* slot/num

```
BS9700#show int gi 1/13
GigaEthernet1/13 is up, line protocol is up
  Ifindex is 102, unique port number is 13
  Hardware is Giga-TX, address is fcfa.f748.1fcc (bia
fcfa.f748.1fcc)
  MTU 1500 bytes, BW 1000000 kbit, DLY 10 usec
  Encapsulation ARPA
  Auto-Duplex(Full), Auto-Speed(1000Mb/s), Flow-
Control Off
  5 minutes input rate 6155 bits/sec, 10 packets/sec
  5 minutes output rate 381 bits/sec, 0 packets/sec
  Real time input rate 7506 bits/sec, 14 packets/sec
  Real time output rate 1400 bits/sec, 2 packets/sec
```

5분 평균/실시간 입/출력

```
Received 14035 packets, 1120437 bytes
  10566 broadcasts, 2082 multicasts
  1292 discard, 0 error, 0 PAUSE
  0 align, 0 FCS, 0 symbol
  0 jabber, 0 oversize, 0 undersize
  0 carriersense, 0 collision, 0 fragment
  90 L3 packets, 0 discards, 0 Header errors
  0 URPF errors
Transmitted 766 packets, 49607 bytes
  3 broadcasts, 662 multicasts
  0 discard, 0 error, 0 PAUSE
  0 sqetest, 0 deferred, 0 oversize
  0 single, 0 multiple, 0 excessive, 0 late
  0 L3 forwards
```

패킷 종류별 Count

백본스위치 이론 교육

Show mac address-table

BS9700#show mac address-table ?

dynamic -- Dynamic entry type
 brief -- Brief information
 static -- Static entry type
 multicast -- Multicast entry type
 interface -- Interface keyword
 vlan -- Vlan keyword
 H.H.H -- 48 bit mac address
 blackhole -- Blackhole entry
 | -- Output modifiers

BS9700#

BS9700#show mac address-table dynamic

Mac Address Table (Totals : 1)

Vlan	Mac Address	Type	Ports
----	-----	----	-----
1	0025.9086.7151	DYNAMIC	g1/13

백본스위치 이론 교육

Show arp

```
BS9700#show arp | include ?
WORD -- word to be matched
```

```
BS9700#show arp
```

```
Total ARP entries 7, Incomplete ARP entries: 0, pending time 15 seconds
```

Protocol	Address	Age(min)	Hardware Address	Type	Interface
IP	1.1.3.1	-	fc:fa:f7:44:6f:b0	ARPA	VLAN30
IP	192.168.212.2	-	fc:fa:f7:44:6f:b0	ARPA	GigaEthernet6/0
IP	192.168.211.11	0	00:06:c4:76:02:72	ARPA	v1(g1/13)[1]
IP	192.168.211.3	0	00:06:c4:74:5b:b0	ARPA	v1(g1/13)[1]
IP	192.168.211.1	35	00:00:5e:00:01:d3	ARPA	v1(g1/13)[1]
IP	192.168.211.99	-	fc:fa:f7:44:6f:b0	ARPA	VLAN1
IP	1.1.1.2	-	fc:fa:f7:44:6f:b0	ARPA	VLAN10

```
Total complete arp entries 7, pending update arp entries 0
```

Switchport도 정보도 같이 확인

ARP table 상에 IP Address/MAC/Port 세 가지 정보 모두 확인 가능하다.

IP: 192.168.254.254



```
BS9700#ping 20.0.1.2 -l 1024 -n 100
PING 192.168.211.1 (20.0.1.2): 1024 data bytes
!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!
!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!
--- 20.0.1.2 ping statistics ---
100 packets transmitted, 98 packets received, 2% packet loss
round-trip min/avg/max = 0/0/10 ms
BS9700#
```

```
BS9700#traceroute 200.1.1.254
traceroute to 200.1.1.254 (200.1.1.254), 30 hops max, 36 byte
packets
```

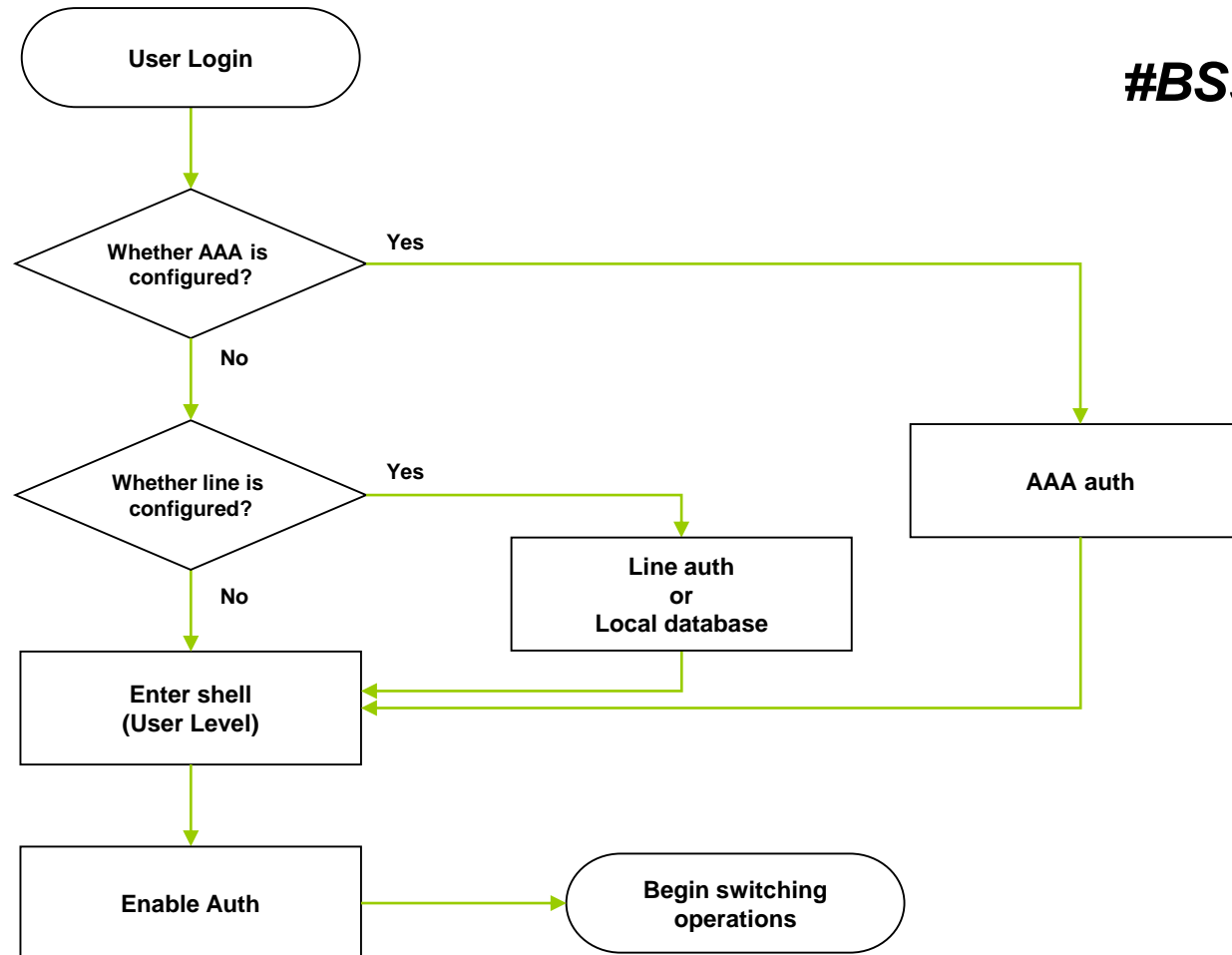
BS9700#

- f -- Set Don't Fragment flag in packet
- i -- Source address
- m -- Source interface
- j -- Loose source route
- k -- Strict source route
- l -- Data size
- s -- Type Of Service
- t -- Time To Live
- v -- Verbose output
- w -- Timeout in seconds to wait for each reply
- c -- Output concise information

백본스위치 이론 교육

Authentication Process

#BS9700 auth sequence



백본스위치 이론 교육

Password

› Password 설정

- 공장 초기화 상태 = No Password
- 최대 32자 영문, 특수문자, 숫자 조합 설정

› Password 종류

- Enable Password: Top Level 접근 시 인증(USER --> TOP)
- Account-based: 원격 접근 시 Local Database를 통한 인증

Password 설정 예제

- Enable Password
BS9700_config#
BS9700_config#enable level 15 password 0
Please input password:
Please input the password AGAIN:
- Account Password
BS9700_config#username admin password 0
Please input password:
Please input the password AGAIN:

NOTE:

- Enable password
 - Password Level 0 설정
- Account password
 - Password Level 0 설정

백본스위치 이론 교육

IP Address Setting

› IP Address 설정

- VLAN-based IP 설정
- L3 Interface 생성 시 기본 Enabled 상태로 전환됨

```
BS9700#conf
BS9700_config#vlan 100
BS9700_config_vlan100#exit
BS9700_config#interface vlan100
Jan  1 00:09:36 %LINE-5-UPDOWN: Line on Interface VLAN100, changed state to up
Jan  1 00:09:36 %LINEPROTO-5-UPDOWN: Line protocol on Interface VLAN100, changed state
to up
BS9700_config_v100#
BS9700_config_v100#ip address 192.168.213.1 ?
A.B.C.D  -- IP netmask
BS9700_config_v100#ip address 192.168.213.1 255.255.255.0
BS9700_config_v100#
```

백본스위치 이론 교육

Management

› Hostname 설정

- 장비 식별
- 최대 43 char 까지 설정

```
BS9700#conf
BS9700_config#hostname PIOLINK
PIOLINK_config#
```

› Banner 설정

- 장비 로그인 시 경고메시지 출력
- 최대 500 char 까지 설정

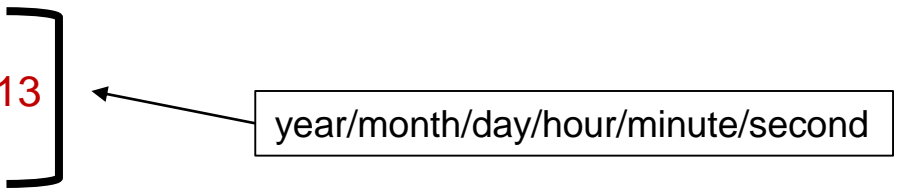
```
BS9700_config#banner message
BS9700_config_banner#text ?
  STRING -- Define the text
BS9700_config_banner#text Welcome to PIOLINK
```

백본스위치 이론 교육

Management

- › **Clock Time 설정**
 - 시스템 Local 시간 설정

```
BS9700#conf
BS9700_config#service timestamps log date
BS9700_config#service timestamps debug date
BS9700_config#time-zone kst 9
BS9700_config#exit
BS9700#Jan 1 09:55:23 %SYS-6-CONFIG: Configured from vty 0 by admin(192.168.212.130)
BS9700#date
The current date is 1970-1-1 9:55:30
Enter the new date(yyyy-mm-dd):2019-08-13
Enter the new time(hh:mm:ss):14:19:30
BS9700#conf
BS9700_config#exit
BS9700#Aug 13 14:19:37 %SYS-6-CONFIG: Configured from vty 0 by admin(192.168.212.130)
```

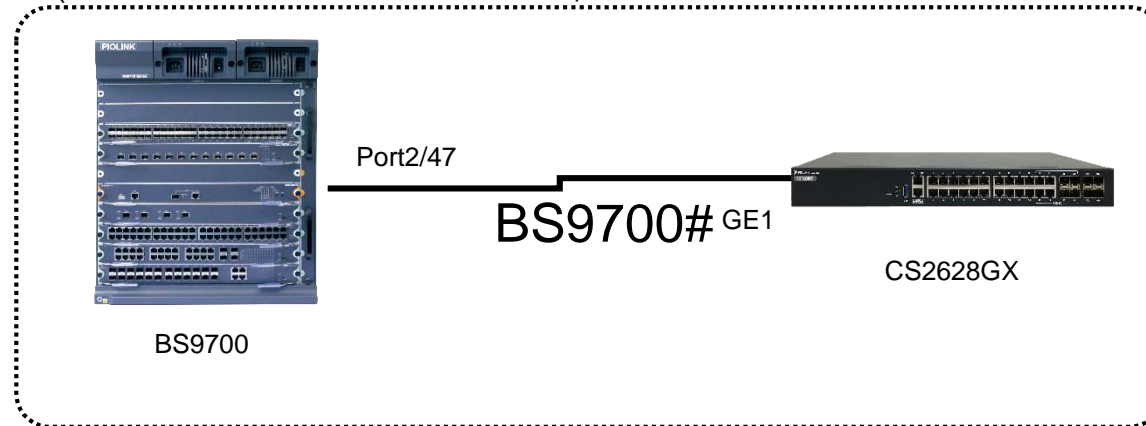


백본스위치 이론 교육

Management

› LLDP 설정

- Link Layer Discovery Protocol
- 표준 프로토콜
- 인접 Neighbor 정보 확인(상대방 연결 포트/IP/Hostname)



```
BS9700#conf
BS9700_config#lldp run
BS9700_config#interface gi2/47
BS9700_config_g2/47#lldp receive
BS9700_config_g2/47#lldp transmit
```

LLDP 데몬 활성화

포트에서 LLDP 활성화

백본스위치 이론 교육

Management

› LLDP 확인

```
BS9700#show lldp neighbors
Capability Codes:
  (R)Router,(B)Bridge,(C)DOCSIS Cable Device,(T)Telephone
  (W)WLAN Access Point, (P)Repeater,(S)Station,(O)Other
```

Device-ID	Local-Intf	Hldtme	Port-ID	Capability
0006.c476.0272	Gig2/47	101	ge1	B

Total entries displayed: 1

BS9700#

```
BS9700#show lldp traffic
```

LLDP traffic statistics:

Total frames out: 12

Total entries aged: 0

Total frames in: 12

Total frames received in error: 0

Total frames discarded: 0

Total TLVs unrecognized: 0

BS9700#

백본스위치 이론 교육

Management

- › **NTP 설정**
 - NTP 서버를 통한 시간 동기화

```
BS9700_config#ntp server 123.123.123.1
BS9700_config#exit
BS9700#show ntp status
Time-zone: GMT+9:00, kst
Current time: 2019-08-13 14:22:49
Clock Status: synchronized
Clock Stratum: 16
Leap Indicator: 3
Reference ID: INIT
Clock Jitter: 0.000000
Clock Precision: -18
Clock Offset: 0.000 ms
Root Delay: 0.000 ms
Root Dispersion: 0.180 ms
Packets Sent: 1
Packets Received: 0 (bad version: 0)
Reference Time: 1970-01-01 00:00:00
Last Update Time: 1970-01-01 00:00:00
```


백본스위치 이론 교육

Management

- › **Remote Access 제한**
 - Remote/SNMP Access 제한 시 Standard ACL을 기반 제어

```
BS9700_config#ip access-list standard 1
BS9700_config_std#permit 192.168.0.1
BS9700_config_std#permit 192.168.1.0 255.255.255.0
BS9700_config_std#deny any
BS9700_config_std#exit
BS9700_config#interface vLAN 1
BS9700_config_v1#ip access-group 1 in
BS9700#show ip access-list
Standard IP access list 1
Index      Rule content
-----
1          permit 192.168.0.1 255.255.255.255
2          permit 192.168.1.0 255.255.255.0
3          deny any
```

백본스위치 이론 교육

Management

› Local Account 확인

```
BS9700#show local-users
```

Local group default:

username	links	pw_present	login_tries	login_try_time	freezing_cause
admin	1	0s	0	0s	
test	1	0s	0	0s	

```
BS9700#
```

› 접속 Level 확인

```
BS9700>enable
```

```
BS9700#Jan 1 02:30:18 User admin enter privilege mode from console 0, level = 15
```

```
BS9700#
```

백본스위치 이론 교육

Management

› Terminal Length 조정

```
BS9700#terminal ?
length          -- Set number of lines on a screen
monitor         -- Copy debug output to the current terminal line
terminal-type   -- Set the terminal type
width          -- Set width of the display terminal
BS9700#terminal length ?
<0-512> Number of lines on screen (0 for no pausing)
BS9700#terminal length
```

NOTE:

› 연결 세션 확인

- Terminal length 0 제한 없이 출력
- Terminal length <1-512> 입력 line 만큼 제한

```
BS9700#show line
No. Type Len Width Terminal Remote-address Interface
=====
* 0 CTY 24 80 ANSI - -
BS9700#
```

백본스위치 이론 교육

주요 Show Commands

구분	정보	명령어
System	버전 및 Uptime 정보 확인	show version
	하드웨어 확인	show power-status show fan-status Show oir-information
	CPU 사용률 확인	show cpu Show cpu-util
	Memory 사용률 확인	show memory datab show memory mbk
	로그 확인	show logging
Layer 1	포트 요약 정보 확인	show interface brief
	포트 상세 정보 확인	show interface gi slot/num
Layer 2	VLAN 정보 확인	show vlan id
	Port별 VLAN 정보 확인	show vlan interface gi slot/num
	STP 정보 확인	show spanning-tree
	MAC 테이블 확인	show mac address-table dynamic
Layer 3	L3 Interface 요약 정보 확인	show ip interface brief
	ARP 테이블 확인	show arp
	Routing 테이블 확인	show ip route
Error Statistics	포트 사용률(통계) 확인 포트 Error 확인	show interface gi slot/num

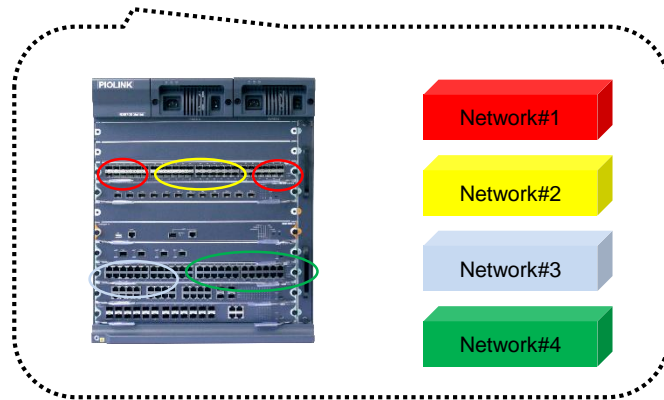
Part# VLAN

VLAN

VLAN(Virtual Local Area Network)

› VLAN 이란?

- VLAN은 물리적인 Switch를 논리적으로 여러 개의 Network로 나누는 기술



백본 스위치를 논리적으로 4개의
Network 대역으로 분리 (최대4K)

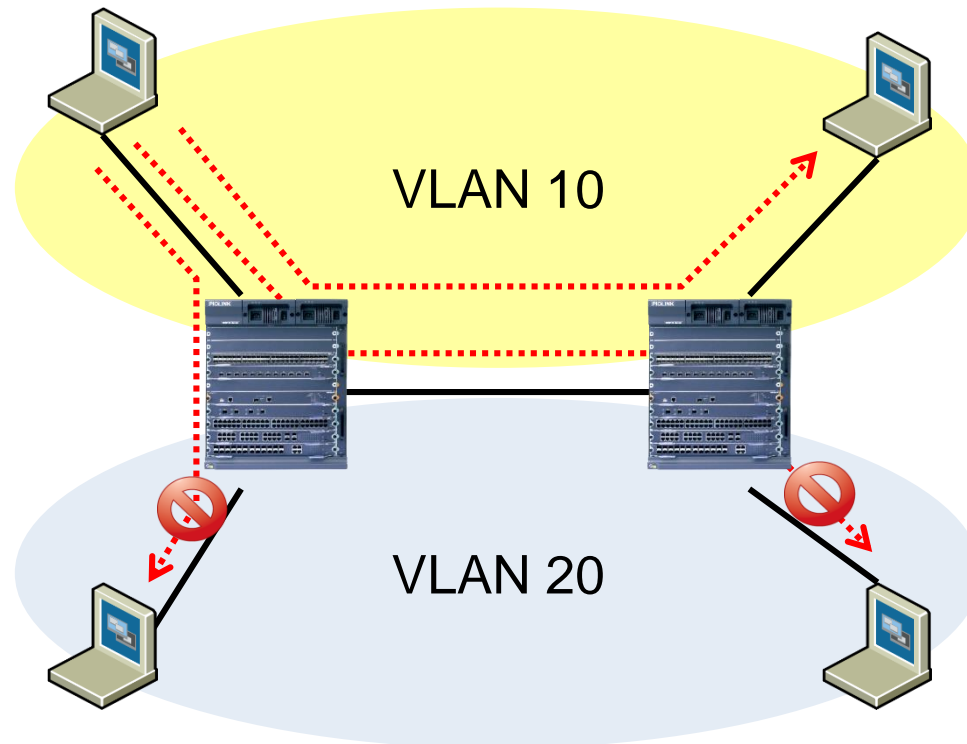
› VLAN사용시 이점

- 브로드캐스트 도메인 분할
- Network 보안성 강화
- L2 Load Balancing

VLAN

VLAN(Virtual Local Area Network)

- › **브로드캐스트 도메인 분할**
 - Network상에 존재하는 많은 브로드캐스트 트래픽들을 분리하여 Network의 성능저하 방지
- › **보안성 강화**
 - 서로 다른 VLAN간의 통신을 차단하여 사용자의 Privacy 보장

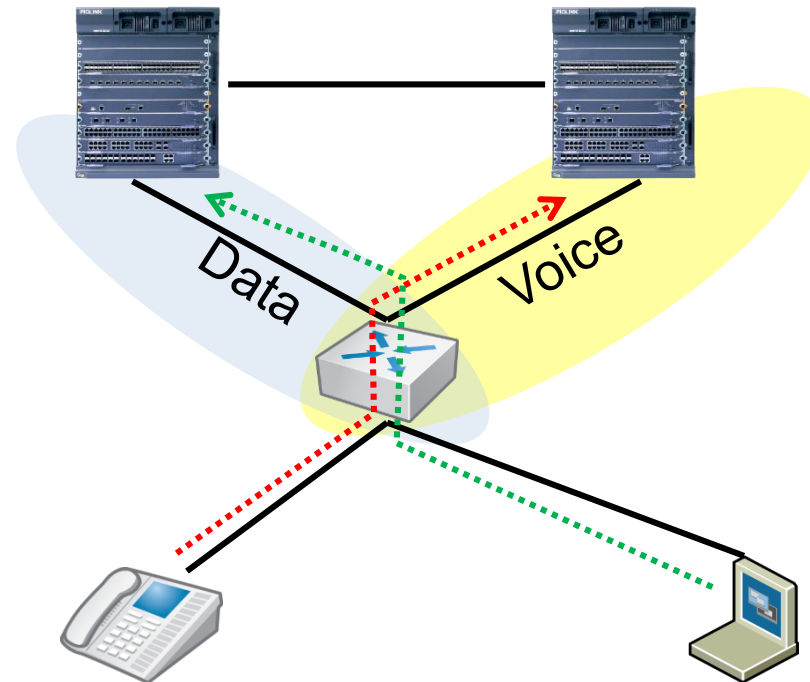


VLAN

VLAN(Virtual Local Area Network)

› **L2 Load Balancing**

- 이중화 구성 시 각 경로 별로 VLAN을 구분하여 L2 Load Balancing 기능



VLAN

VLAN(Virtual Local Area Network)

› VLAN 구분

- Network 에서 VLAN들을 구분 하는 방법은 VLAN ID로 구분
- 사용 가능한 VLAN ID는 1 ~4094

› VLAN 종류

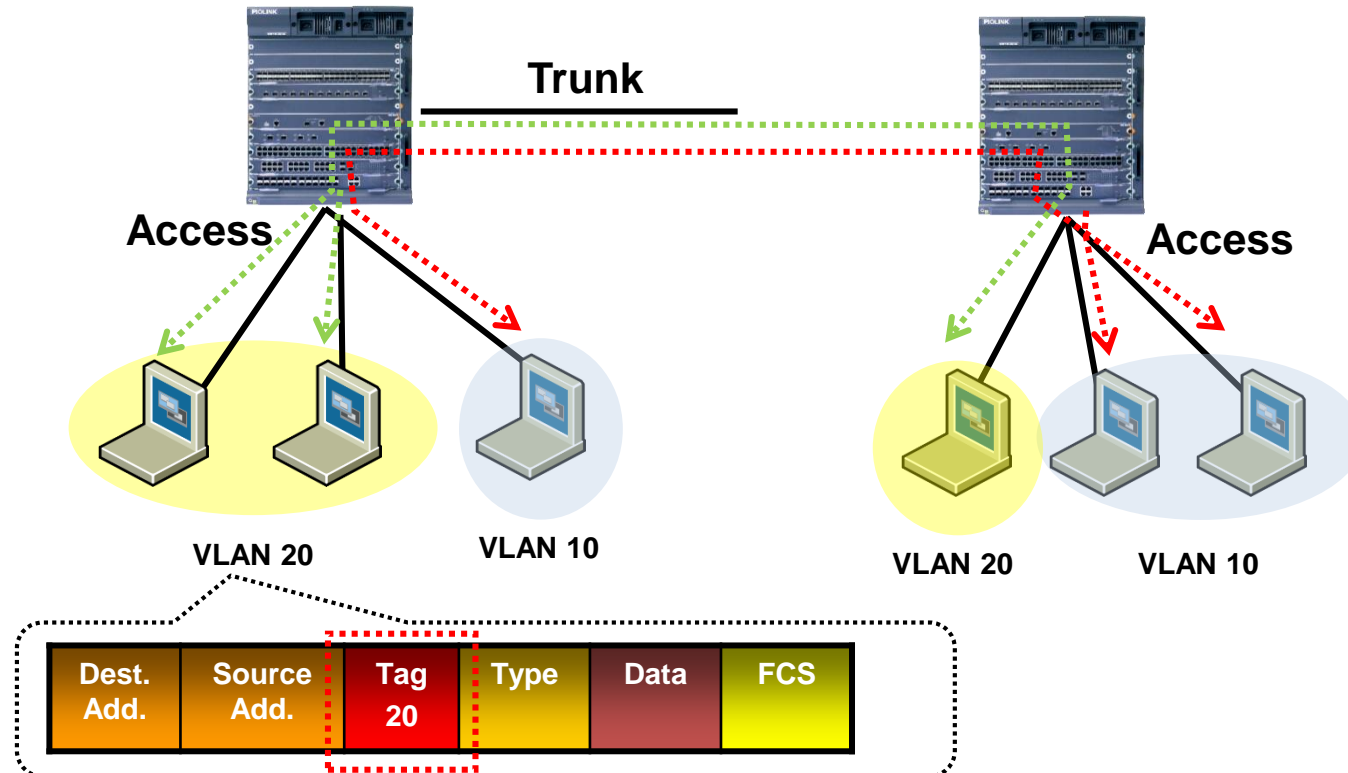
- **Port Based VLAN**
- MAC Based VLAN
- IP Subnet Based VLAN
- Protocol Based VLAN
- Voice VLAN
- Private VLAN

VLAN

VLAN(Virtual Local Area Network)

› 802.1q Trunk

- IEEE 802.1q 산업 표준 프로토콜
- Switch에서 다른 VLAN간 통신을 위해서 지원



VLAN

VLAN(Virtual Local Area Network)

› 1. VLAN 생성

```
BS9700#conf
BS9700_config#vlan 10
BS9700_config_vlan10#
```

› 2. Port Based VLAN 설정

```
BS9700_config#interface gi1/1
BS9700_config_g1/1#switchport mode ?
access                -- Access mode
trunk                 -- Trunk mode
dot1q-translating-tunnel -- Dot1q translating tunnel mode
dot1q-tunnel-uplink   -- Dot1q tunnel uplink mode
private-vlan          -- Private-vlan mode
BS9700_config_g1/1#switchport mode access
BS9700_config_g1/1#switchport pvid 10
BS9700_config_g1/1#
```

VLAN

VLAN(Virtual Local Area Network)

› 3. 802.1q Trunk VLAN 설정

```
BS9700_config#int gi1/1
BS9700_config_g1/1#
BS9700_config_g1/1#switchport mode ?
access                -- Access mode
trunk                 -- Trunk mode
dot1q-translating-tunnel -- Dot1q translating tunnel mode
dot1q-tunnel-uplink   -- Dot1q tunnel uplink mode
private-vlan          -- Private-vlan mode
BS9700_config_g1/1#switchport mode trunk
BS9700_config_g1/1#switchport trunk ?
vlan-allowed          -- Set allowed VLANs when port is in trunking mode
vlan-untagged         -- Set untagged VLANs when port is in trunking mode
BS9700_config_g1/1#switchport trunk vlan-allowed add 10
BS9700_config_g1/1#
```

VLAN

VLAN(Virtual Local Area Network)

› 4. VLAN Configuration 확인

```
BS9700#sh run | inc vlan
Building configuration...
```

```
Current configuration:
```

```
!
```

```
vlan 1,10,30
```

```
BS9700#
```

VLAN

VLAN(Virtual Local Area Network)

› 5. Show Command 확인

- 802.1q Trunk VLAN 상태

BS9700#show vlan		
VLAN	Status	Name Ports

1	Static	Default g2/1, g2/2, g2/3, g2/4, g2/5 g2/6, g2/7, g2/8, g2/9, g2/10 g2/11, g2/12, g2/13, g2/14, g2/15 g2/16, g2/17, g2/18, g2/19, g2/20 g2/21, g2/22, g2/23, g2/24, g1/1 g1/3, g1/4, g1/5, g1/6, g1/7 g1/8, g1/9, g1/10, g1/11, g1/12 g1/13, g1/14, g1/15, g1/16, g1/17 g1/18, g1/19, g1/20, g1/21, g1/22 g1/23, g1/24, g1/25, g1/26, g1/27 g1/28, g1/29, g1/30, g1/31, g1/32 g1/33, g1/34, g1/35, g1/36, g1/37 g1/38, g1/39, g1/40, g1/41, g1/42 g1/43, g1/44, g1/45, g1/46, g1/47 g1/48
10	Static	VLAN0010 g1/1
30	Static	VLAN0030 g1/1, g1/2
BS9700#		

Part# Spanning-tree

Spanning-tree

Spanning-tree 개요

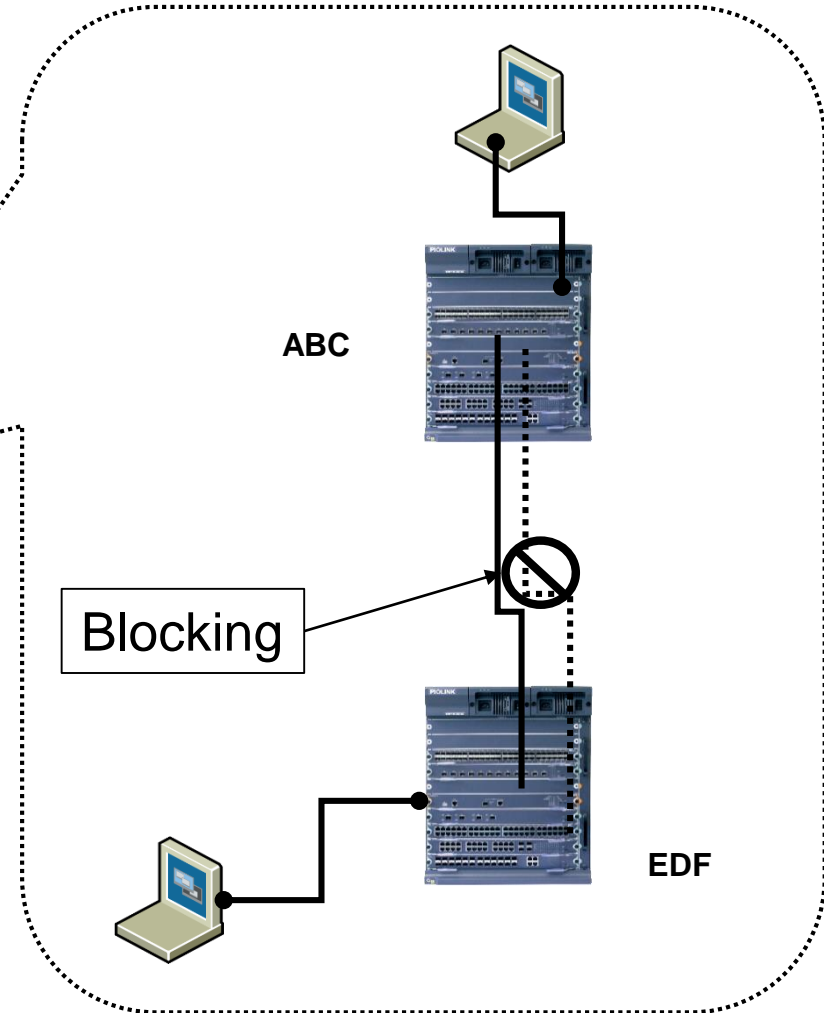
- › **STP(Spanning-tree Protocol) 란**
 - IEEE 802.1D에서 정의
 - 루프 방지(Loop Prevention) 프로토콜
 - Transparent Bridging의 기술적 한계 극복

IEEE에서 정의 된 산업 표준

- IEEE 802.1D, Spanning Tree
- IEEE 802.1w, Rapid spanning Tree
- IEEE 802.1s, Multiple Spanning Tree(MST)

VLAN별 Spanning-tree 지원

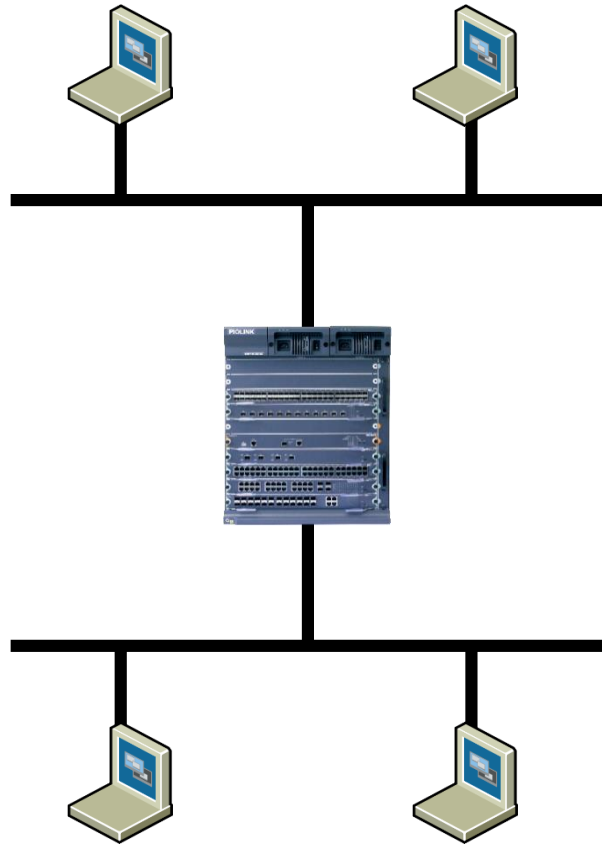
- Per VLAN Spanning Tree (PVST)



Spanning-tree

Spanning-tree 필요성

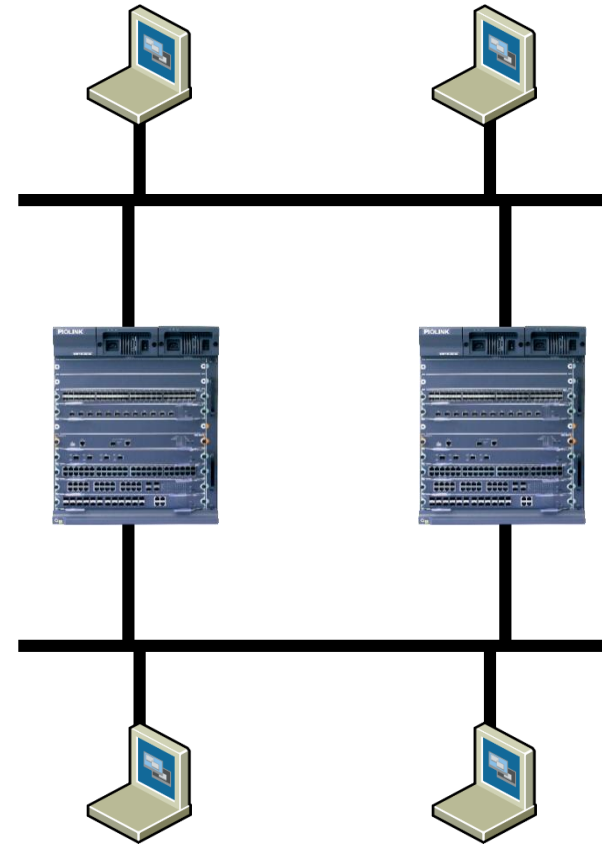
Single 네트워크



단순한 네트워크 연결



STP 네트워크



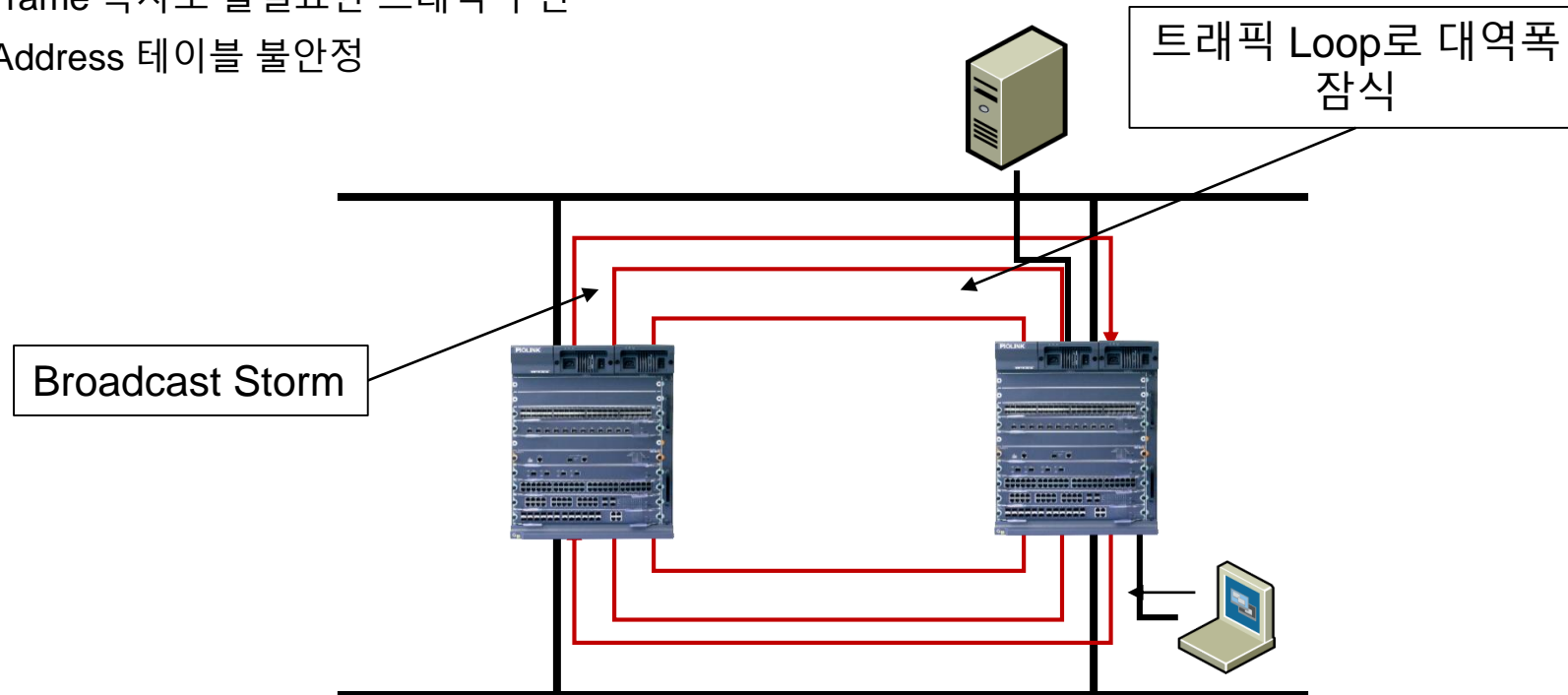
네트워크 장애 시 빠른 복구가 요구됨

Spanning-tree

Spanning-tree 필요성

› Spanning-tree 없다면 ..

- 반복적인 Broadcast 트래픽 전파로 Broadcast Storm 발생
- 다중 Frame 복사로 불필요한 트래픽 수신
- MAC Address 테이블 불안정



알려지지 않는 Unicast나 Broadcast가 유입되면 Loop가 발생되고 Network가 불안정해진다.

Spanning-tree

BPDU(Bridge Protocol Data Unit)

BPDU 프로토콜

- STP 프로세스 사이에서 교환하는 Protocol
- 2초 간격으로 정보 교환
- Root Bridge 선정
- Loop 발생 위치 결정
- Loop 방지 위한 Blocking 위치 결정
- 네트워크 상태 변화 인지
- STP 상태 모니터링

Bytes	Field
2	Protocol ID
1	Version
1	Message Type
1	Flags
8	Root ID
4	Path Cost
8	Bridge ID
2	Port ID
2	Message age
2	Maximum time
2	Hello time
2	Forward delay

Spanning-tree

BPDU(Bridge Protocol Data Unit)

› Configuration BPDU

- Only Root Bridge에 의해서만 생성
- Root Bridge 선출, Topology 초기화 및 복구 시 전송

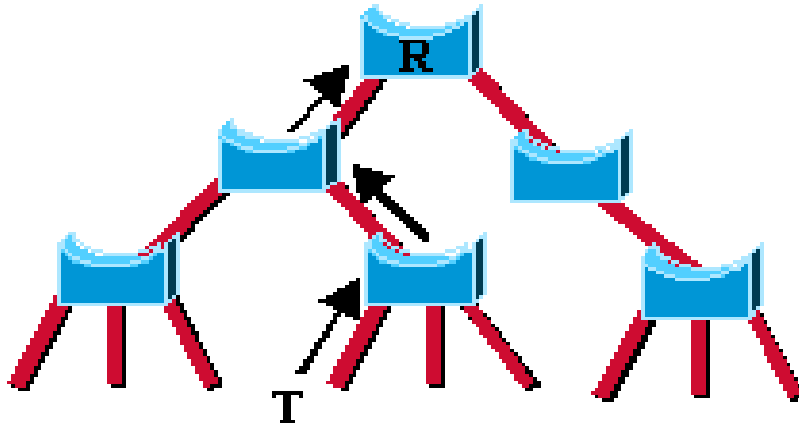
› Topology Change Notification BPDU (TCN)

- Only Non-Root Bridges에 의해 생성
- Topology Change 발생을 Root로 전송
- Root로부터 TC bit =1 로 설정된 BPDU를 수신한 스위치는 MAC Aging time을 15초로 변경

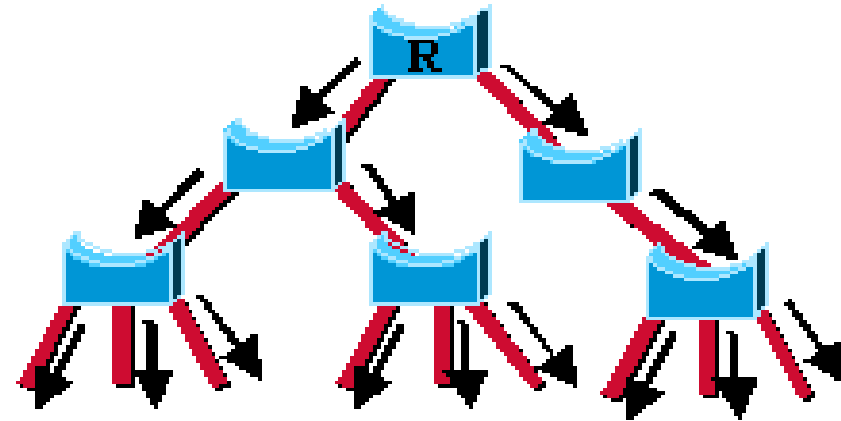
Spanning-tree

BPDU(Bridge Protocol Data Unit)

› Topology Change



A topology change is generated on point T.
1st step: A TCN is going up to the root.



2nd step: the root advertises the TC for max-age+ forward delay.

TC(Topology Change)가 발생되면, 이 정보는 전체 네트워크로 전달된다.

Spanning-tree

Spanning-tree

Spanning-tree 동작 방식

- I. 루트 브리지(Root Bridge) 선출
- II. 비루트 브리지에서 루트 포트(RP: Root Port) 선택
- III. 세그먼트에서 지정 포트(DP: Designated Port) 선택
- IV. 블록 포트(BP: Block Port) 생성

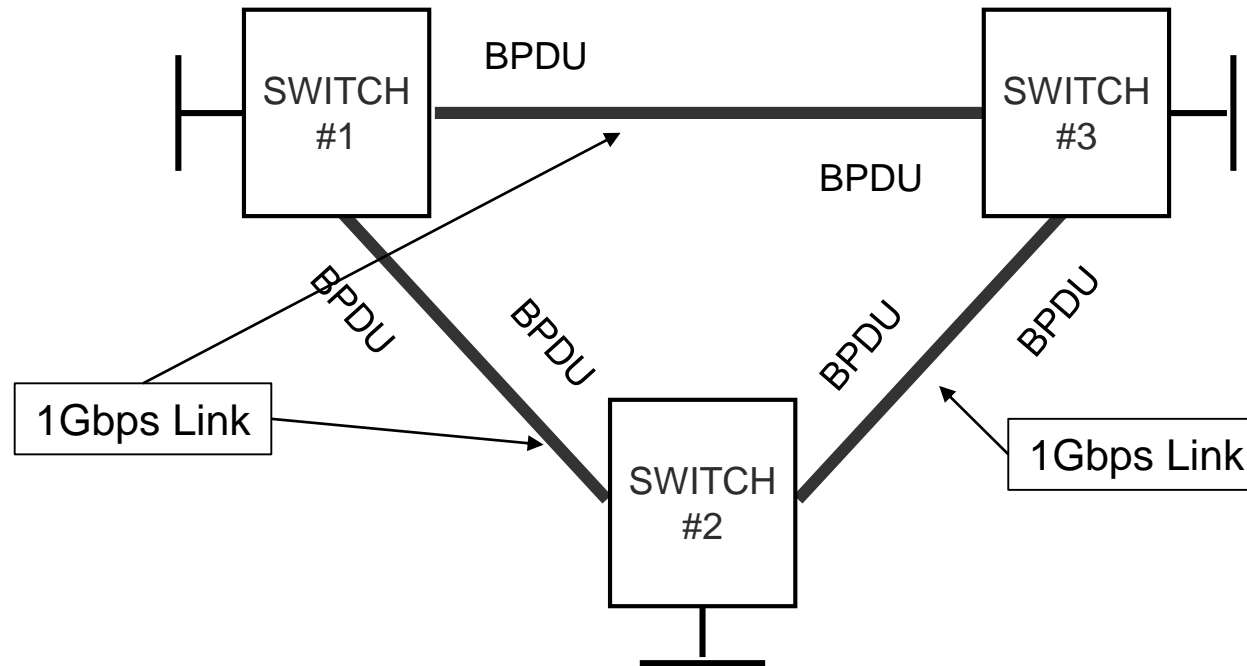
Spanning-tree

Spanning-tree 동작 방식

루트 브리지(Root Bridge) 선출

Bridge ID=32768.0000-0000-0001
Root ID=32768.0000-0000-0001

Bridge ID=32768.0000-0000-0003
Root ID=32768.0000-0000-0003



Bridge ID=32768.0000-0000-0002
Root ID=32768.0000-0000-0002

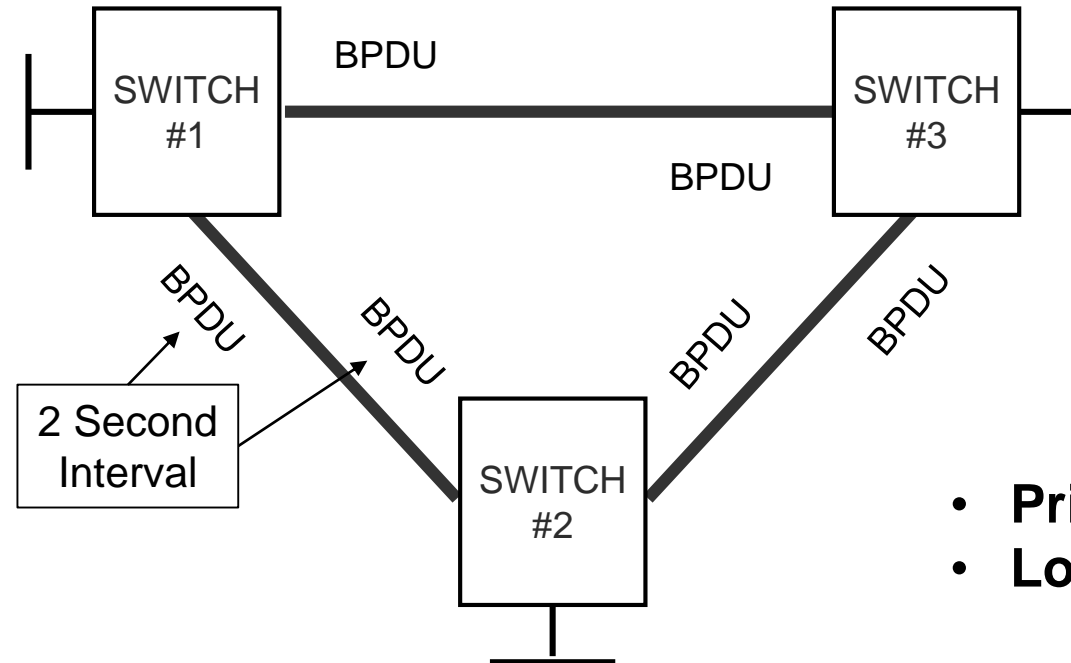
Spanning-tree

Spanning-tree 동작 방식

- › 브리지의 기본 Priority는 32,768
- › Priority가 동일할 경우 Low MAC을 갖는 브리지가 루트 브리지로 선출

Bridge ID=32768.0000-0000-0001
Root ID=32768.0000-0000-0001

Bridge ID=32768.0000-0000-0003
Root ID=32768.0000-0000-0001



Bridge ID=32768.0000-0000-0002
Root ID=32768.0000-0000-0001

- Priority 32768
- Low MAC Address

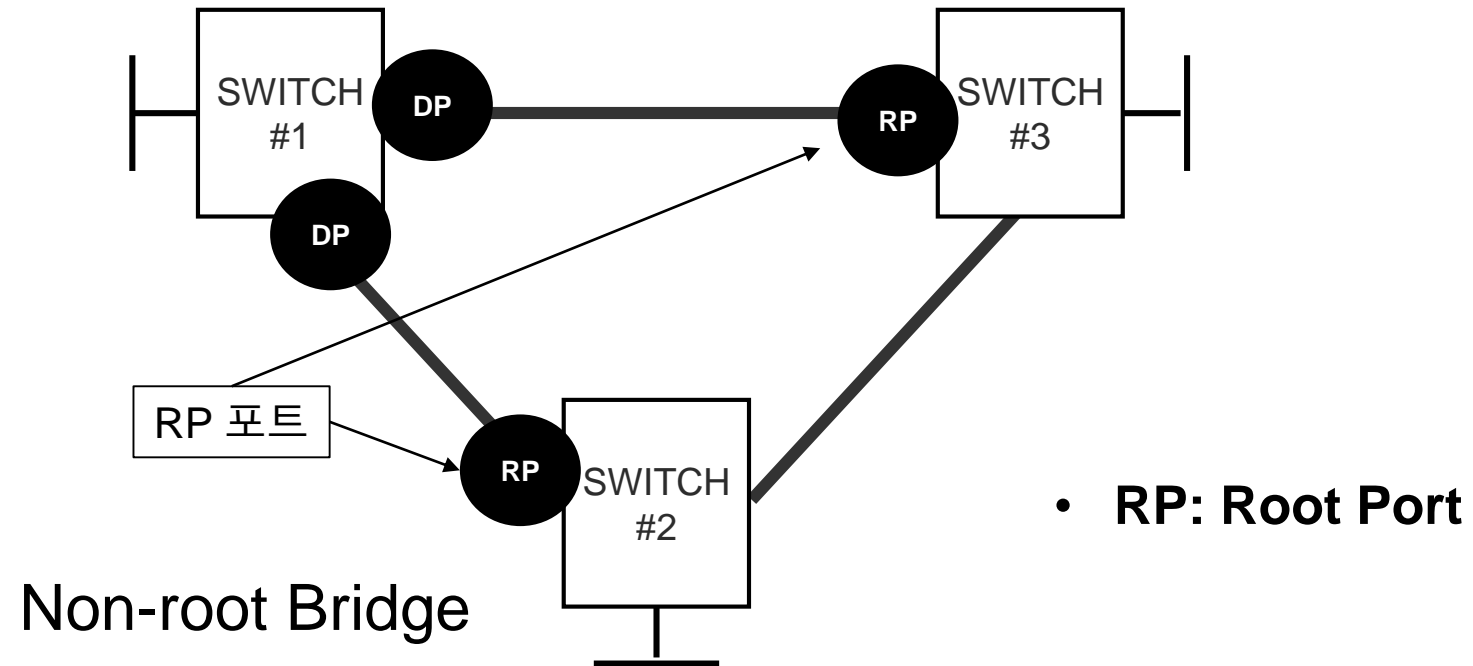
Spanning-tree

Spanning-tree 동작 방식

- › 비루트 브리지는 루트 포트(Root Port)를 선택
- › 루트 브리지로의 최단 경로 참조

Root Bridge

Non-root Bridge



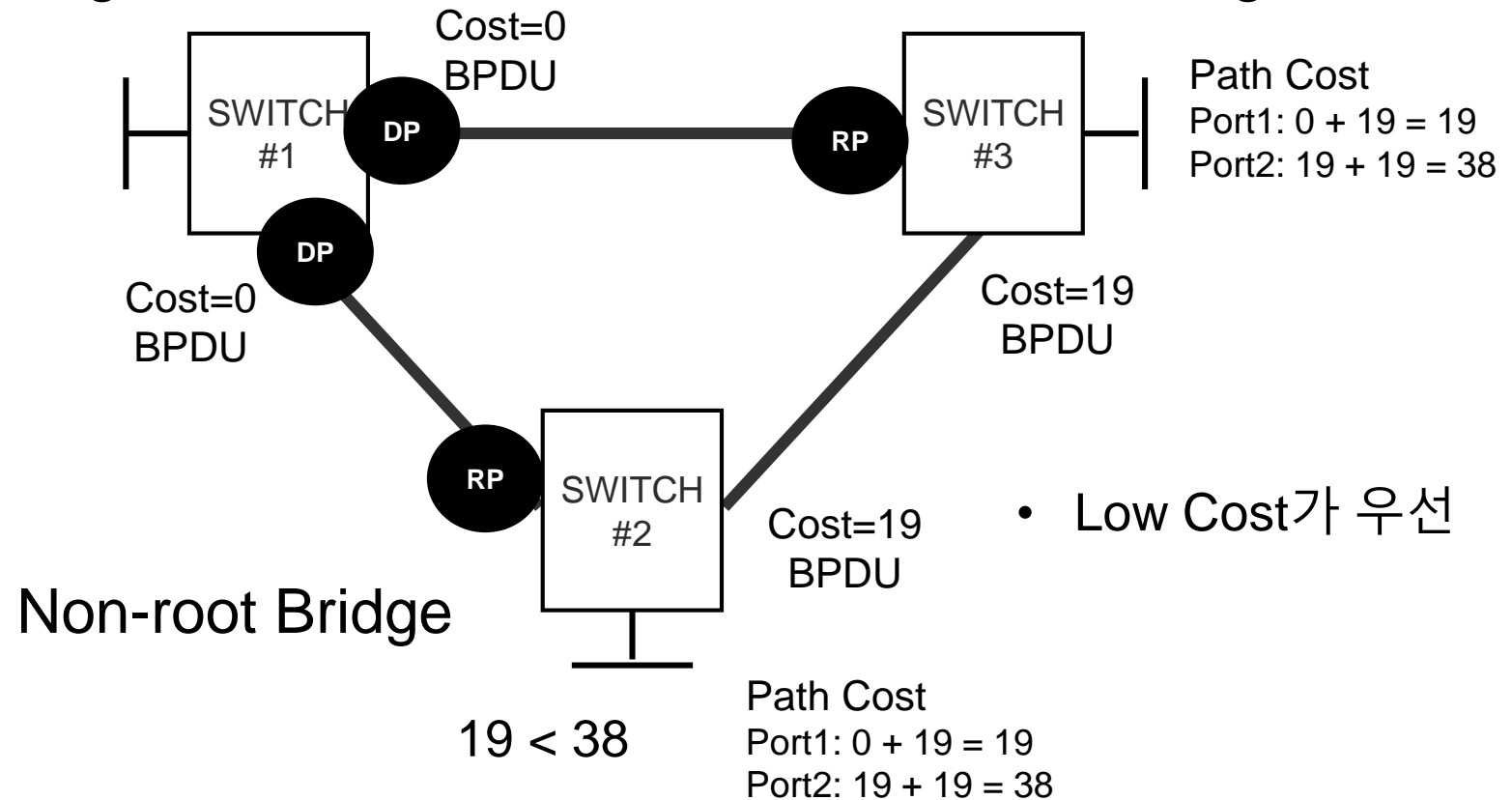
Spanning-tree

Spanning-tree 동작 방식

- › 최단 경로 선택 시 누적되는 Path Cost 참조

Root Bridge

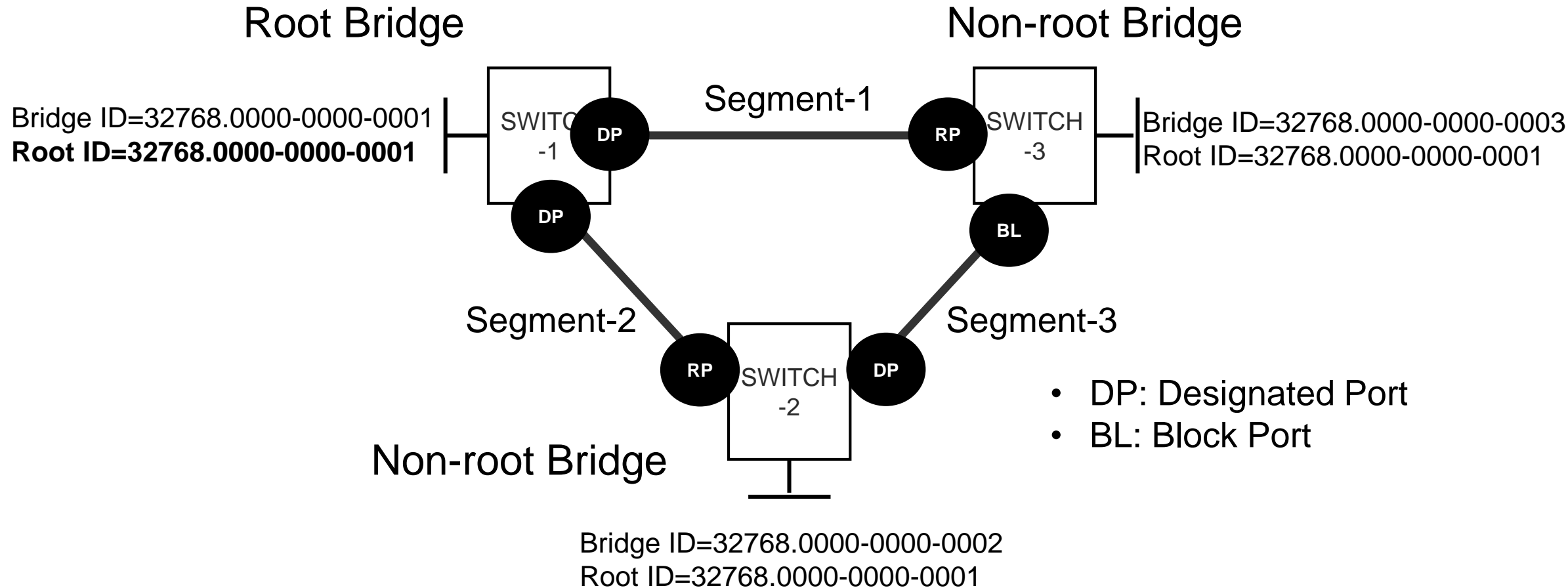
Non-root Bridge



Spanning-tree

Spanning-tree 동작 방식

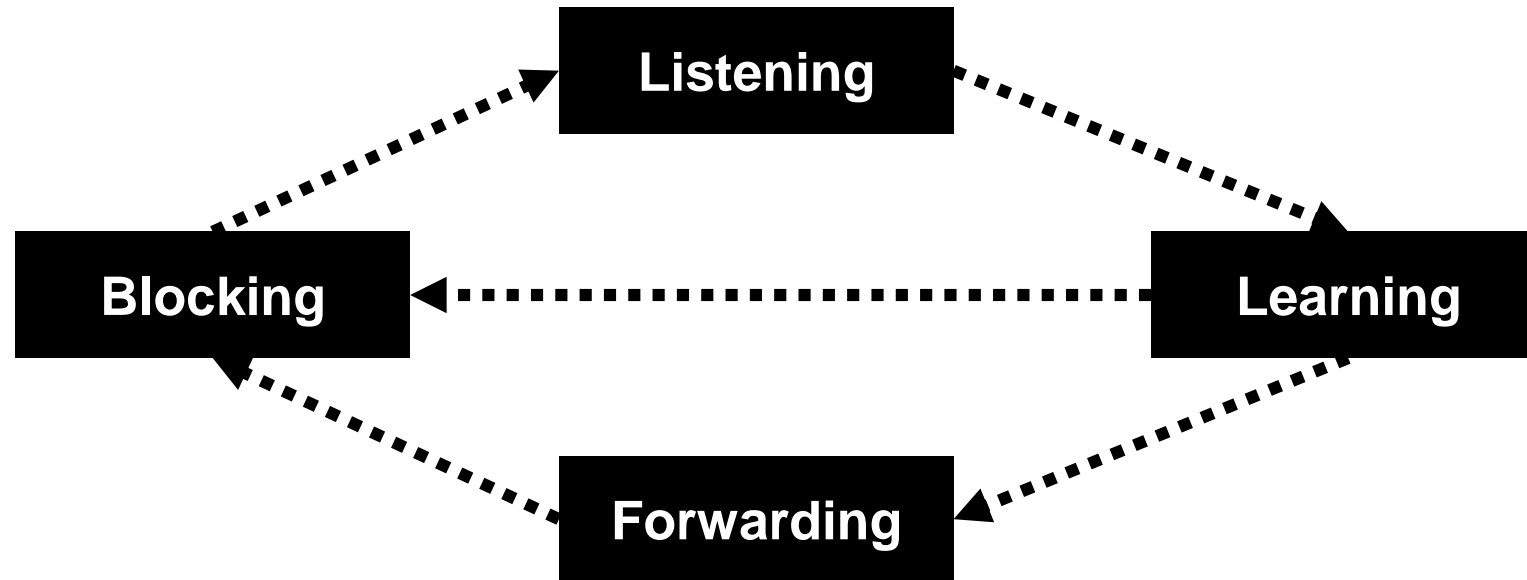
루트 포트 선택 후 블록 포트 선택



Spanning-tree

Spanning-tree 동작 방식

› 트래픽 Forwarding 시작



최소 50 초 소요

Blocking → Listening → Learning → Forwarding
(20 sec) (15 sec) (15 sec)

Spanning-tree

Spanning-tree 동작 방식

› 포트 상태에 따른 역할

포트 상태	설명
Disabled	어떠한 교섭도 하지 않으며, Frame도 전달하지 않음
Blocking	수신되는 BPDU만을 청취하고 Frame은 전달하지 않음
Listening	포트 역할 선출 과정을 진행하고 Frame은 전달하지 않음
Learning	수신되는 Frame의 MAC 정보를 학습하고 Frame은 전달하지 않음
Forwarding	수신되는 Frame에 대해 전달 가능함

Spanning-tree

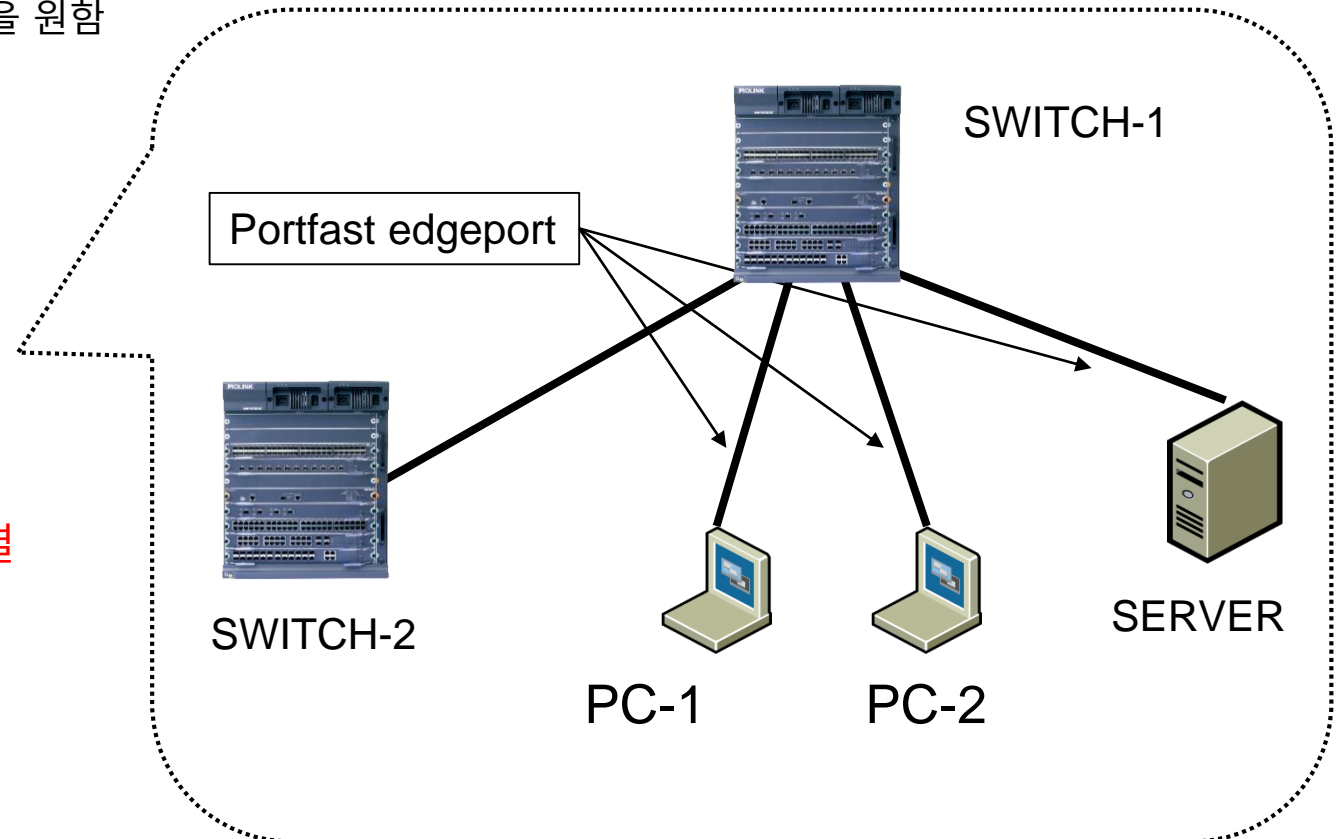
Portfast edgeport

Fast Convergence 필요성

- Spanning-tree는 Topology 변화에 대해 느리게 수렴
- 약 30~ 50초 소요
- 일반적인 PC 또는 서버는 좀 더 빠른 수렴을 원함

Portfast 특성

- 포트 상태를 빠르게 변경
- Listening과 Learning 상태를 생략
- PC나 서버와 같은 단말에만 적용
- Portfast가 적용된 포트에 스위치 연결 시 Loop의 위험성을 가짐



Spanning-tree

Portfast edgeport

› Portfast 설정

```
BS9700_config#interface gi1/0
BS9700_config#spanning-tree ?
backbonefast  -- Setup spanning-tree protocol backbonefast function
bpdu-terminal  -- Disable bpdu forwarding when no STP mode is running
designated-auto -- Enable Auto-designated-ports on linecards
fast-aging     -- Enable fast MAC-address aging in rapid spanning-tree modes
loopfast      -- Setup spanning-tree protocol loopfast function
loopguard     -- Setup spanning-tree protocol loopguard function
management    -- Configure SNMP management of Spanning-tree
mode          -- Setup spanning-tree protocol mode
mstp          -- Setup spanning-tree protocol on mstp mode
portfast      -- Setup spanning-tree protocol portfast function
rstp          -- Setup spanning-tree protocol on rstp mode
sstp          -- Setup spanning-tree protocol on sstp mode
uplinkfast    -- Setup spanning-tree protocol uplinkfast function
vlan          -- Setup spanning-tree protocol on vlans
BS9700_config#spanning-tree portfast ?
bpdufilter    -- Start bpdu filter
bpduguard     -- Start bpdu guard
default       -- Default
BS9700_config#
```


Spanning-tree

RSTP(Rapid Spanning-tree Protocol)

› RSTP의 장점

- RSTP는 STP에 비해 상대적으로 빠른 복구가 가능
- 10초 이내의 빠른 복구 시간
- 새로운 Root Port는 급속히 Forwarding 상태로 전환
- Designated port도 신속하게 Forwarding 상태로 전환

STP와 RSTP 포트 상태 비교

STP 포트 상태	RSTP 포트 상태	포트 활성화 여부	포트의 MAC 주소 학습 여부
Disabled	Discarding	미지원	미지원
Blocking	Discarding	미지원	미지원
Listening	Discarding	지원	미지원
Learning	Learning	지원	지원
Forwarding	Forwarding	지원	지원

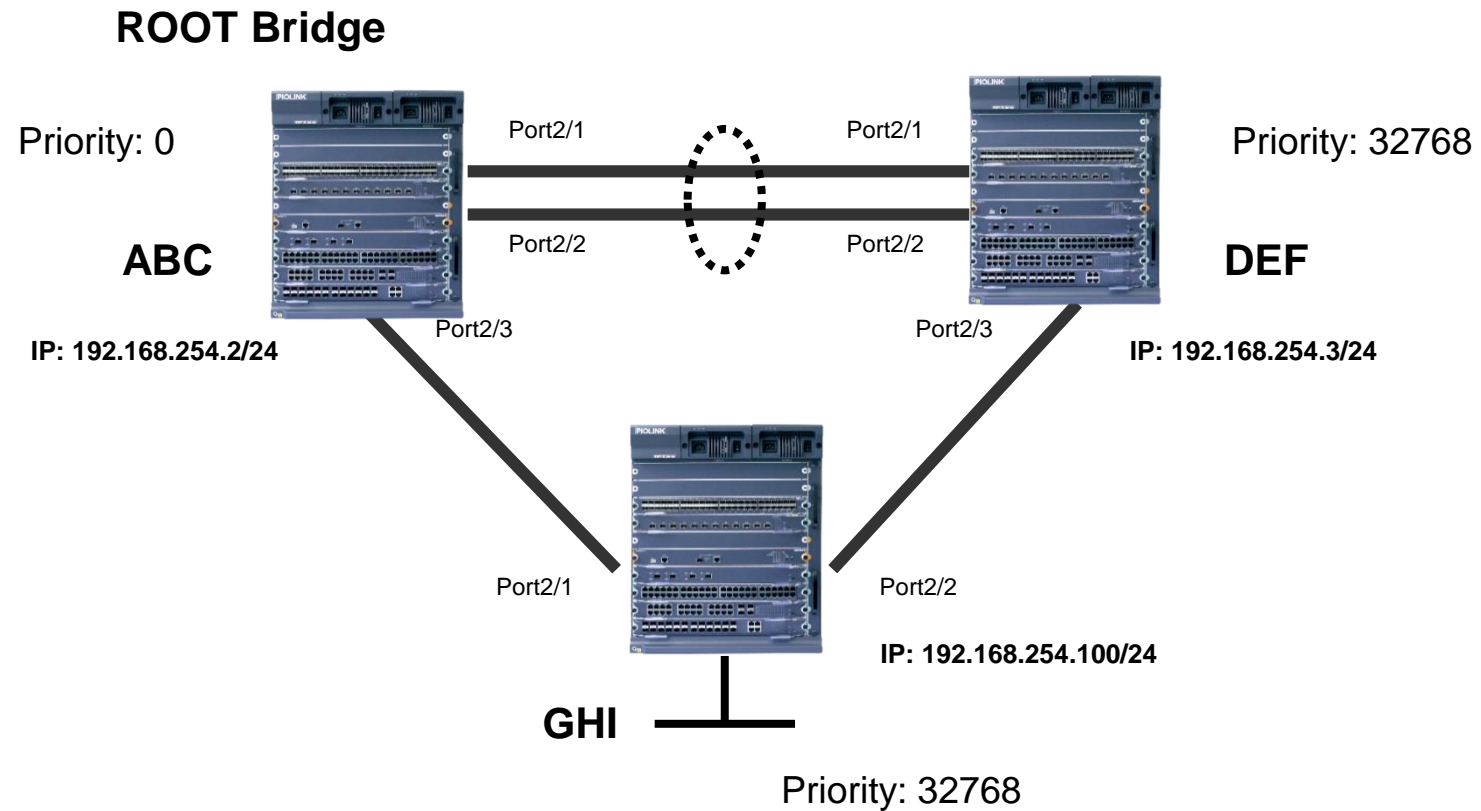
Spanning-tree

Default STP Configuration

구분	Default Value
STP Process	Disabled
Bridge Priority	32,768
Port Priority	128
Path Cost Method	dot1D-1998 dot1T-2001(Default)
Path Cost	10G: 2,000 1G: 20,000 100M: 200,000
Hello Time	2 second
Forward Delay Time	15 second
MAX Aging Time	20 second

Spanning-tree

Spanning-tree 예제



Spanning-tree

Spanning-tree

Spanning-tree 설정 절차

- I. STP 모드 선택
- II. STP priority 선택(optional)
- III. STP path cost method 선택(optional)
- IV. STP 프로세스 활성화
- V. STP 설정 확인
- VI. Show command 확인

Spanning-tree

Spanning-tree 설정 방법

› 1. STP 모드 선택

```
BS9700#conf
BS9700_config#
BS9700_config#spanning-tree mode ?

mstp -- Setup multiple spanning-tree protocol mode
pvst -- Setup spanning-tree protocol pvst mode
rstp -- Setup rapid spanning-tree protocol mode
ssdp -- Setup spanning-tree protocol ssdp mode

BS9700_config#spanning-tree mode ssdp
```

› 2. STP priority 선택(optional)

```
BS9700_config#spanning-tree ssdp priority ?
<0-61440> -- ssdp mode priority value
BS9700_config#spanning-tree ssdp priority 0
```

Spanning-tree

Spanning-tree 설정 방법

› 3. STP path cost 설정

```
BS9700#conf
BS9700_config#int gi1/1
BS9700_config_g1/1#spanning-tree cost ?
<1-65535> -- interface cost value
BS9700_config_g1/1#spanning-tree cost
```

› 4. STP 프로세스 활성화

```
BS9700_config#spanning-tree
BS9700_config#
```

Spanning-tree

Spanning-tree 설정 방법

› 5. STP 설정 확인

```
BS9700#sh run | inc spanning-tree  
Building configuration...
```

Current configuration:

!

```
spanning-tree mode rstp  
spanning-tree portfast default  
spanning-tree sstp priority 0  
BS9700#
```

Spanning-tree

Spanning-tree 설정 방법

› 6. Show command 확인

```
BS9700#show spanning-tree
```

```
Spanning tree enabled protocol RSTP(2004)
```

```
RSTP
```

```
Root ID Priority 32768
```

```
Address FCFA.F744.6FB0
```

```
This bridge is the root
```

```
Hello Time 2 sec Max Age 20 sec Forward Delay 15 sec
```

```
Bridge ID Priority 32768
```

```
Address FCFA.F744.6FB0
```

```
Hello Time 2 sec Max Age 20 sec Forward Delay 15 sec
```

```
Interface Role Sts Cost Pri.Nbr Type
```

```
-----
```

```
g1/13 Desg FWD 20000 128.102 Edge
```

```
BS9700#
```


Spanning-tree

Spanning-tree 상세 정보

› Spanning-tree 상세 정보

```
BS9700#show spanning-tree detail
```

```
RSTP (running)
```

```
The bridge has priority 32768, address FCFA.F744.6FB0
```

```
Configured hello time 2, max age 20, forward time 15
```

```
We are the root of the spanning tree
```

```
Port 102 (GigaEthernet1/13) of RSTP is Forwarding
```

```
Edge port(TRUE), Link type is auto ptop
```

```
Port Identifier 128.102, Port role DesignatedPort
```

```
Port path cost 20000, Port priority 128
```

```
Designated root has priority 32768, address FCFA.F744.6FB0
```

```
Designated bridge has priority 32768, address FCFA.F744.6FB0
```

```
Designated port id is 128.102, designated path cost 0
```

```
.  
.
.
```

```
BS9700#
```

Spanning-tree

Spanning-tree 상세 정보

› Spanning-tree 특정 포트만 필터 하여 확인

```
BS9700#show spanning-tree interface gi1/13
```

```
Port 102 (GigaEthernet1/13) of RSTP is Forwarding
Edge port(TRUE), Link type is auto ptop
Port Identifier 128.102, Port role DesignatedPort
Port path cost 20000, Port priority 128
Designated root has priority 32768, address FCFA.F744.6FB0
Designated bridge has priority 32768, address FCFA.F744.6FB0
Designated port id is 128.102, designated path cost 0
Timers: message age 0, forward delay 15, hello 2
        message expires in 0 seconds
Number of transitions to forwarding state: 1
        last transitions occurred 00:36:49 ago
ADP delay 5 seconds
sent BPDU :    1108
        TCN: 0, RST: 1108, Config BPDU: 0
received BPDU : 0
        TCN: 0, RST: 0, Config BPDU: 0
```

```
BS9700#
```

Part#LAG

LAG

Link-Aggregation 개요

› Link-Aggregation 란?

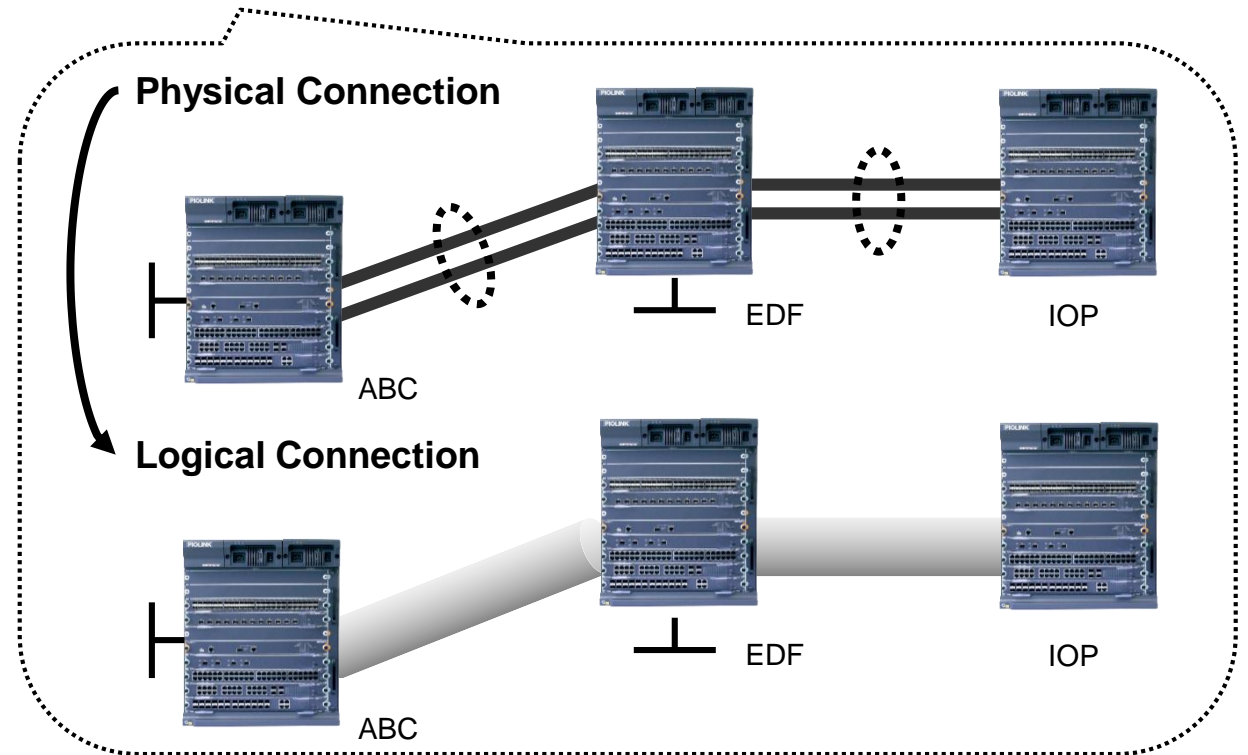
- 다수의 물리적인 포트를 하나의 논리적인 포트로 구성하는 기술

사용하는 용어

- Omni-channel
- Multi-Link Trunk
- Ether-Channel
- LACP
- 기타

› Link-Aggregation 이점

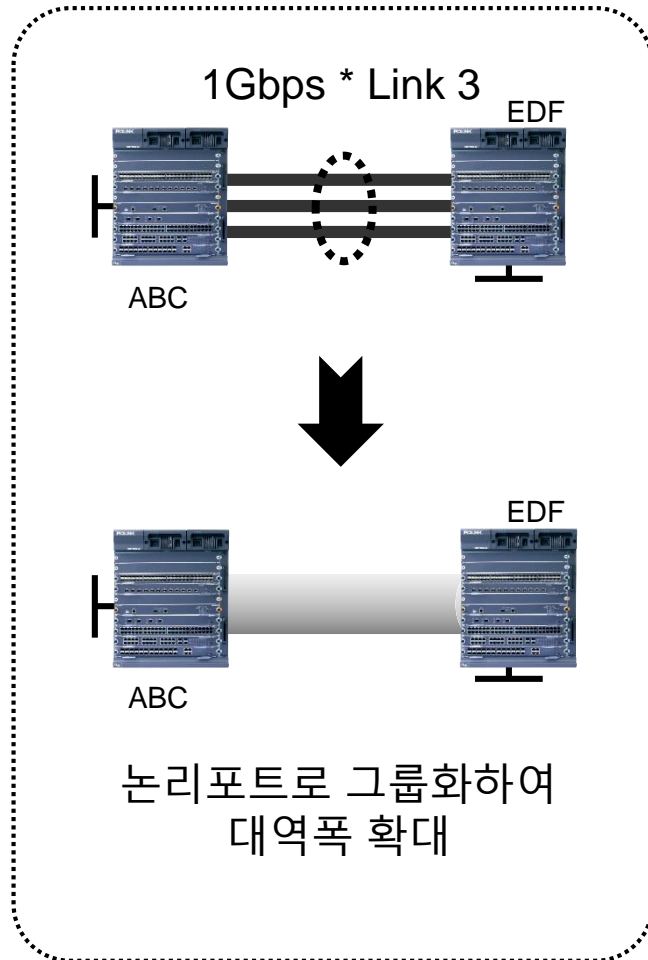
- 대역폭 증가(Bandwidth Increment)
- 링크 이중화(Redundancy)
- 부하 분산 효과(Load-sharing)



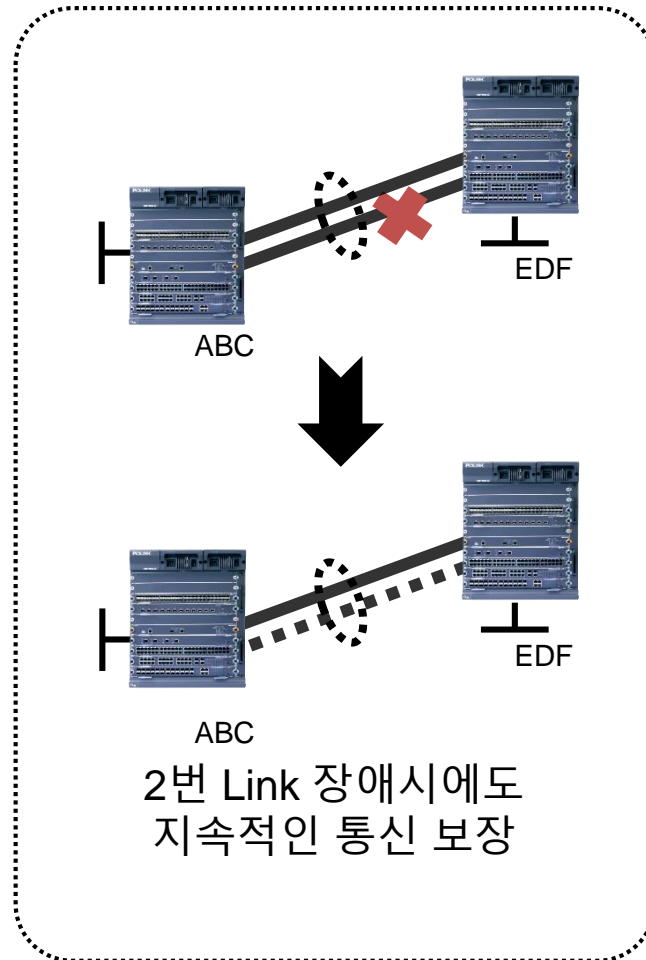
LAG

Link-Aggregation 효과

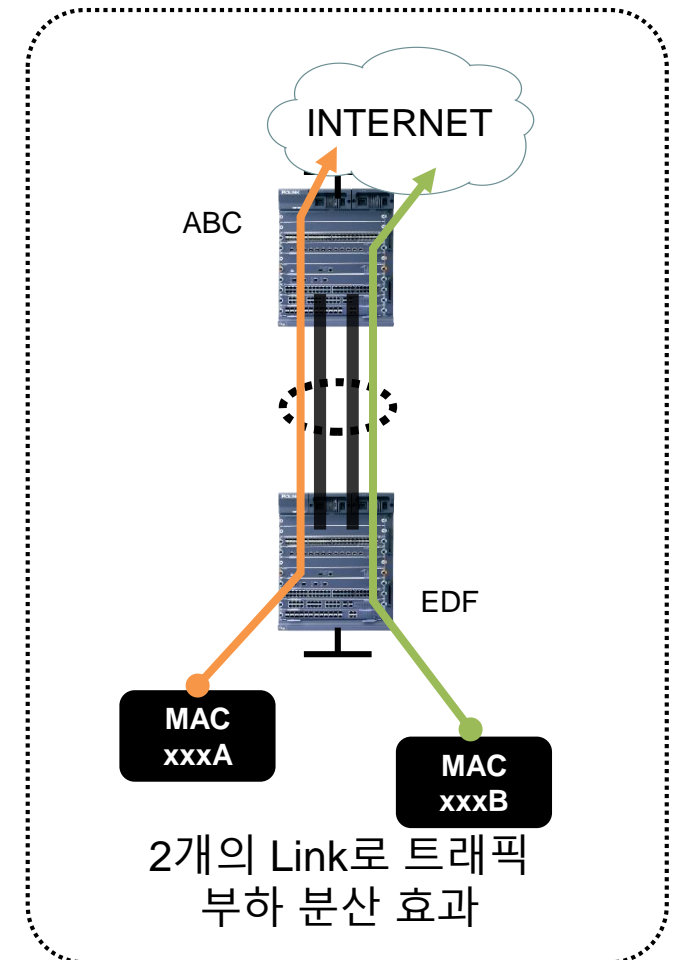
대역폭 증가



링크 이중화



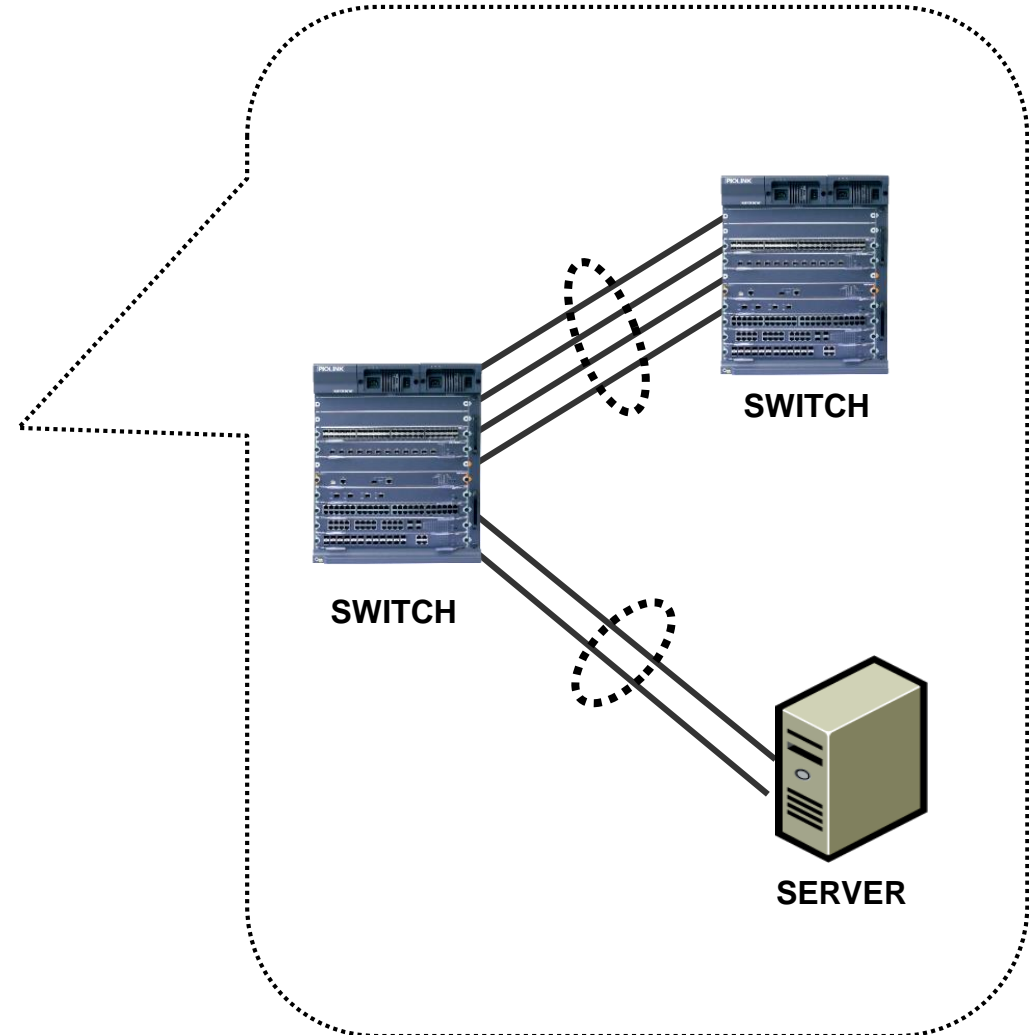
부하 분산



LAG

Link-Aggregation 방법

- › **Link-Aggregation 구성 방법**
 - Manual Link Aggregation
 - Dynamic Link Aggregation
- › **Manual Link-Aggregation (Static)**
 - Manual Aggregation는 사용자에게 의해 구성
 - 상대 Aggregation 그룹과 교섭 과정 없음
- › **Dynamic Link-Aggregation**
 - IEEE 802.3ad (LACP)
 - 상대 Aggregation 그룹과의 교섭 과정으로 구성
 - 표준 프로토콜
- › **Link-Aggregation 용도**
 - Switch to Switch
 - Switch to Server
 - Switch to etc



LAG

Link-Aggregation

- › **Link-Aggregation 부하 분산 방법**
 - 기본적으로 출발지 MAC을 기준으로 부하 분산
 - Network 구성 환경에 따라 선택

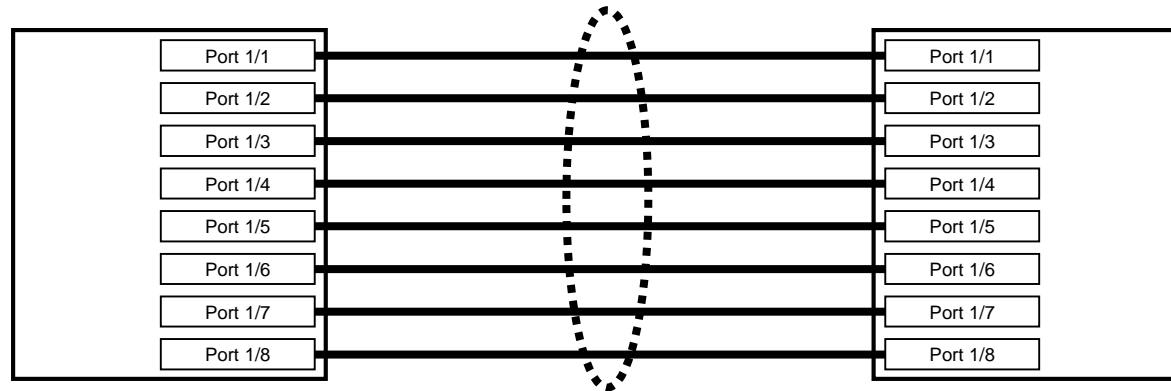
구분	설명
dst-ip	목적지 IP를 기준으로 Load balance 실행
dst-mac	목적지 MAC를 기준으로 Load balance 실행
src-dst-ip	출발지와 목적지 IP 조합을 기준으로 Load balance 실행
src-dst-mac	출발지와 목적지 MAC 조합을 기준으로 Load balance 실행
src-ip	출발지 IP를 기준으로 Load balance 실행
src-mac	출발지 MAC를 기준으로 Load balance 실행 (Default)

LAG

Link-Aggregation

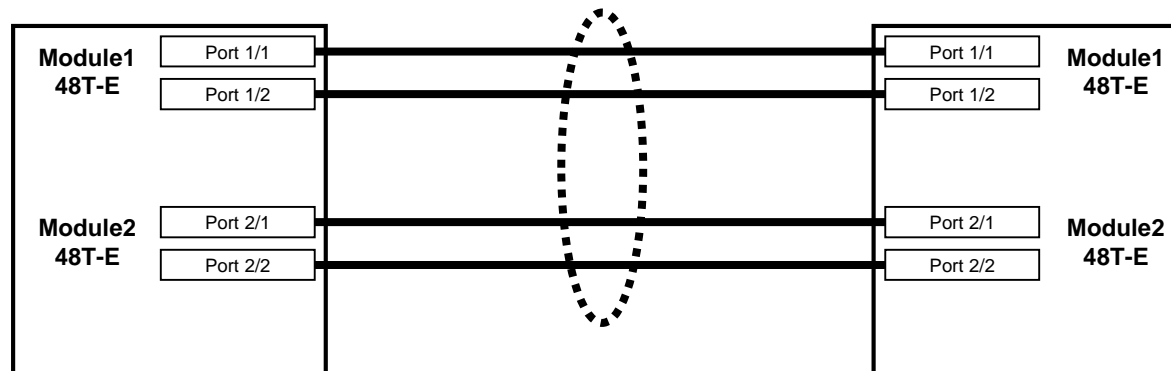
› Link-Aggregation 가이드라인

- 최대 여덟 개의 포트가 한 그룹에 포함 될 수 있다.



MAX 8-port in a group

- 동일한 타입의 모듈로 채널 그룹을 구성해야 한다.



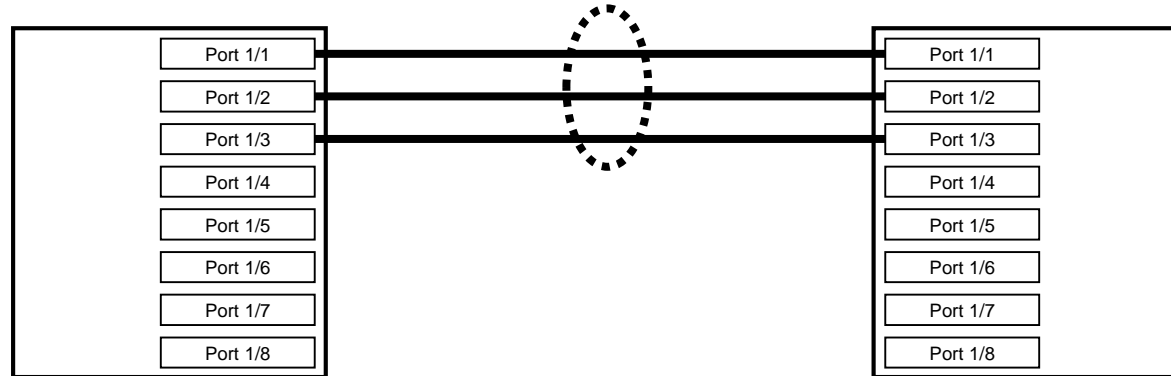
Same Media-type

LAG

Link-Aggregation

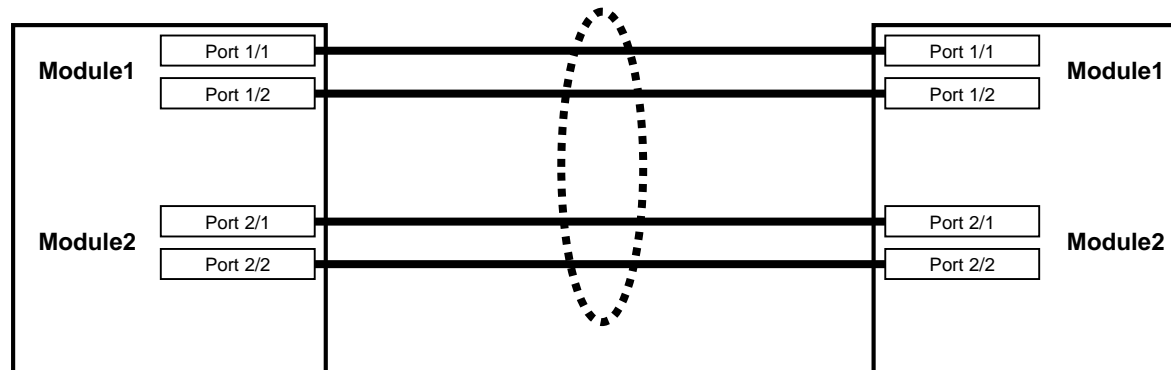
› Link-Aggregation 가이드라인

- Link 채널 구성 시 연속적인 포트번호로 구성 할 수 있다.



Multi-port in single slot

- 포트가 비 연속적이거나 서로 다른 모듈간에 구성도 가능하다.

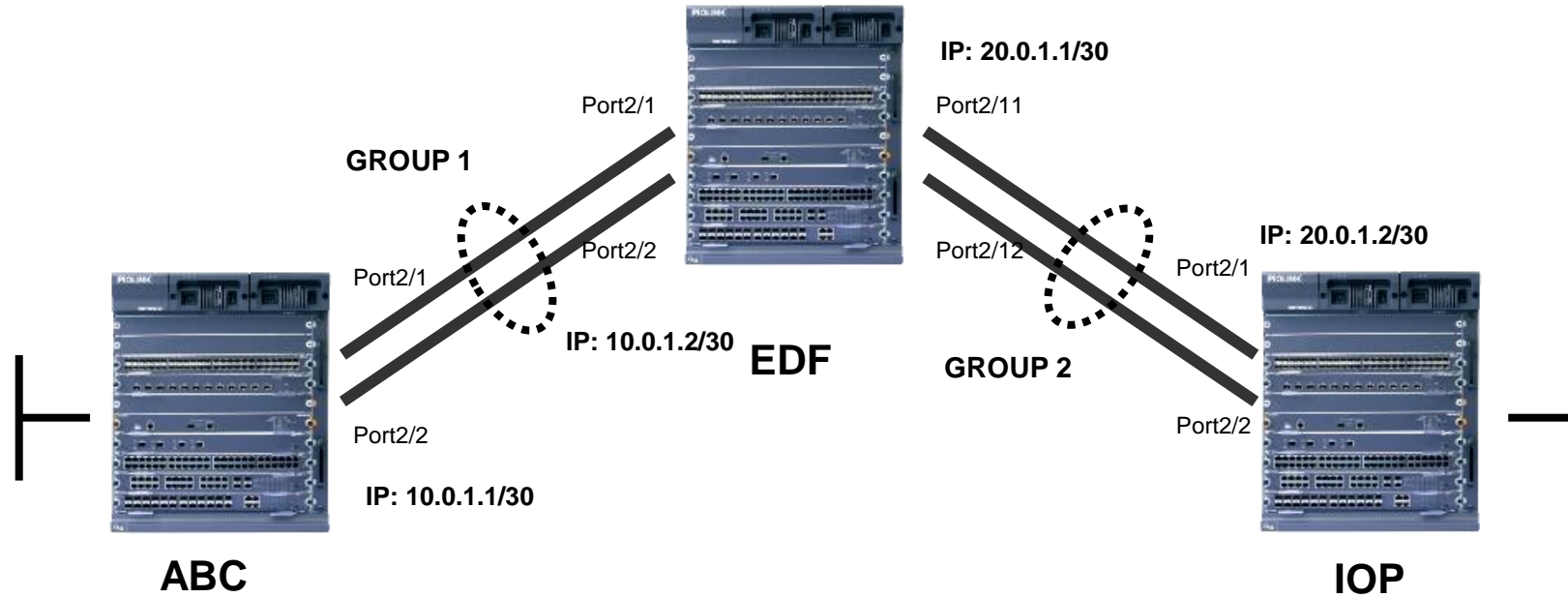


Multi-port in multi slot

LAG

Link-Aggregation

› Link-Aggregation 예제



LAG

Link-Aggregation

Link-Aggregation 설정 절차

- I. Link-Aggregation 그룹 생성 및 동작 모드 선택
- II. 포트에 생성된 Link-Aggregation 그룹 할당
- III. 생성된 Link-Aggregation 그룹에 VLAN 및 기타 설정
- IV. Link-Aggregation 설정 확인
- V. Show command 확인

LAG

Link-Aggregation 설정 방법

› 1. Link-Aggregation 그룹 생성

```
BS9700_config#interface port-aggregator 1
BS9700_config_p1#
```

› 2. 포트에 생성된 Link-Aggregation 그룹 할당

```
BS9700#conf
BS9700_config#interface gi1/1
BS9700_config_g1/1#aggregator-group 1 mode ?
static -- Static port aggregate to aggregator
lacp   -- Enable lacp protocol negotiate
BS9700_config_g1/1#aggregator-group 1 mode lacp ?
Active -- Lacp Active mode (default)
Passive -- Lacp Passive mode
<cr>
BS9700_config_g1/1#aggregator-group 1 mode lacp
```

LAG

Link-Aggregation 설정 방법

› 3. Link-Aggregation 그룹에 VLAN 설정

```
BS9700_config#  
BS9700_config#interface port-aggregator 1  
BS9700_config_p1#switchport mode trunk  
BS9700_config_p1#switchport trunk ?  
  vlan-allowed  -- Set allowed VLANs when port is in trunking mode  
  vlan-untagged -- Set untagged VLANs when port is in trunking mode  
BS9700_config_p1#switchport trunk vlan-allowed add 10  
BS9700_config_p1#exit
```

› 4. Link-Aggregation 설정 확인

```
BS9700#sh run interface port-aggregator 1  
Building configuration...  
  
Current configuration:  
!  
interface Port-aggregator1  
  switchport mode trunk  
BS9700#
```

```
BS9700#sh run interface gi1/1  
Building configuration...  
  
Current configuration:  
!  
interface GigaEthernet1/1  
  aggregator-group 1 mode lacp  
  switchport mode trunk  
BS9700#
```

LAG

Link-Aggregation 설정 방법

› 5. Show command 확인

Link-aggregation 전체 Summary 정보

```
BS9700#show aggregator-group summary
Flags: D - down      A - Use In port-aggregator
      U - Up        I - Not In port-aggregator
      d - default
Group Port-aggregator Ports
-----+-----+-----
1   Po1(D)   g1/1(DId)
BS9700#
```

Link-aggregation 포트 Member 정보

```
BS9700#show aggregator-group brief
      Aggregator-group brief infomation
      -----
Group: 1
-----
System ID : 32768 FCFA.F744.6FB0   Partner : 0 0000.0000.0000
Group ID  : 32768 FCFA.F744.6FB0   state  : lineDown
Max Ports : 8                      ports  : 1
-----
```

LAG

Link-Aggregation 설정 방법

› Link-aggregation 포트 일반 정보

```
BS9700#show interface port-aggregator 1
Port-aggregator1 is down, line protocol is down
Ifindex is 561
Hardware is PortAggregator, Address is fcfa.f744.6fb0(fcfa.f744.6fb0)
MTU 1500 bytes, BW 10000 kbit, DLY 2000 usec
Encapsulation ARPA
Members in this Aggregator:
5 minutes input rate 0 bits/sec, 0 packets/sec
5 minutes output rate 0 bits/sec, 0 packets/sec
Real time input rate 0 bits/sec, 0 packets/sec
Real time output rate 0 bits/sec, 0 packets/sec
  Received 0 packets, 0 bytes
    0 broadcasts, 0 multicasts
    0 discard, 0 error, 0 PAUSE
    0 align, 0 FCS, 0 symbol, 0 fragment
    0 jabber, 0 oversize, 0 undersize
  Transmitted 0 packets, 0 bytes
    0 broadcasts, 0 multicasts
    0 discard, 0 error, 0 PAUSE
    0 collision, 0 indisc, 0 deferred
    0 single, 0 multiple, 0 excessive, 0 late
BS9700#
```

LAG

Link-Aggregation 설정 방법

› Link-aggregation 포트 LACP 정보

```
BS9700#show aggregator-group detail
      Aggregator-group detail information(1)
      -----
Group: 1
-----
System ID : 32768 FCFA.F744.6FB0   Partner : 0 0000.0000.0000
Group ID : 32768 FCFA.F744.6FB0   state : lineDown
Max Ports : 8                      ports : 1
-----
Flags: U - Port line status Up.      D - Port line status Down.
      F - lacp abled(FullDuplex Mode).  A - port Aggregated in Group.
State: a - LACP is Running In Active Mode. p - LACP Passive Mode
      l - LACP Use LongTimeOut.        s - LACP synchronization.
      d - LACP use default setting.    e - LACP Expired.

Port: g1/1
Status: Up   Individual
Aggregator-group : 1   Mode : LACP
LACP information
Actor          |Partner
Port  Flags State Pri |Port Pri State System
g1/1  UF   algd 0   |0   0   algd 0-0000.0000.0000
RX SM:  Defaulted
PT SM:  SlowPeriodic
SL SM:  ready_N ready
        FALSE  FALSE  =>Unselected
Mx SM:  Detached
Tx SM:  NTT    Count Interval(ms)
        FALSE  1    950
```


LAG

Link-Aggregation 설정 방법

› Link Down 상태 시

```

BS9700#show aggregator-group detail
      Aggregator-group detail information(1)
      -----
Group: 1
-----
System ID : 32768 FCFA.F744.6FB0   Partner : 0 0000.0000.0000
Group ID : 32768 FCFA.F744.6FB0   state : lineDown
Max Ports : 8                      ports : 1
-----
Flags: U - Port line status Up.      D - Port line status Down.
      F - lacp abled(FullDuplex Mode).  A - port Aggregated in Group.
State: a - LACP is Running In Active Mode. p - LACP Passive Mode
      l - LACP Use LongTimeOut.        s - LACP synchronization.
      d - LACP use default setting.     e - LACP Expired.

Port: g1/1
Status: Down Individual
Aggregator-group : 1 Mode : LACP
LACP information
Actor          |Partner
Port  Flags State Pri |Port Pri State System
g1/1  DF   algd 0   |0   0   algd 0-0000.0000.0000
RX SM:  PortDisabled
PT SM:   NoPeriodic
SL SM:   ready_N ready
        FALSE  FALSE  =>Unselected
Mx SM:   Detached
Tx SM:   NTT    Count  Interval(ms)
        FALSE  1     35750
  
```

LAG

Link-Aggregation

Link-Aggregation 삭제 절차

- I. LAG group 삭제
- II. LAG configuration 삭제 확인
- III. Show command 확인

LAG

Link-Aggregation 삭제 방법

› 1. LAG group 삭제

```
BS9700#conf
BS9700_config#no interface port-aggregator 1
BS9700_config#
```

› 2. LAG configuration 삭제 확인

```
BS9700#show run interface ?
GigaEthernet    -- GigaEthernet interface
Vlan             -- VLAN interface
Null            -- Null interface
BS9700#show run interface

port-aggregator 항목이 없어짐.
```

```
BS9700#sh run interface gi1/1
Building configuration...

Current configuration:
!
interface GigaEthernet1/1
 switchport mode trunk
BS9700#
```

(config)# 모드에서 LAG group 삭제 시 관련된 설정이 모두 삭제 된다.

LAG

Link-Aggregation 삭제 방법

› 3. Show command 확인

```
BS9700#show aggregator-group summary
Flags: D - down      A - Use In port-aggregator
      U - Up        I - Not In port-aggregator
      d - default
Group Port-aggregator Ports
-----+-----+-----
BS9700#
BS9700#show aggregator-group 1 brief
      Aggregator-group brief infomation
      -----
BS9700#
```

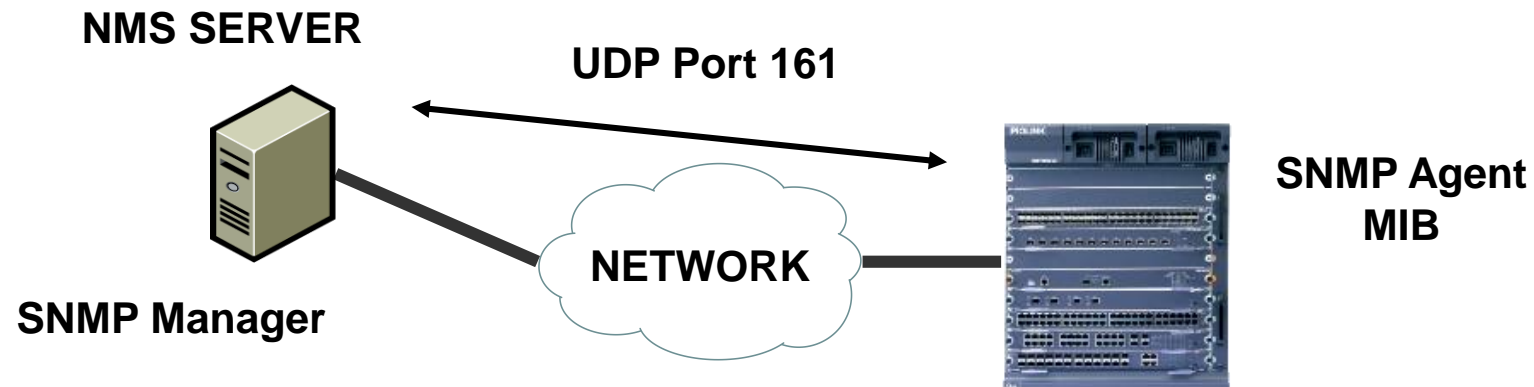
Part# SNMP

SNMP(Simple Network Management Protocol)

SNMP

- › **SNMP(Simple Network Management Protocol)란**
 - 간단한 네트워크 관리 프로토콜
 - 네트워크에 있는 다양한 장비를 관리 및 감시하는 응용 프로토콜

- › **SNMP 활용**
 - 대형화된 네트워크를 효과적으로 관리
 - 다양한 정보를 수집 및 응용 가능(ex: 트래픽 사용량, CPU/Memory 사용량 등)



SNMP(Simple Network Management Protocol)

SNMP

› SNMP 버전별 차이점

- SNMPv1/v2는 인증 시 Community String을 사용함
- SNMPv3는 기존 Model 들에 비해 보안(인증 및 암호화)이 더 강화됨

Model	보안 Level	인증	암호화	설명
SNMPv1	noAuthNoPriv	Community String	No	인증 시 Community를 사용
SNMPv2	noAuthNoPriv	Community String	No	인증 시 Community를 사용
SNMPv3	noAuthNoPriv	Username	No	인증 시 Username을 사용
	authNoPriv	MD5 or SHA	No	인증 시 MD5 또는 SHA 보안 알고리즘 사용
	authPriv	MD5 or SHA	DES or AES	인증 및 암호화까지 보안 알고리즘 사용

SNMP(Simple Network Management Protocol)

SNMP

› SNMP 예제

NMS SERVER



IP: 192.168.254.200/24



ABC

IP: 192.168.254.1/24

Community: test123

SNMP(Simple Network Management Protocol)

SNMP 설정 방법

SNMP 설정 절차

- I. SNMP 프로세스 활성화
- II. SNMP community 설정
- III. SNMP 접근 제어(ACL, optional)
- IV. SNMP 설정 확인
- V. Show command 확인

SNMP(Simple Network Management Protocol)

SNMP 설정 방법

› 1. SNMP 프로세스 활성화

```
BS9700#conf
BS9700_config#snmp-server enable
BS9700_config#
```

› 2. SNMP community 설정

```
BS9700#conf
BS9700_config#snmp-server community test123 ?
WORD -- Std IP accesslist allowing access with this community string
ro -- Read-only access with this community string
rw -- Read-write access with this community string
view -- Restrict this community to a named MIB view
<cr>
BS9700_config#snmp-server community test123 ro ?
WORD -- Std IP accesslist allowing access with this community string
view -- Restrict this community to a named MIB view
<cr>
BS9700_config#snmp-server community test123 ro
BS9700_config#
```

SNMP(Simple Network Management Protocol)

SNMP 설정 방법

› 3. SNMP 접근 제어(optional)

```
BS9700#conf
BS9700_config#ip access-list standard 1
BS9700_config_std#permit 192.168.212.0 255.255.255.0
BS9700_config_std#exit
BS9700_config#
BS9700_config#snmp-server community test123 ro ?
WORD -- Std IP accesslist allowing access with this community string
view -- Restrict this community to a named MIB view
<cr>
BS9700_config#snmp-server community test123 ro 1
```

SNMP(Simple Network Management Protocol)

SNMP 설정 방법

› 4. SNMP 설정 확인

```
BS9700#sh run | inc snmp-server  
Building configuration...
```

Current configuration:

!

```
snmp-server community 0 test123 RO 1
```

```
BS9700#
```

```
BS9700#
```

```
BS9700#conf
```

```
BS9700_config#no snmp-server community test123
```

SNMP(Simple Network Management Protocol)

SNMP 설정 방법

› SNMP 통계 확인

```
BS9700#  
BS9700#show snmp  
0 SNMP packets input  
  0 Bad SNMP version errors  
  0 Unknown community name  
  0 Illegal operation for community name supplied  
  0 Encoding errors  
  0 Number of requested variables  
  0 Number of altered variables  
  0 Get-request PDUs  
  0 Get-next PDUs  
  0 Set-request PDUs  
0 SNMP packets output  
  0 Too big errors (Maximum packet size 3000)  
  0 No such name errors  
  0 Bad values errors  
  0 General errors  
  0 Response PDUs  
  0 Trap PDUs  
BS9700#
```

SNMP(Simple Network Management Protocol)

SNMPv3 설정 방법

› SNMPv3 예제

NMS SERVER



IP: 192.168.254.200/24



ABC

IP: 192.168.254.1/24

SNMPv3 user: test
SNMPv3 group: itteam

SNMP(Simple Network Management Protocol)

SNMPv3 설정 방법

SNMPv3 설정 절차

- I. SNMPv3 group 및 user 설정
- II. SNMP 접근 제어(View, optional)
- III. SNMPv3 설정 확인
- IV. Show command 확인

SNMP(Simple Network Management Protocol)

SNMPv3 설정 방법

› 1. SNMPv3 group 및 user 설정

```
BS9700_config#snmp-server group ?
WORD    -- Name of the group
BS9700_config#snmp-server group piolink v3 ?
auth    -- Specifies authentication of a packet without encrypting it
noauth  -- Specifies no authentication of a packet
priv    -- Specifies authentication of a packet with encryption
BS9700_config#snmp-server group piolink v3 auth ?
access  -- Specify an access-list associated with this group
notify  -- Specify a notify view for the group
read    -- Specify a read view for the group
write   -- Specify a write view for the group

BS9700_config#snmp-server group piolink v3 auth read ?
WORD    -- Name of view

BS9700_config#snmp-server user test piolink v3 priv aes256 auth sha test123!@#
```


SNMP(Simple Network Management Protocol)

SNMPv3 설정 방법

› 2. SNMP 접근 제어(View, optional)

```
BS9700_config#snmp-server view ?
```

```
WORD -- Name of the view
```

```
BS9700_config#snmp-server view system ?
```

```
WORD<1,64> -- MIB view family name
```

```
BS9700_config#snmp-server view system 1.3.6.1.2.1.1 ?
```

```
excluded -- MIB family is excluded from the view
```

```
included -- MIB family is included in the view
```

```
BS9700_config#snmp-server view system 1.3.6.1.2.1.1 included
```

```
BS9700_config#snmp-server group piolink v3 auth read ?
```

```
WORD -- Name of view
```

```
BS9700_config#snmp-server group piolink v3 auth read system
```

```
BS9700_config#
```

SNMP(Simple Network Management Protocol)

SNMPv3 설정 방법

› 3. SNMPv3 설정 확인

```
BS9700#show run | inc snmp-server  
Building configuration...
```

Current configuration:

!

```
snmp-server group piolink v3 auth read system  
snmp-server user test piolink v3 priv aes256 auth sha 0 test123!@#  
snmp-server community 0 test123 RW  
snmp-server view system 1.3.6.1.2.1.1 included  
BS9700#
```

SNMP(Simple Network Management Protocol)

SNMPv3 설정 방법

› SNMPv3 group 및 user 정보 확인

```
BS9700#show snmp group
groupname: piolink
security model: v3 auth
read: system
write: <no writeview specified>
notify: <no notifyview specified>
```

```
BS9700#show snmp user
```

```
User name: admin
Engine ID: 80000cf803fcfaf7446fb
storage-type: nonvolatile
Rowstatus: active
Authentication Protocol: SHA
Group-name: test
```

```
BS9700#
```

SNMP(Simple Network Management Protocol)

SNMPv3 설정 방법

› SNMP view 정보 확인

```
BS9700_config#snmp-server view system 1.3.6.1.2.1.1 included
BS9700_config#show snmp view
system system -      included      permanent      active
BS9700_config#
```

Part# Syslog

SYSLOG

Syslog 개요

- › **Syslog(System Log)란**
 - 시스템에서 발생하는 경보 및 Event 등의 정보를 관리자에게 Message를 통해 전송
- › **Syslog Level**
 - Syslog Level은 총 8개의 Level로 구분 됨

Level	구분	
0	Emergencies	Log 출력 시 즉각적인 수정이 필요
1	Alerts	
2	Critical	
3	Errors	Log 출력 시 System 점검이 필요
4	Warnings	
5	Notifications	
6	Informational	개발자들이 사용하는 Log Level
7	debugging	

100

0

위험도

SYSLOG

Syslog Level 설정

› 1. Syslog Level 확인

```
BS9700_config#show logging
Syslog logging: enabled (0 messages dropped, 0 flushes, 0 overruns)
  Console logging: level debugging, 159 messages logged
  Monitor logging: level debugging, 7 messages logged
  Buffer logging: level debugging, 899 messages logged
  Trap logging: level informational, 0 message lines logged

Log Buffer (4000000 bytes total 3944662 bytes remain):
```

남은 Log buffer 용량 확인

SYSLOG

Syslog Level 설정

› 2. console Syslog Level 변경

```
BS9700_config#logging console ?
<4096-2147483647> -- Logging buffer size(bytes)
alarm-threshold      -- Alarm threshold
alerts               -- Immediate action needed          (severity=1)
critical             -- Critical conditions                (severity=2)
debugging            -- Debugging messages                (severity=7)
emergencies          -- System is unusable                (severity=0)
errors               -- Error conditions                  (severity=3)
informational         -- Informational messages                (severity=6)
notifications        -- Normal but significant conditions  (severity=5)
rate-limit           -- Set rate-limit
warnings             -- Warning conditions                (severity=4)
time-range           -- Set the time range for logging
BS9700_config#logging console
```


SYSLOG

Syslog Level 설정

› 3. buffer Syslog Level 변경

```
BS9700_config#logging buffered ?
<4096-2147483647> -- Logging buffer size(bytes)
alarm-threshold      -- Alarm threshold
alerts               -- Immediate action needed          (severity=1)
critical             -- Critical conditions                (severity=2)
debugging            -- Debugging messages                (severity=7)
emergencies          -- System is unusable                 (severity=0)
errors               -- Error conditions                   (severity=3)
informational         -- Informational messages              (severity=6)
notifications        -- Normal but significant conditions  (severity=5)
rate-limit           -- Set rate-limit
warnings             -- Warning conditions                  (severity=4)
time-range           -- Set the time range for logging
BS9700_config#logging buffered
```

SYSLOG

Syslog Level 설정

› 4. Syslog Level 변경 확인

```
BS9700#show logging
Syslog logging: enabled (0 messages dropped, 0 flushes, 0 overruns)
  Console logging: level alerts, 195 messages logged
  Monitor logging: level debugging, 7 messages logged
  Buffer logging: level informational, 942 messages logged
  Trap logging: level informational, 0 message lines logged

Log Buffer (4000000 bytes total 3941073 bytes remain):
```

SYSLOG

Syslog 저장 용량 설정

› 5. Syslog 저장 용량 변경

```
BS9700_config#logging buffered ?
<4096-2147483647> -- Logging buffer size(bytes)

BS9700_config#logging buffered 1048576
```

› 6. Syslog 저장 용량 변경 확인

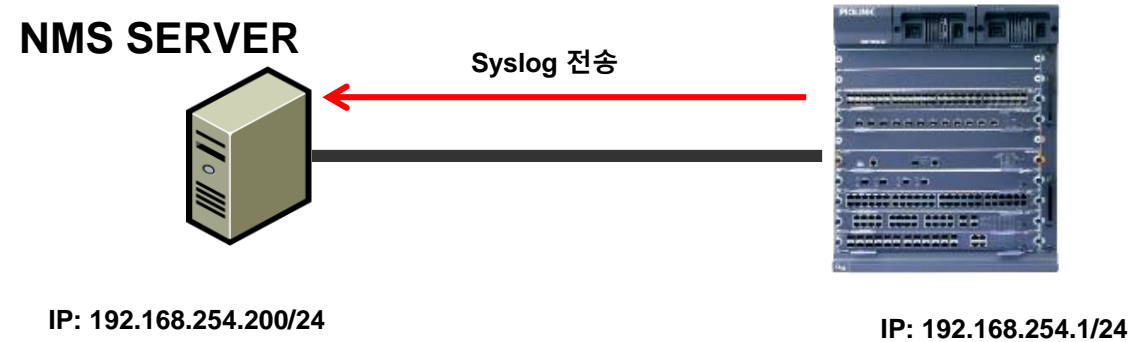
```
BS9700#show logging
Syslog logging: enabled (0 messages dropped, 0 flushes, 0 overruns)
  Console logging: level alerts, 195 messages logged
  Monitor logging: level debugging, 7 messages logged
  Buffer logging: level informational, 1 messages logged
  Trap logging: level informational, 0 message lines logged
```

Log Buffer (1048576 bytes total 1048488 bytes remain):

SYSLOG

Remote Syslog

- › **Remote Syslog 란**
 - 시스템에서 발생하는 경보 및 Event 등의 정보를 별도의 Log Server로 Syslog를 전송



SYSLOG

Remote Syslog 설정

› 1. Remote Syslog 설정

BS9700_config#logging ?

A.B.C.D -- IP address of the logging host

X:X:X::X -- IP address of the logging host

buffered -- Set buffered logging parameters

console -- Set console logging level

facility -- Facility parameter for syslog messages

history -- Configure syslog history table

command -- Logging while each command being executed

monitor -- Set terminal line (monitor) logging level

on -- Enable logging

source-interface -- Specify interface for source address in logging transactions

trap -- Set syslog server logging level

BS9700_config#logging

BS9700_config#logging 192.168.211.100 ?

SYSLOG

Remote Syslog 설정

› 2. Remote Syslog 목적지 설정

```
BS9700_config#logging 192.168.211.100 ?
emergencies      -- System is unusable                (severity=0)
alerts           -- Immediate action needed            (severity=1)
critical         -- Critical conditions                 (severity=2)
errors           -- Error conditions                   (severity=3)
warnings         -- Warning conditions                 (severity=4)
notifications    -- Normal but significant conditions (severity=5)
informational     -- Informational messages             (severity=6)
debugging        -- Debugging messages                (severity=7)
rfc3164          -- Send log to server with RFC3164(default)
rfc5424          -- Send log to server with RFC5424
<cr>

BS9700_config#logging 192.168.211.100 informational
```

SYSLOG

Remote Syslog 설정

› 3. Remote Syslog 설정 확인

```
BS9700#show logging
Syslog logging: enabled (0 messages dropped, 0 flushes, 0 overruns)
  Console logging: level debugging, 104 messages logged
  Monitor logging: level debugging, 0 messages logged
  Buffer logging: level debugging, 104 messages logged
  Trap logging: level informational, 1 message lines logged

Log Buffer (4000000 bytes total 3992546 bytes remain):
```

Part# Mirror

MIRROR

Mirror 개요

- › **Mirror 란**
 - 특정 포트에서 통신되는 트래픽을 다른 포트로 복사하는 기술
 - 통상 포트 기반한 Mirror 를 구성

- › **Mirror 활용**
 - 보안 장비에서 특정 트래픽을 관제 할 때(ex: NAC 솔루션)
 - 특정 트래픽을 관찰 할 때(ex: 통신 장애시 모니터링)

- › **Mirror 장점**
 - 스위치에서 일반적으로 지원되는 기능(언제라도 활용 가능)
 - 어느 포트나 Mirror 포트로 설정 가능(유연성)

- › **Mirror 단점**
 - 특정 트래픽에 대해 캡처가 제한될 수 있음
 - Mirror 세션 수 제한

MIRROR

Mirror Support

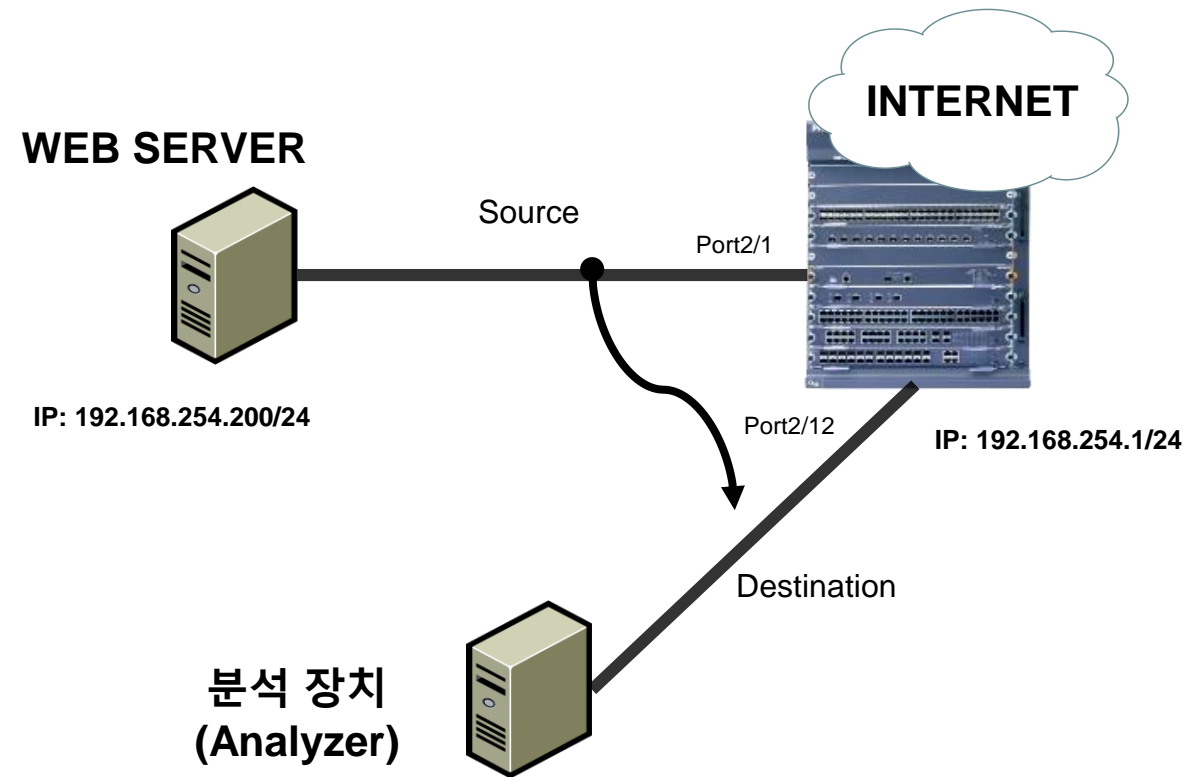
› Default Mirror Configuration

구분	Default Value
Mirror	None
MAX Session in System	4
MAX Session In Slot	RX 1, TX 1(both) RX 3
Configured	1:1, N:1
Method	Local Mirror Remote Mirror(VLAN-based)

MIRROR

Mirror 설정 방법

› Mirror 예제



MIRROR

Mirror 설정 방법

Mirror 설정 절차

- I. Mirror source 포트 설정
- II. Mirror destination 포트 설정
- III. Mirror 설정 확인
- IV. Show command 확인

MIRROR

Mirror 설정 방법

› 1. Mirror source 포트 설정

```

BS9700_config#mirror session ?
<1-4>          -- SPAN session number
BS9700_config#mirror session 1 ?
destination -- SPAN destination interface
source      -- SPAN source interface
BS9700_config#mirror session 1 source ?
interface -- SPAN source interface
BS9700_config#mirror session 1 source interface gi2/1 ?
,          -- Specify another range of interfaces
-          -- Specify a range of interfaces
both -- Monitor received and transmitted traffic
rx  -- Monitor received traffic only
tx  -- Monitor transmitted traffic only
<cr>
BS9700_config#mirror session 1 source interface gi2/1 both

```

MIRROR

Mirror 설정 방법

› 2. Mirror destination 포트 설정

```
BS9700_config#mirror session 1 destination interface gi2/12
```

› 3. Mirror 설정 확인

```
BS9700#show mirror

Session 1
-----
Destination Ports: g2/12
Source Ports:
    RX Only:      None
    TX Only:      None
    Both:         g2/1

BS9700#
```

MIRROR

Mirror 설정 방법

› 4. Show command 확인

```
BS9700#show run | inc mirror  
Building configuration...
```

Current configuration:

!

```
mirror session 1 destination interface g2/12  
mirror session 1 source interface g2/1 both  
BS9700#
```

Part# Routing

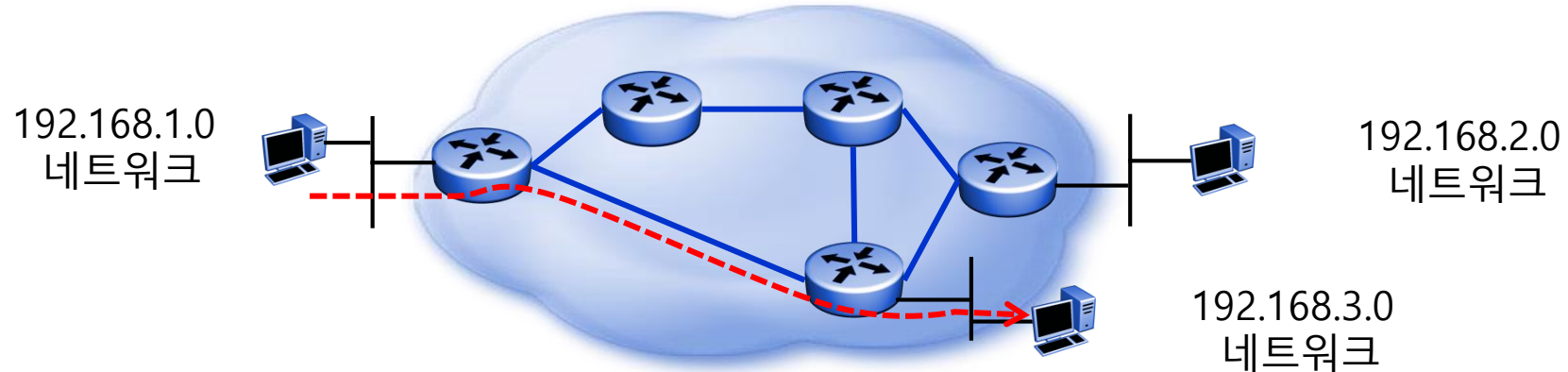
ROUTING

Routing 개요

› Routing 이란

- IP와 같은 3계층(네트워크 계층) 정보를 전송
- 전송 되어질 'IP 패킷을 안내할 경로 정보'입니다.
- 특정 목적지 주소로 패킷을 전송하기 위해 어느 장비로 패킷을 전송할 지 결정

192.168.1.0 네트워크를 192.168.3.0 네트워크로 전송



ROUTING

Routing 개요

› Routing 원칙

- 라우팅은 기본적으로 목적지 정보만 보고 이루어진다.
- 출발지 주소와 관계없이 목적지 정보만 확인한다.
- 목적지 정보가 동일하면 동일한 경로를 통과한다.

› Longest Match

- 다수의 경로가 존재 할 경우 가장 많이 부합 되는 경로로 찾아 간다.
- 예를 들어 10.1.1.0 네트워크 대역으로 가기 위한 경로가 다수일 경우 3번 경로를 이용해서 목적지를 찾아 간다.
 - ① ip route 0.0.0.0 0.0.0.0 192.168.1.2
 - ② ip route 10.0.0.0 255.0.0.0 192.168.2.2
 - ③ ip route 10.1.1.0 255.255.255.0 192.168.3.2

ROUTING

Routing 개요

› Default Routing

- 0.0.0.0/0 또는 0.0.0.0 0.0.0.0 으로 표기
- 알지 못하는 모든 네트워크를 표기할 때 사용
- 외부로 연결되는 경로가 1개일 경우에 주로 사용
- 즉, 인터넷 상에 존재하는 수십만 개의 네트워크 경로를 설정하거나, Routing Protocol을 연동하지 않아도 Default route를 사용하여 통신이 가능함

ROUTING

Static Routing

› Static Routing

- 자동으로 경로 정보를 받지 못하고 운영자가 수동으로 경로를 설정하는 방법
- 다른 네트워크로 연결되는 구간이 하나이거나 백업 경로가 없는 경우에 적합
- Default Metric(Cost)는 1이다.

› Floating Routing

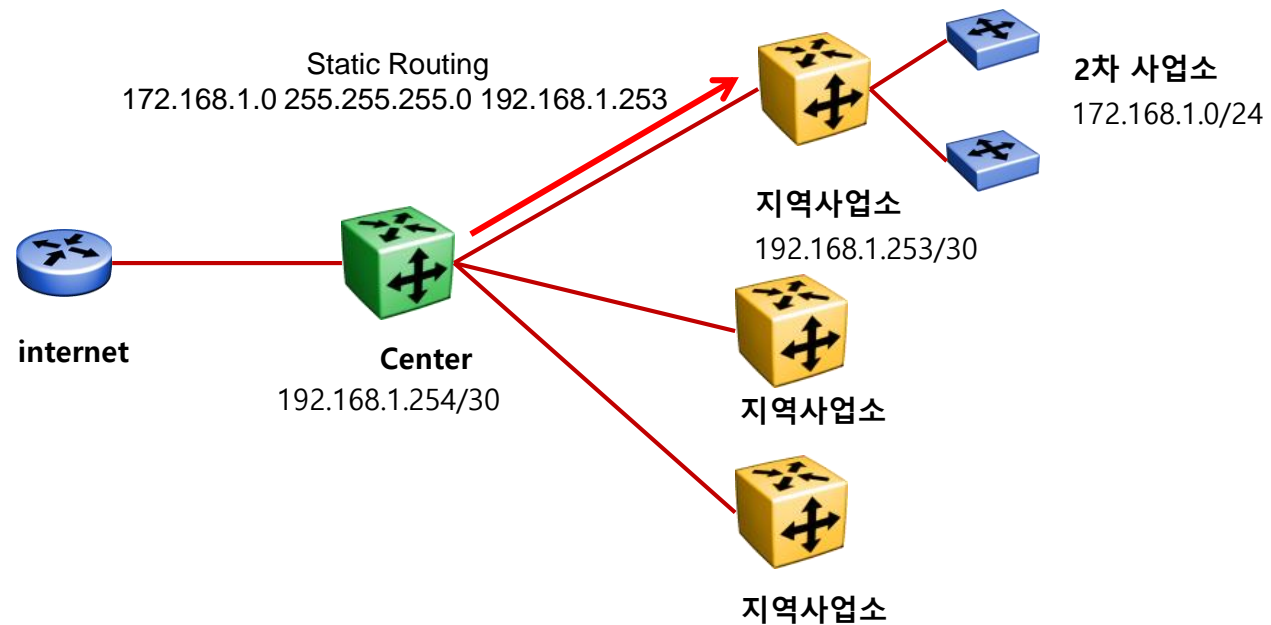
- Metric(Cost)를 높게 설정한다.
- ip route 0.0.0.0 0.0.0.0 192.168.1.2
- ip route 0.0.0.0 0.0.0.0 192.168.2.2 10
- 192.168.1.2라는 next hop IP가 살아 있으면 192.168.1.2로 전송
- 192.168.1.2라는 next hop IP가 Down되면 192.168.2.2로 전송
- Next Hop IP가 있는 네트워크 대역이 Down되면 Table에서 자동으로 삭제된다.

ROUTING

Static Routing

Static Routing 사용

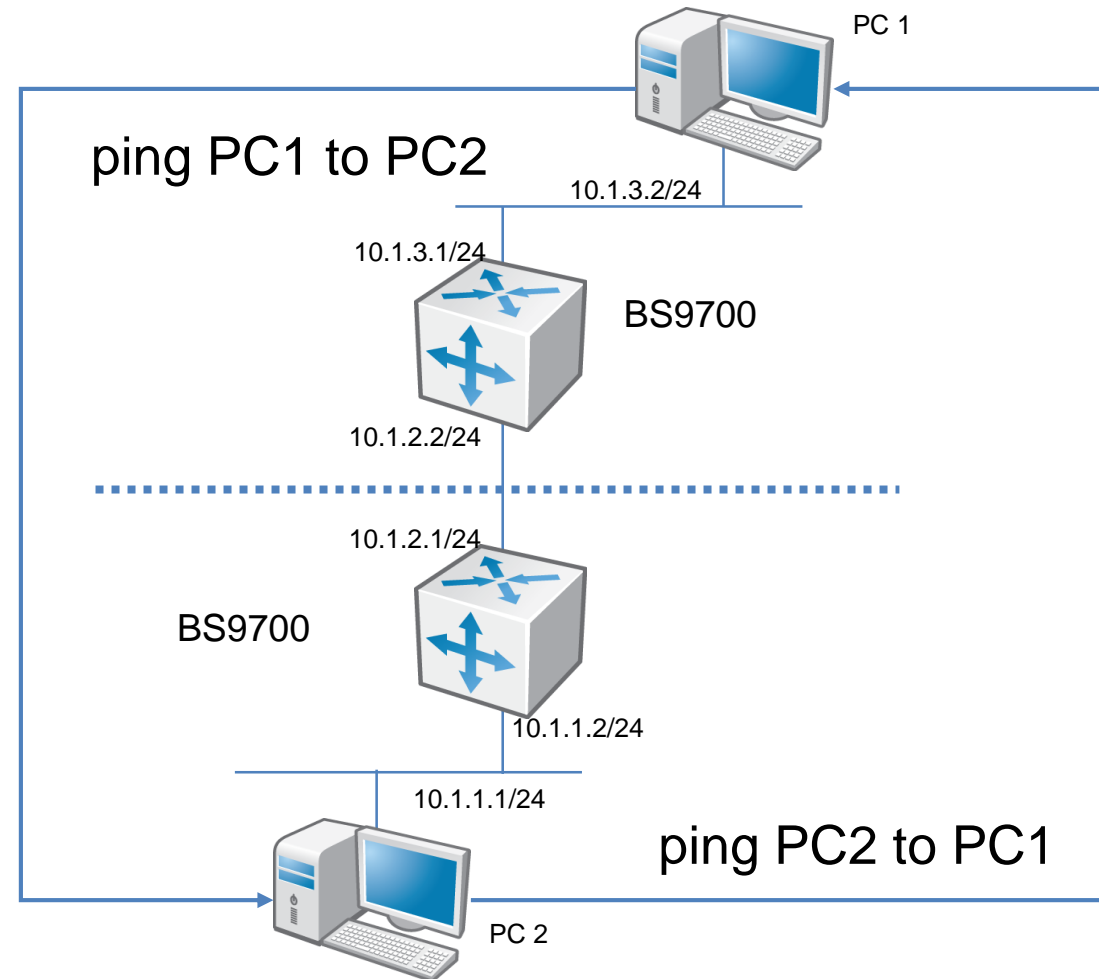
- 소규모 네트워크에 적합
- 다른 네트워크로 연결되는 구간이 하나이거나 백업 경로가 없는 경우에 적합
- 관문 구간에 있는 방화벽(UTM) 장비도 Dynamic 라우팅을 지원하지만, 주로 Static 라우팅 사용



ROUTING

Static Routing

› Static IP Routing



ROUTING

Static Routing 설정 방법

Static Routing 설정 절차

- I. 목적지 네트워크에 대한 정보 확인
- II. 목적지 네트워크로 가기 위한 L3 Next-hop 정보 확인
- III. Static Routing 설정
- IV. Static Routing 설정 확인
- V. Show command 확인

ROUTING

Static Routing 설정 방법

› 1. Static Routing 설정

```

BS9700_config#ip route ?
  A.B.C.D      -- Dest IP address
  bfd          -- Bidirectional forwarding detection
  default      -- Default route
  load-balance -- Enable ip route load balance
  max-number   -- Maximum number of routes allowed in routing table
  max-paths    -- Maximum next-hop number of load-balancing routes
  policy-time  -- Task policy time
  vrf          -- Configure static route for a VPN Routing/Forwarding instance
BS9700_config#ip route 10.1.1.0 ?
  A.B.C.D -- Dest netmask
BS9700_config#ip route 10.1.1.0 255.255.255.0 ?
  GigaEthernet -- GigaEthernet interface
  Vlan          -- VLAN interface
  Null          -- Null interface
  Loopback      -- Loopback interface
  SuperVlan     -- SuperVLAN interface
  Tunnel        -- Tunnel interface
  A.B.C.D       -- gateway IP address
BS9700_config#ip route 10.1.1.0 255.255.255.0 10.1.2.1

```


ROUTING

Static Routing 설정 방법

› 2. Static Routing 설정 확인

```
BS9700#show run | inc route  
Building configuration...
```

```
Current configuration:
```

```
!
```

```
ip route 10.1.1.0 255.255.255.0 10.1.2.1
```

```
BS9700#
```

ROUTING

Static Routing 설정 방법

› 3. Show command 확인

```
BS9700#sh ip route
Codes: C - connected, S - static, R - RIP, B - BGP, BC - BGP connected
       D - BEIGRP, DEX - external BEIGRP, O - OSPF, OIA - OSPF inter area
       ON1 - OSPF NSSA external type 1, ON2 - OSPF NSSA external type 2
       OE1 - OSPF external type 1, OE2 - OSPF external type 2
       DHCP - DHCP type, L1 - IS-IS level-1, L2 - IS-IS level-2, IA - ISIS inter-level I - IPSEC type

VRF ID: 0
```

Next-hop 과 연결 Link가 Down 상태

```
BS9700#sh ip route
Codes: C - connected, S - static, R - RIP, B - BGP, BC - BGP connected
       D - BEIGRP, DEX - external BEIGRP, O - OSPF, OIA - OSPF inter area
       ON1 - OSPF NSSA external type 1, ON2 - OSPF NSSA external type 2
       OE1 - OSPF external type 1, OE2 - OSPF external type 2
       DHCP - DHCP type, L1 - IS-IS level-1, L2 - IS-IS level-2, IA - ISIS inter-level I - IPSEC type

VRF ID: 0
S    10.1.1.0/24      [1,0] via 10.1.2.1(on VLAN1)
C    10.1.1.0/24      is directly connected, VLAN1
```

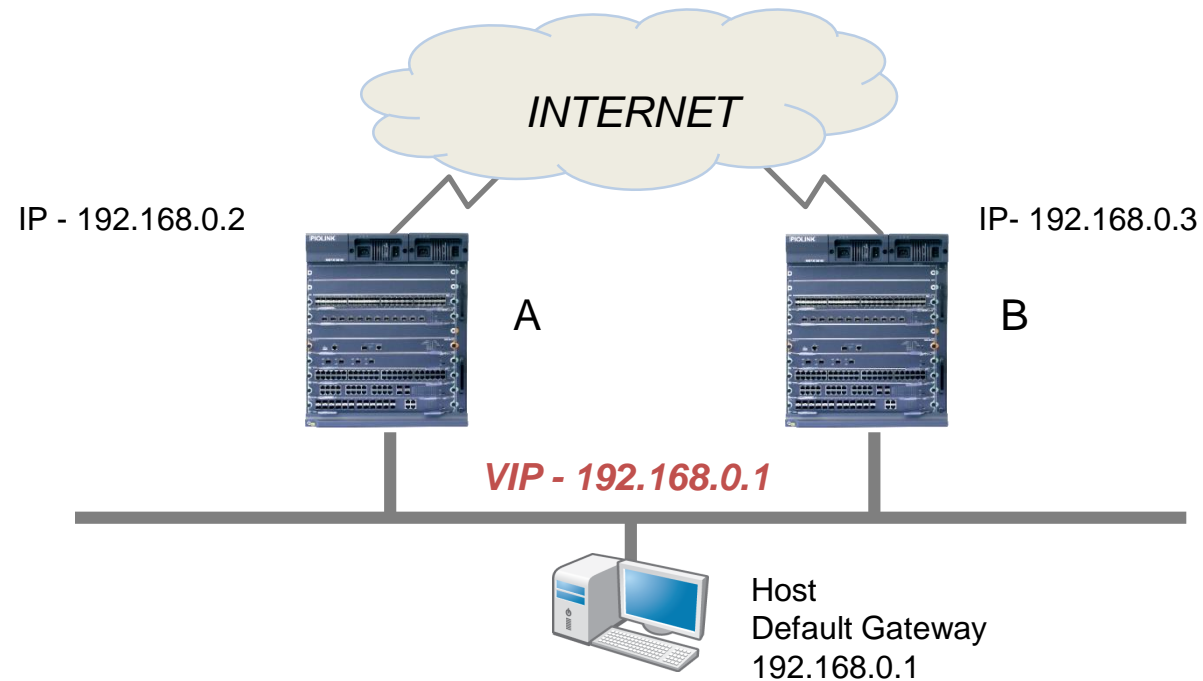
Next-hop 과 연결 Link가 Up 상태

ROUTING

VRRP

› VRRP(Virtual Router Redundancy Protocol) 란

- Gateway 이중화 프로토콜
- Gateway 장애 시에도 지속적인 서비스 보장
- IETF 표준 RFC 2338에 정의

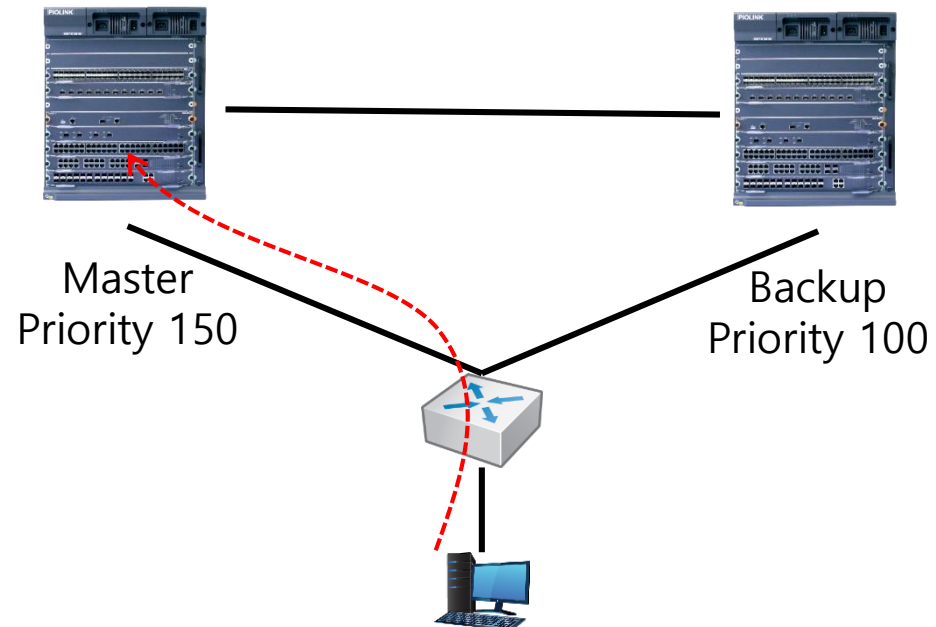


ROUTING

VRRP

› VRRP 동작 원리

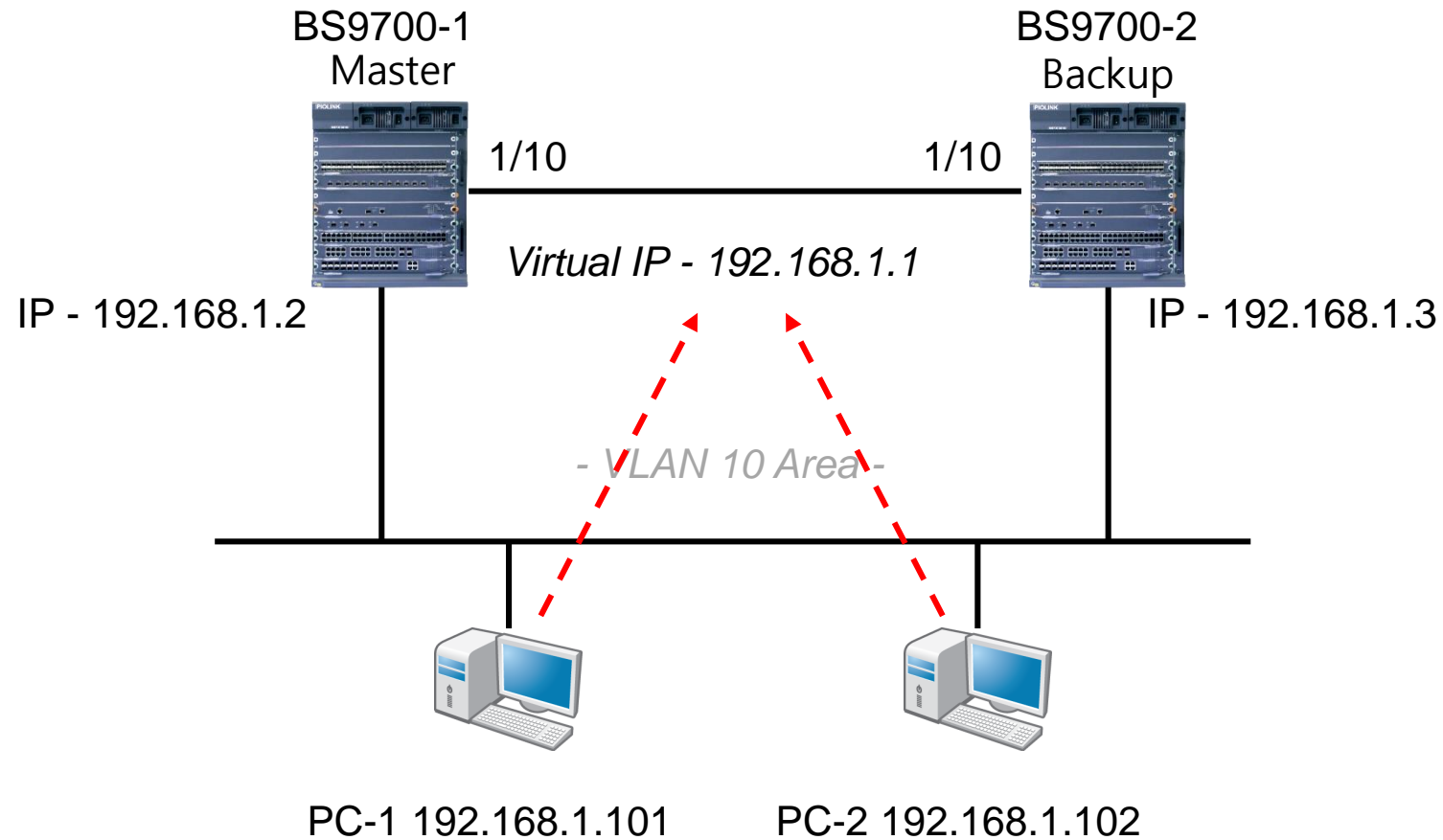
- 하나의 그룹으로 설정
- 가상의 Gateway IP를 할당
- 정상 동작 시에는 Master 스위치가 트래픽을 처리
- Master 스위치 장애 시에는 Backup 스위치가 Master 권한으로 트래픽 처리
- 지속적인 서비스 보장



ROUTING

VRRP

› VRRP 예제



ROUTING

VRRP 설정 방법

VRRP 설정 절차

- I. VRRP Real IP 설정
- II. VRRP 가상의 Gateway IP 설정
- III. VRRP Master/Backup 설정
- IV. VRRP 설정 확인
- V. Show Command 확인

ROUTING

VRRP 설정 방법

› 1. VRRP Real IP 설정

```
BS9700_1_config#interface vlan10
BS9700_1_config_v10#ip add 192.168.1.2 255.255.255.0
BS9700_1_config_v10#exit
BS9700_1_config#int gi1/10
BS9700_1_config_g1/10#switchport mode access
BS9700_1_config_g1/10#switchport pvid 10
BS9700_1_config_g1/10#exit
```

```
BS9700_2_config#interface vlan10
BS9700_2_config_v10#ip add 192.168.1.3 255.255.255.0
BS9700_2_config_v10#exit
BS9700_2_config#int gi1/10
BS9700_2_config_g1/10#switchport mode access
BS9700_2_config_g1/10#switchport pvid 10
BS9700_2_config_g1/10#exit
```

ROUTING

VRRP 설정 방법

› 2. VRRP 가상IP (VIP) 설정 (Gateway IP)

```

BS9700_1_config#interface VLAN10
BS9700_1_config_v10#vrrp 1 ?
  associate                -- Config VRRP group virtual IP
  description              -- Config VRRP group description string
  priority                 -- Config VRRP group priority level
  preempt                  -- Config VRRP group preempt
  track                    -- Config VRRP group priority track
  authentication           -- Config VRRP group authentication string
  timers                   -- Config VRRP group timer
  source-mac-use-system    -- Use system mac address as the source in all periodic VRRP
  messages
  bfd                      -- Config BFD for VRRP

BS9700_1_config_v10#vrrp 1 associate ?
  A.B.C.D -- VRRP Group virtual address
BS9700_1_config_v10#vrrp 1 associate 192.168.1.1 255.255.255.0
BS9700_1_config_v10#

```


ROUTING

VRRP 설정 방법

› 2. VRRP 가상IP (VIP) 설정 (Gateway IP)

```

BS9700_2_config#interface VLAN10
BS9700_2_config_v10#vrrp 1 ?
  associate                -- Config VRRP group virtual IP
  description              -- Config VRRP group description string
  priority                 -- Config VRRP group priority level
  preempt                  -- Config VRRP group preempt
  track                    -- Config VRRP group priority track
  authentication           -- Config VRRP group authentication string
  timers                   -- Config VRRP group timer
  source-mac-use-system    -- Use system mac address as the source in all periodic VRRP
messages
  bfd                      -- Config BFD for VRRP

BS9700_2_config_v10#vrrp 1 associate ?
  A.B.C.D -- VRRP Group virtual address
BS9700_2_config_v10#vrrp 1 associate 192.168.1.1 255.255.255.0
BS9700_2_config_v10#

```

ROUTING

VRRP 설정 방법

› 3. VRRP Master/Backup(우선순위) 설정

```

BS9700_1_config#interface vlan10
BS9700_1_config_v10#vrrp ?
<1-255>          -- VRRP Group ID
BS9700_1_config_v10#vrrp 1 ?
associate        -- Config VRRP group virtual IP
description      -- Config VRRP group description string
priority        -- Config VRRP group priority level
preempt          -- Config VRRP group preempt
track            -- Config VRRP group priority track
authentication   -- Config VRRP group authentication string
timers           -- Config VRRP group timer
source-mac-use-system -- Use system mac address as the source in all periodic VRRP
messages
bfd              -- Config BFD for VRRP
BS9700_1_config_v10#vrrp 1 priority ?
<1-254>          -- Priority value
BS9700_1_config_v10#vrrp 1 priority 150
BS9700_1_config_v10#

```

ROUTING

VRRP 설정 방법

› 4. VRRP 설정 확인

```
BS9700_1#show run interface vlan10
Building configuration...

Current configuration:
!
interface VLAN10
 ip address 192.168.1.2 255.255.255.0
 no ip directed-broadcast
 vrrp 1 associate 192.168.1.1 255.255.255.0
 vrrp 1 priority 150
```

```
BS9700_2#show run interface vlan10
Building configuration...

Current configuration:
!
interface VLAN10
 ip address 192.168.1.2 255.255.255.0
 no ip directed-broadcast
 vrrp 1 associate 192.168.1.1 255.255.255.0
```

ROUTING

VRRP 설정 방법

› 5. Show Command 확인

```
BS9700_1#sh vrrp
VLAN10 - Group 1
  VRRP State is Master
VRRP REDN State is Init
VRRP flags : 0x84
Virtual IP address : 192.168.1.1/24
Virtual Mac address : 0000.5e00.0101
Current Priority : 150 (Config 150)
VRRP timer : Advertise 1.0s (default) master_down 3.41s
VRRP current timer :
  Advertise    : 0.63s
  master_down  : 0.00s
  preempt after : 0.00s
Authentication string is not set
Preempt is set (delay : 0 s)
Learn Advertise Interval is not set
Master Router IP : 192.168.1.2, priority : 150, advertisement : 1.00s
BS9700_1#
```

ROUTING

VRRP 설정 방법

› 5. Show Command 확인

```
BS9700_2#show vrrp
VLAN10 - Group 1
  VRRP State is BACKUP
  VRRP REDN State is Init
  VRRP flags : 0x84
  Virtual IP address : 192.168.1.1/24
  Virtual Mac address : 0000.5e00.0101
  Current Priority : 90 (Config 90)
  VRRP timer : Advertise 1.0s (default) master_down 3.64s
  VRRP current timer :
    Advertise : 0.00s
    master_down : 2.65s
    preempt after : 0.00s
  Authentication string is not set
  Preempt is set (delay : 0 s)
  Learn Advertise Interval is not set
  Master Router IP : 192.168.1.2, priority : 100, advertisement : 1.00s
BS9700_1#
```

ROUTING

VRRP 설정 방법

› 5. Show Command 확인

```
BS9700_1#show vrrp brief
Interface Grp Prio Pree State Master addr Virtual addr
v10      1 150 Y Master 192.168.1.2 192.168.1.1
BS9700_1#
```

```
BS9700_2#show vrrp brief
Interface Grp Prio Pree State Master addr Virtual addr
v10      1 90 Y BACKUP 192.168.1.2 192.168.1.1
BS9700_2#
```

백본스위치 장애 처리

Part# 하드웨어 장애 처리

하드웨어 장애 처리

장애 처리

› 육안 점검 - 시스템 하드웨어

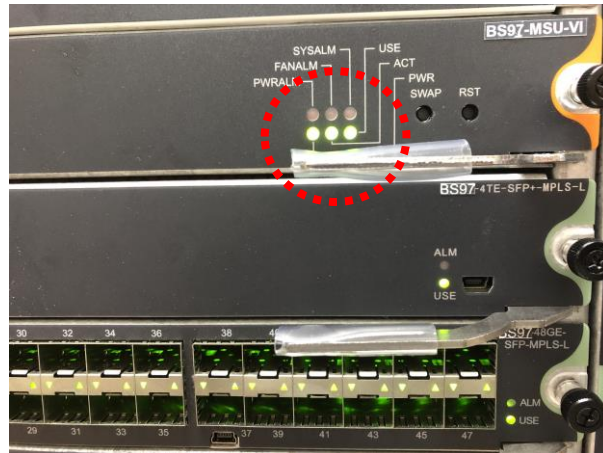


그림1. 정상 상태

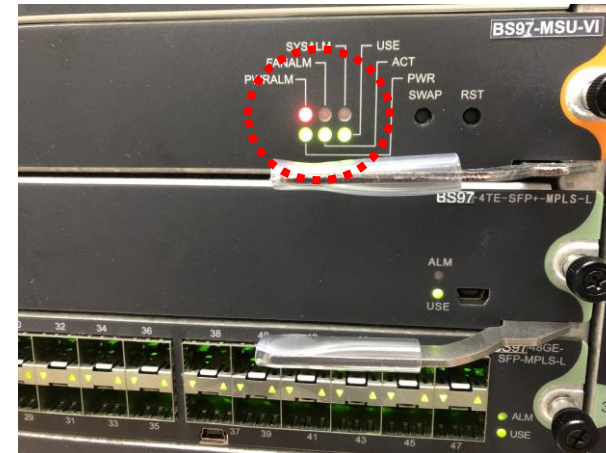


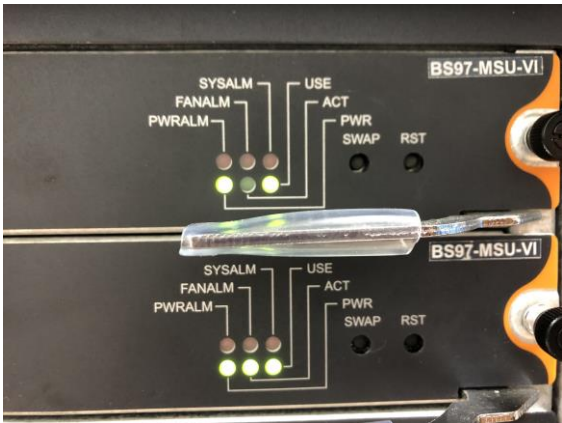
그림2. 비정상 상태

구분	LED 상태	설명
정상	<ul style="list-style-type: none"> ALRAM LED 녹색 	<ul style="list-style-type: none"> 하드웨어 동작 정상 상태
비정상	<ul style="list-style-type: none"> ALRAM LED 적색 	<ul style="list-style-type: none"> 하드웨어 구성 요소 중 문제가 있다는 것을 알려줌 전원, FAN 및 모듈 온도 상태 알람

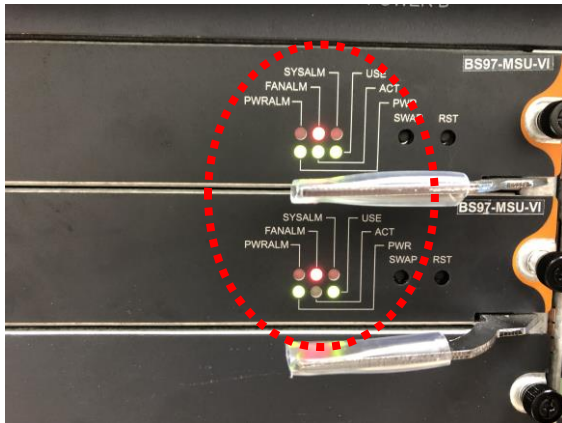
하드웨어 장애 처리

장애 처리

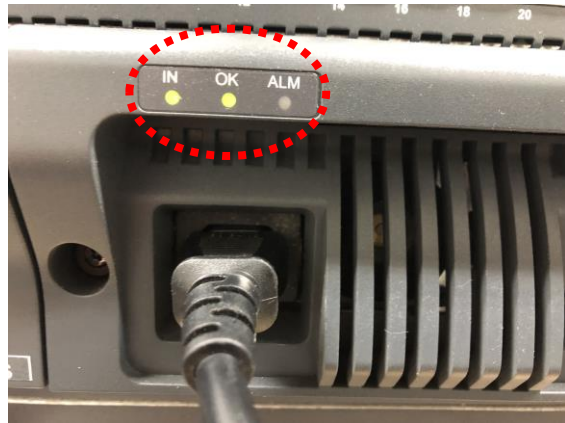
› 육안 점검 – 모듈별 상태



관리 모듈(정상)



관리 모듈(비정상)



PWR

구분	LED 상태	설명
정상	<ul style="list-style-type: none"> • USE/ACT/POWER 녹색 • OK LED ON, FANALM LED OFF 	<ul style="list-style-type: none"> • 관리 모듈 이중화 시 Active로 동작하는 모듈 ACT로 표시 • 하드웨어 동작 정상 상태
비정상	<ul style="list-style-type: none"> • USE/ACT/POWER 적색 • ALM/FANALM LED ON 	<ul style="list-style-type: none"> • 비 정상적인 동작 상태

하드웨어 장애 처리

장애 처리

› Line Card 점검

```
BS9700#show oir-information
Slot 1 type LS_4TE_MPLS_L_CARD(present)
Slot 2 type LS_24GE_SFP_CARD(present)
Slot 4 type LS_24GE_TX_CARD(present)
BS9700#
BS9700#show oir-information ?
WORD    -- slot name, such as 1, 2/1
<cr>
BS9700#show oir-information 4
Slot 4 type LS_24GE_TX_CARD(present)
Capability bits: 00000000000000000010111100000001
  Capability supported: IPv4 switch/routing
  Capability supported: IPv6 switch/routing
  Capability supported: HiG Forward
  Capability supported: Subnet-based vlan
  Capability supported: Private vlan
  Capability supported: Reserved
Up to 4096 layer 3 interface supported
Up to 4189 logic interface supported
physical port: 90-113
BS9700#
```

Present : 정상 동작 상태
Absent : 모듈 인식 안됨

하드웨어 장애 처리

장애 처리

› Power Module 점검

```
BS9700#show power-status
```

CHASSIS_NUMBER	POWER_NUMBER	STATUS
1	1	on
1	2	down

BS9700#

Power number

On: 정상 동작 상태
down: 전원 인입이 되지 않은 상태

하드웨어 장애 처리

장애 처리

› FAN Module 점검

BS9700#

BS9700#show fan-status

CHASSIS_NUMBER	CARD_NUMBER	FAN_NUMBER	STATUS
1	1	1	on
1	1	2	on
1	1	3	on
1	1	4	on
1	1	5	on
1	1	6	on

BS9700#

FAN NUMBER.

On: 정상 동작 상태
Off: 동작 중지

하드웨어 장애 처리

장애 처리

› Network Service 지연 시

BS9700#show interface brief

Port	Description	Status	Vlan	Duplex	Speed	Type
g6/0		down		full	1000Mb	Giga-Combo-FIBER
g1/1		down	Trunk(10)	auto	auto	Giga-TX
g1/2		down	30	auto	auto	Giga-TX
g1/3		down	1	auto	auto	Giga-TX
g1/4		down	1	auto	auto	Giga-TX
g1/5		down	1	auto	auto	Giga-TX
g1/6		down	1	auto	auto	Giga-TX
g1/7		down	1	auto	auto	Giga-TX
g1/8		down	1	auto	auto	Giga-TX
g1/9		down	1	auto	auto	Giga-TX
g1/10		down	10	auto	auto	Giga-TX
g1/11		down	1	auto	auto	Giga-TX
g1/12		down	1	auto	auto	Giga-TX
g1/13		up	1	full	1000Mb	Giga-TX
g1/14		down	1	auto	auto	Giga-TX
g1/15		down	1	auto	auto	Giga-TX
g1/16		down	1	auto	auto	Giga-TX
g1/17		down	1	auto	auto	Giga-TX
g1/18		down	1	auto	auto	Giga-TX
g1/19		down	1	auto	auto	Giga-TX
g1/20		down	1	auto	auto	Giga-TX
g1/21		down	1	auto	auto	Giga-TX
g1/22		down	1	auto	auto	Giga-TX
--More--						

Port - 포트 리스트

Status - 해당 포트의 Link 상태

(Up: Link 연결, Down: Link 연결 안됨)

Vlan - 해당 포트의 Vlan id

Duplex - 해당 포트의 연결 상태 (Full: 양방향, Half: 단방향)

Speed - 연결 속도 상태

Type - 포트 타입

하드웨어 장애 처리

장애 처리

› Network Service 지연 시

```
BS9700#show interface gi1/13
GigaEthernet1/13 is up, line protocol is up
  Ifindex is 102, unique port number is 13
  Hardware is Giga-TX, address is fcfa.f748.1fcc (bia fcfa.f748.1fcc)
  MTU 1500 bytes, BW 1000000 kbit, DLY 10 usec
  Encapsulation ARPA
  Auto-Duplex(Full), Auto-Speed(1000Mb/s), Flow-Control Off
  5 minutes input rate 6194 bits/sec, 11 packets/sec
  5 minutes output rate 1748 bits/sec, 1 packets/sec ...
  Real time input rate 5818 bits/sec, 10 packets/sec
  Real time output rate 791 bits/sec, 1 packets/sec
    Received 8640 packets, 605168 bytes
    6032 broadcasts, 1232 multicasts
    827 discard, 0 error, 0 PAUSE
    0 align, 0 FCS, 0 symbol
    0 jabber, 0 oversize, 0 undersize
    0 carriersense, 0 collision, 0 fragment
    530 L3 packets, 0 discards, 0 Header errors
    0 URPF errors
  Transmitted 793 packets, 84865 bytes
    4 broadcasts, 428 multicasts
    0 discard, 0 error, 0 PAUSE
    0 sqetest, 0 deferred, 0 oversize
    0 single, 0 multiple, 0 excessive, 0 late
    0 L3 forwards
BS9700#
```

Port In Out 트래픽 상태 확인
포트 에러 카운트 확인

- Discard, Error Count 증가 시 Cable 및 SFP 상태 점검
- IN / Out 트래픽 비정상 증가 시 루핑 및 인접장비 상태 점검

하드웨어 장애 처리

장애 처리

› 장애 발생 확인 시

```
BS9700#show logging
```

```
Syslog logging: enabled (0 messages dropped, 0 flushes, 0 overruns)
```

```
Console logging: level debugging, 105 messages logged
```

```
Monitor logging: level debugging, 0 messages logged
```

```
Buffer logging: level debugging, 105 messages logged
```

```
Trap logging: level informational, 0 message lines logged
```

```
Log Buffer (4000000 bytes total 3992484 bytes remain):
```

```
Jan 1 00:12:28 User admin enter privilege mode from vty 0, level = 15
```

```
Jan 1 00:12:27 User admin logged in from 192.168.211.26 on vty 0
```

```
Jan 1 00:09:05 User admin logout from 192.168.212.130 on vty 0
```

```
Jan 1 00:04:05 User admin logged in from 192.168.212.130 on vty 0
```

```
Jan 1 00:02:23 %LINEPROTO-5-UPDOWN: Line protocol on Interface VLAN1, changed state to up
```

```
Jan 1 00:02:21 %LINEPROTO-5-UPDOWN: Line protocol on Interface GigaEthernet1/13, changed state to up
```

```
Jan 1 00:02:21 %LINE-5-UPDOWN: Line on Interface GigaEthernet1/13, changed state to up
```

```
Jan 1 00:02:18 check SLOT 1 IOS consistency.....
```

```
Jan 1 00:02:18 SYS-6-CONFIG: The operation of config cmds enable at present, input OK!
```

```
Jan 1 00:02:18 OIR-6-INSERT: ONLINE INSERT COMPLETED(slot 1)
```

```
Jan 1 00:02:18 OIR-6-ENABLE_PORTS: Enabling ports of slot 1
```

```
Jan 1 00:02:18 OIR-6-DIST_GLOBAL_CFG: Distributing pending global configurations to slot 1
```

```
Jan 1 00:02:18 OIR-6-CONFIG_LINECARD: Distributing configurations corresponding to slot 1 to application
```

```
Jan 1 00:02:18 OIR-5-FEATURE_DECREASE: The max logic interface number is resized from 4189 to 4165
```

```
Jan 1 00:02:17 OIR-6-NOTIFY_LINECARD: Slot 1 register successful, notify linecard
```

```
Jan 1 00:02:17 OIR-6-CREATE_INTERFACE: Interfaces of slot 1 are created successful
```

```
--More--
```

- 장비에서 발생하는 모든 Event 기록
- 재기동시 삭제 되므로, 별도 syslog Server 운영 권장

Port Down/up Log

하드웨어 장애 처리

장애 처리

장비간 연결상태 및 Host 상태 확인

```
BS9700#ping 192.168.212.1
PING 192.168.212.1 (192.168.212.1): 56 data bytes
!!!!
--- 192.168.212.1 ping statistics ---
5 packets transmitted, 5 packets received, 0% packet loss
round-trip min/avg/max = 0/2/10 ms
BS9700#
```

정상적인 통신일 경우 !!!!! 가 표시 되며
비 정상적인 통신일 경우 으로 표시
* 옵션을 통한 다수의 ping 전송 시 공격성 패킷으로 판단하여
보안장비에서 차단될 수 있음

```
BS9700#traceroute 168.126.63.1
traceroute to 168.126.63.1 (168.126.63.1), 30 hops max, 36 byte packets
 1 192.168.211.2 0 ms 10 ms 0 ms
 2 3.3.211.1 0 ms 0 ms 0 ms
 3 1.1.1.1 0 ms 0 ms 0 ms
 4 192.168.200.4 10 ms 0 ms 0 ms
 5 12.12.12.11 0 ms 0 ms 0 ms
 6 192.168.208.21 0 ms 0 ms 0 ms
 7 * * *
 8 192.168.200.2 0 ms 0 ms 0 ms
```

연결되는 구간의 정보가 표시 됨
(Routing 구간의 IP)
* 표시는 보안 장비 또는 방화벽에 의해 막혀 있을 때 표시 됨
* 표시가 지속될 경우 해당 구간에서 통신 불가 확인

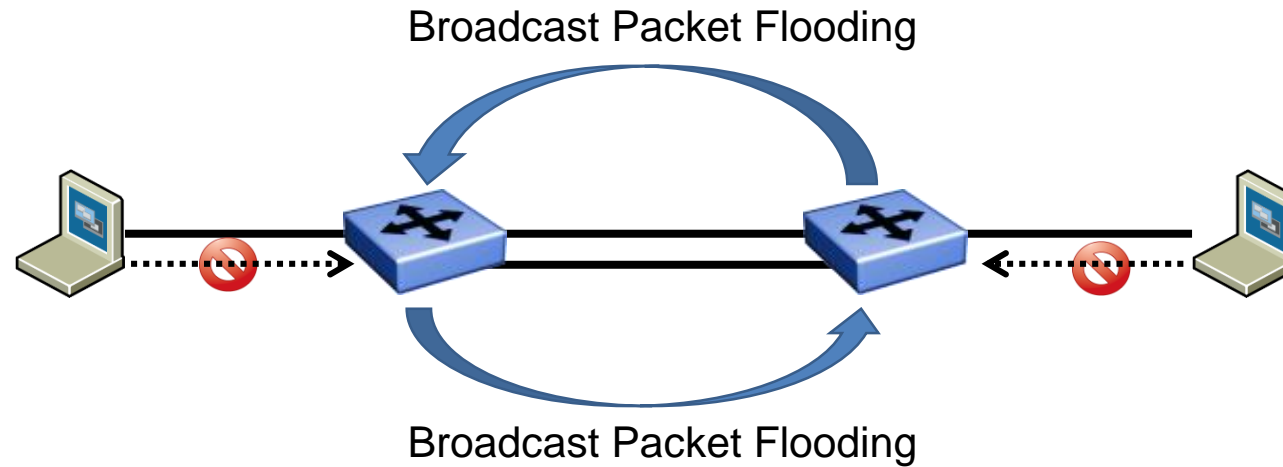
Part# Looping 장애 처리

LOOPING 장애 처리

Loop-Detection

› Loop 란?

- 사전적 의미: 올라미나 동그라미 모양의 고리
- Looping은 이더넷의 특성상 프레임이 무한정으로 돌기 때문에 다른 Data 들의 전송이 불가능해 Network 서비스를 하지 못하는 상태

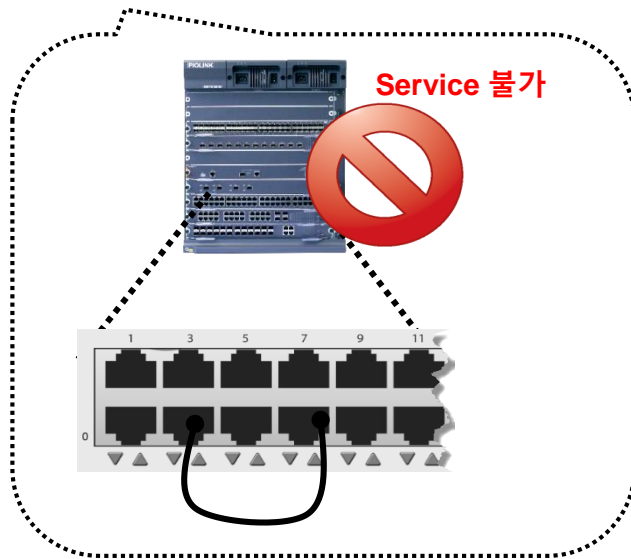


LOOPING 장애 처리

Loop-Detection

› Loop 발생 환경 Case#1

– Local Loop



EX)

사용자의 실수로 Outlet 포트에 물리적으로 연결하게 되면 Loop가 발생하여 네트워크 서비스 마비



Loop차단 방법

1. Spanning Tree
2. Loopback-Detection
3. 물리적 케이블 연결 Port 차단

› Loopback-Detection 란?

- 백본과 연결된 Switch 또는 HUB 에서 Loop 발생시 차단하는 기능

LOOPING 장애 처리

Loopback-Detection

- › Loop 발생 환경 Case#2
 - Remote Loop



EX)

사용자가 임의로 사용하는 공유기 또는 Spanning Tree가 지원하지 않는 허브 등에서 Loop가 발생하여 네트워크 서비스 마비

Loop차단 방법

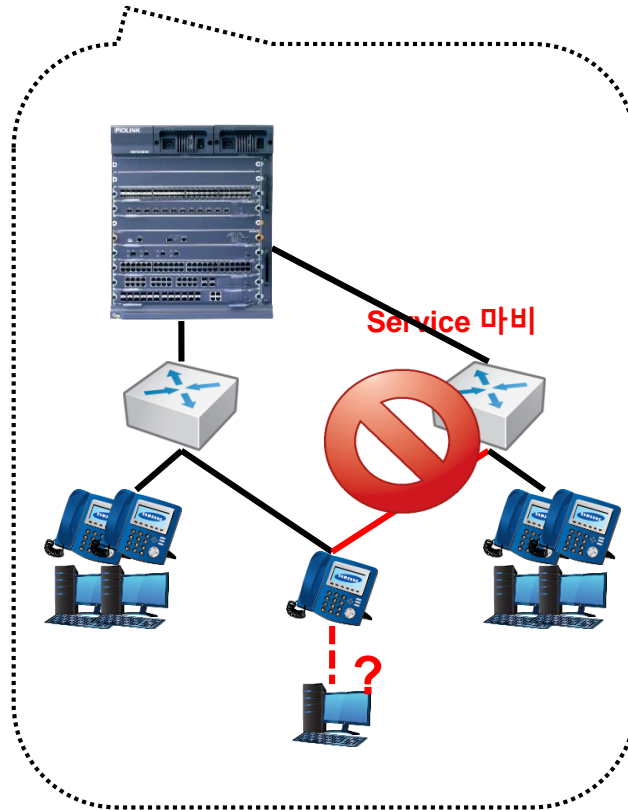
1. STP BPDU-Guard
2. Loopback-Detection

LOOPING 장애 처리

Loopback-Detection

Loop 발생 환경 Case#3

- 잘못된 Cable 연결



EX)

IPT 환경에서 자주 발생하는 문제로 전화기의 PC가 연결 되어야 하는 Port에 다른 스위치와 연결된 Cable을 연결 하여 Looping이 발생 하여 서비스 마비

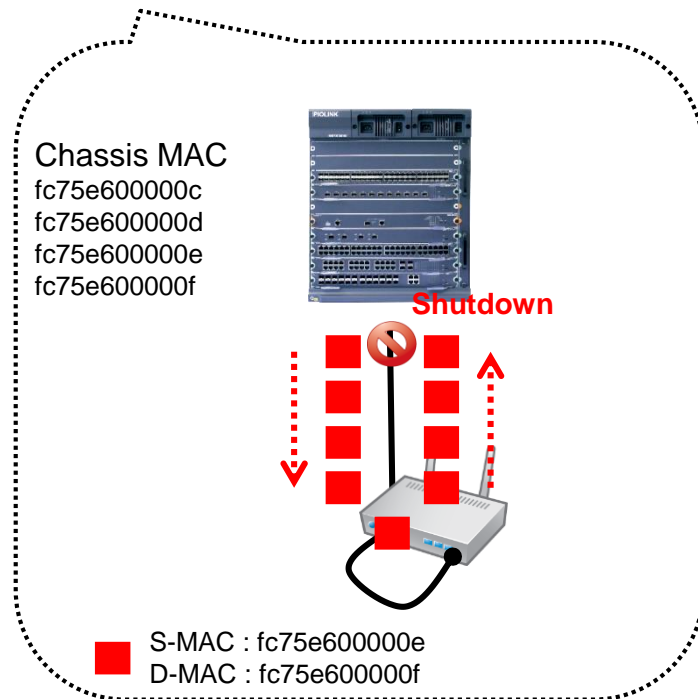
Loop차단 방법

1. Spanning-Tree

LOOPING 장애 처리

Loopback-Detection

- › Loop 탐지 방법
 - Remote Loop



Loop를 감지하는 패킷은 S-MAC, D-MAC 을 백본의 Chassis MAC을 기준으로 30초에(Default) 한번씩 보내게 된다.

이러한 Loop감지 패킷이 다시 되돌아 오게 되면 백본은 Loop로 감지하여 해당 Port를 Shutdown 하여 Looping을 방지한다.

Loop 감지 패킷

LOOPING 장애 처리

Loopback-Detection

Loopback-Detection 절차

- I. Loopback-Detection 활성화
- II. Loop 탐지 포트에 Loopback-Detection Configuration 설정
- III. Loopback-Detection 탐지 시간 설정
- IV. 차단된 Port 자동 복구 설정
- V. Loopback-Detection Configuration 확인
- VI. Show Command
- VII. Syslog 확인

LOOPING 장애 처리

Looping 차단 설정

› 1. Loop-Detection 기능 활성화

```
BS9700#conf
BS9700_config#loopback-detection
```

› 2. Port에 Loop-Detection 적용

```
BS9700#conf
BS9700_config#interface range gigaEthernet 1/1-20
BS9700_config_if_range#loopback-detection enable
```

› 3. Loop-Detection Interval-time

```
BS9700_config#interface range gigaEthernet 1/1-20
BS9700_config_if_range#loopback-detection hello-time ?
WORD -- The period of the packet transmission (3 - 65535)
BS9700_config_if_range#loopback-detection hello-time 10
```

LOOPING 장애 처리

Looping 차단 설정

› 4. Loop로 인해 차단된 Port 자동복구 설정

```
BS9700_config#error-disable-recovery ?  
  <0-2147483647[0]> - recovery period(unit:seconds)  
BS9700_config#error-disable-recovery
```

LOOPING 장애 처리

Looping 차단 설정

› 5. Loopback-Detection Configuration 확인

```
BS9700#show run | inc loopback-detection
Building configuration...
```

Current configuration:

!

loopback-detection

BS9700#

```
BS9700#show run interface gi1/5
Building configuration...
```

Current configuration:

!

interface GigaEthernet1/5

loopback-detection enable

loopback-detection hello-time 10

BS9700#

LOOPING 장애 처리

Looping 차단 설정

› 6. Show Command 확인

```
BS9700#show loopback-detection
Loopback-detection is enable
Loopback-detection packet's sys Mac address: fcfa.f744.6fb0

Interface state information
Port   Status dest MacAddress Control  VLAN
-----
g2/1 no-loop 0180.c200.000a  WARNING
g2/2 no-loop 0180.c200.000a  WARNING
g2/3 no-loop 0180.c200.000a  WARNING
```

Loopback-detection 정상적인 상태

```
BS9700#show loopback-detection
Loopback-detection is enable
Loopback-detection packet's sys Mac address: fcfa.f744.6fb0

Interface state information
Port   Status dest MacAddress Control  VLAN
-----
g2/1 no-loop 0180.c200.000a  WARNING
g2/2 no-loop 0180.c200.000a  WARNING
g2/3 looped 0180.c200.000a  WARNING
```

Loopback-detection Looping 감지 후 차단 상태

LOOPING 장애 처리

Looping 차단 설정

› 6. Show Command 확인

```
BS9700#sh run | inc error-disable-recovery  
Building configuration...
```

```
Current configuration:  
!  
error-disable-recovery 10  
BS9700#
```

Errordisable Recovery 설정상태 확인

LOOPING 장애 처리

Looping 차단 설정

› 7. syslog 확인

```
BS9700#show logging
Syslog logging: enabled (0 messages dropped, 0 flushes, 0 overruns)
  Console logging: level debugging, 137 messages logged
  Monitor logging: level debugging, 0 messages logged
  Buffer logging: level debugging, 137 messages logged
  Trap logging: level informational, 0 message lines logged

Log Buffer (4000000 bytes total 3989716 bytes remain):
Jan  1 01:07:27 %LINEPROTO-5-UPDOWN: Line protocol on Interface GigaEthernet1/10
, changed state to down
Jan  1 01:07:27 %LINE-5-UPDOWN: Line on Interface GigaEthernet1/10, changed stat
e to down
Jan  1 01:07:26 %LINEPROTO-5-UPDOWN: Line protocol on Interface GigaEthernet1/9,
changed state to down
Jan  1 01:07:26 %LINE-5-UPDOWN: Line on Interface GigaEthernet1/9, changed state
to down
Jan  1 01:07:07 %LOOPBACK-DETECT-5-WARNING-TRAP: Loopback on port g1/9 on vlan 1
Jan  1 01:07:06 %LINEPROTO-5-UPDOWN: Line protocol on Interface GigaEthernet1/10
, changed state to up
Jan  1 01:07:06 %LINE-5-UPDOWN: Line on Interface GigaEthernet1/10, changed stat
e to up
```

Looping에 의한 Interface **Errordisable** 상태 확인

Part# OS 장애처리

OS 장애처리

장애 처리

부트 모니터 모드에서 OS 복구 방법

- 1) Boot Mode 진입 후 ip 설정
- 2) Flash로 OS 업로드
- 3) 업로드 OS로 재 부팅.
- 4) Flash에 있는 비정상 OS 삭제
- 5) 정상적인 OS로 Booting 경로 설정



OS 장애처리

장애 처리

› OS 복구방법(계속)

- 1단계 : 부팅 중 Ctrl + P 입력 하여 monitor 진입 후 ip 설정

```
monitor#ip ?
address -- IP address
route   -- Static route
monitor#ip address ?
A.B.C.D -- IP address
monitor#ip address 192.168.212.131 ?
A.B.C.D - IP netmask
monitor#ip address 192.168.212.131 255.255.255.0 ?
<cr>
monitor#ip address 192.168.212.131 255.255.255.0 → ip 설정
monitor#
monitor#
monitor#ping 192.168.212.130 → FTP 서버와 핑 테스트
PING 192.168.212.130: 56 data bytes
64 bytes from 192.168.212.130: icmp_seq=0. time=760. ms
64 bytes from 192.168.212.130: icmp_seq=1. time=0. ms
64 bytes from 192.168.212.130: icmp_seq=2. time=0. ms
64 bytes from 192.168.212.130: icmp_seq=3. time=0. ms
----192.168.212.130 PING Statistics----
4 packets transmitted, 4 packets received, 0% packet lossround-trip (ms) min/avg/max = 0/190/760
monitor#
```

OS 장애처리

장애 처리

› OS 복구방법(계속)

- 2단계 : flash로 OS 업데이트

```
monitor#copy tftp: flash: → OS 업데이트
Source file name[?BS97_MSU6020_4.1.2C_66595.bin
Remote-server ip address[?192.168.212.130
Destination file name[BS97_MSU6020_4.1.2C_66595.bin]?switch1.bin
```

- 3단계 : 업로드 된 OS로 Booting

```
monitor#dir

Listing Directory /:
switch.bin      <FILE>      9125290   Jan 01 00:14:42 1970
switch1.bin     <FILE>      8921650   Jan 01 00:03:42 1970
startup-config  <FILE>      7766     Jan 01 03:05:00 1970
LS6020_BIN     <FILE>     6071834   Jan 01 00:23:36 1970
LS5020_BIN     <FILE>     3746186   Jan 01 00:26:28 1970
free space is 15130624 bytes
monitor#
monitor#boot flash ?
WORD -- File name
monitor#boot flash switch1.bin →업로드 된 OS로 Booting
Loading flash:switch1.bin.....
```

OS 장애처리

장애 처리

› OS 복구방법(계속)

- 4단계 : flash의 비 정상 OS 삭제

```
BS9700#dir
```

```
Listing Directory /:
```

```
switch.bin      <FILE>      9125290   Jan 01 00:14:42 1970
switch1.bin     <FILE>      8921650   Jan 01 00:03:42 1970
startup-config  <FILE>        7766     Jan 01 03:05:00 1970
LS6020_BIN      <FILE>     6071834   Jan 01 00:23:36 1970
LS5020_BIN      <FILE>     3746186   Jan 01 00:26:28 1970
```

```
free space is 15130624 bytes
```

```
BS9700#delete switch.bin    비정상 OS 삭제
```

```
this file will be erased,are you sure?(y/n)y
```

```
no such file or file is protected!
```

```
BS9700#
```

백본스위치 펌웨어는
Switch.bin 으로 저장

- 5단계 : 정상적인 OS로 Booting 경로 설정

```
BS9700#copy flash: flash:
```

```
source file name?switch1.bin
```

```
destination file name[switch1.bin]?switch.bin
```

```
#####
#####
```

```
Jan 1 00:42:12 file flash:/switch1.bin, successfully wrote
```

Upload한 정상 펌웨어
이름 변경 및 write 작업

Network Trend

네트워크 트렌드

보안적합성 무엇인가!

- 보안적합성 검증은 국가정보통신망의 보안 수준을 제고하고, 국가/공공기관이 도입하는 IT제품의 보안기능에 대해 안정성을 검증하는 제도 이다.

검증 절차



- 공공기관 네트워크 장비의 보안적합성 검증
 - 라우터, 스위치 등의 장비도 보안적합성 검증 시행 관련 공문(2013. 04. 29)



국 가 정 보 원

수신 수신자 참조
(경유)

제목 네트워크 장비 보안적합성 검증 시행 안내

1. 우리원은 전자정부법 제56조(정보통신망 등의 보안대책 수립·시행) 및 同法 시행령 제69조(전자문서의 보관·유통 관련 보안조치)에 의거, 각급기관 정보통신망에 대한 보안대책을 강구하고 있습니다.

2. 이와 관련, 각급기관 정보통신망의 안전성 확보를 위해 라우터·스위치 등 주요 네트워크 장비 대상으로 <붙임 1>과 같이 보안적합성 검증을 시행하고자 하오니 업무수행에 착오없으시길 바랍니다.

< 중략 >

2. 시행일정

- 가. (시험검증) '13. 9. 1 ~ '14. 9. 30간 시험검증 실시
 - 同 기간 중 각급기관은 상기의 검증대상 장비 도입시 국가정보원에 도입 내역(용도, 모델명, 제조사 등)을 통보
 - 국가정보원은 장비 용도, 검증 시급성 등을 종합 고려, 도입기관과 협의하여 선별적인 검증 실시
- 나. (정식검증) '14. 10. 1부 쉐 국가·공공기관 대상 검증 의무화
- 다. 상기 시행일정에 추가하여, '16. 1. 1부터 라우터·스위치에 대해서는 사전에 CC(Common Criteria) 인증을 획득한 장비만 도입

네트워크 트렌드

보안적합성과 보안기능 시험 제도

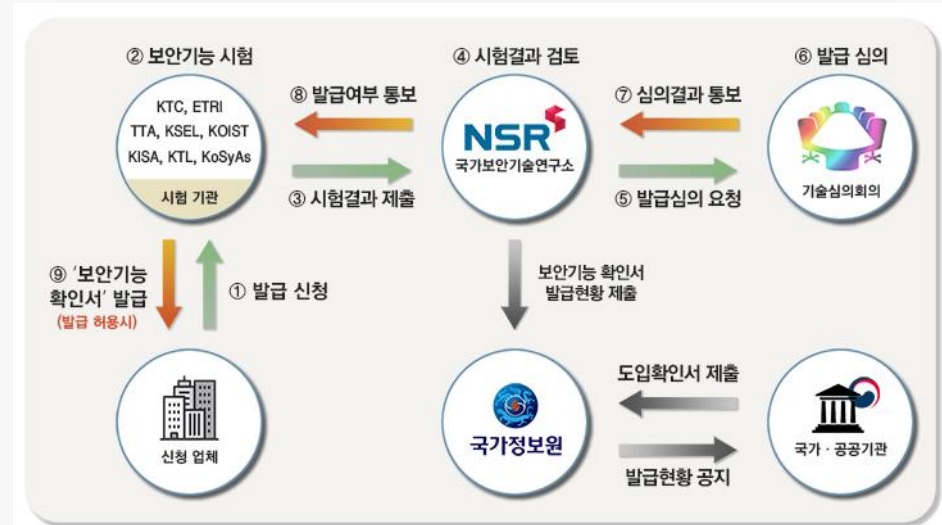
➤ 보안적합성 검증 의무화

- 검증 의무화 2014.10.1 부터
- 중앙행정기관과 정보통신기반시설부터 시행
- 광역 시·도 등 지방자치단체와 교육청·산하기관 등은 네트워크장비 보안적합성 검증이 1년 유예 (2015년 하반기 부터)

➤ 스위치·라우터에 요구되는 보안기능 항목

- ▲식별 및 인증 ▲암호지원 ▲정보흐름통제 ▲보안관리 ▲자체시험 ▲접근통제 ▲전송데이터 보호 ▲감사기록 등 44개 항목
(필수 27개, 선택 17개)

- 보안기능 시험 제도는 보안적합성 검증절차 간소화를 위해 정보보호시스템, 네트워크 장비 등 IP제품에 대해 공인시험기관이 ‘국가용 보안요구사항’ 만족 여부를 시험하여 안전성을 확인해 주는 제도입니다.



Q n A

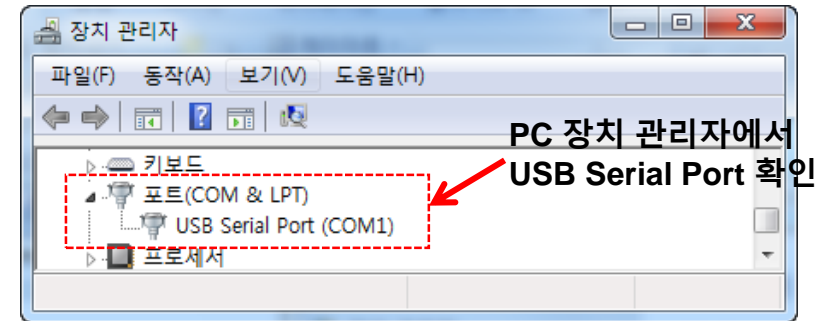
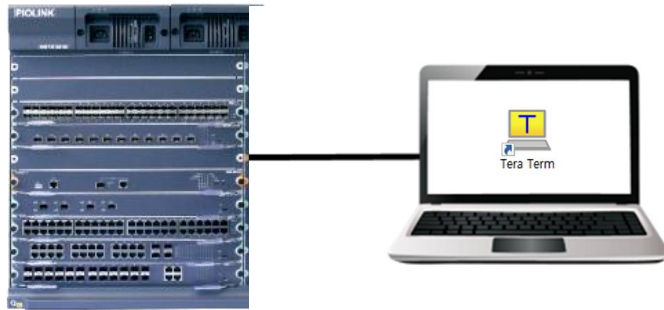
백본스위치 실습 교육

Part# Console/Telnet 접속

백본스위치 실습교육

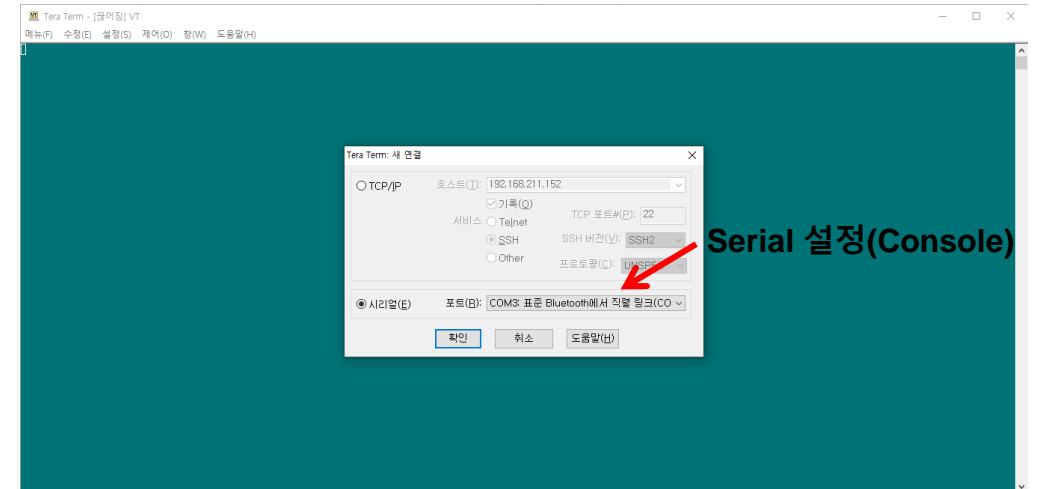
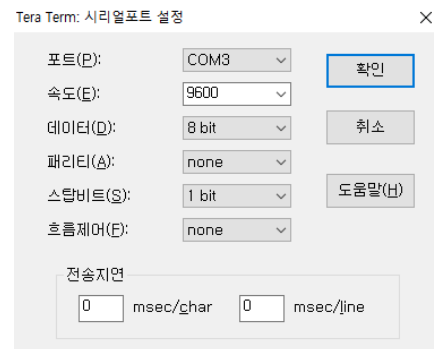
Console/Telnet 장비접속

› Tera Term Program Console 접속 방법



Console 접속 절차

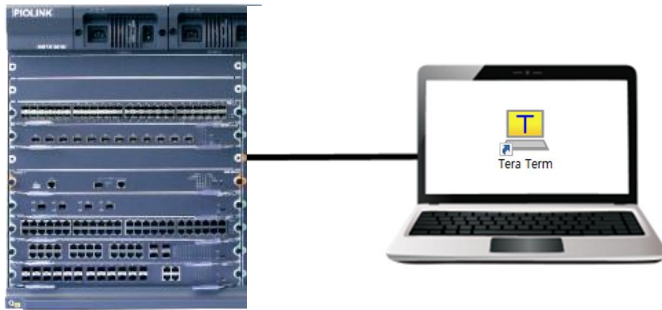
1. PC에 Console Cable 연결(Usb to Serial Cable 사용)
2. 연결된 Usb to Serial Cable의 포트 확인
3. Tera Term Program 실행
4. 시리얼(E)에서 COM Port 선택 후 접속
5. 접속 시 설정 항목에서 아래 사항 확인



백본스위치 실습교육

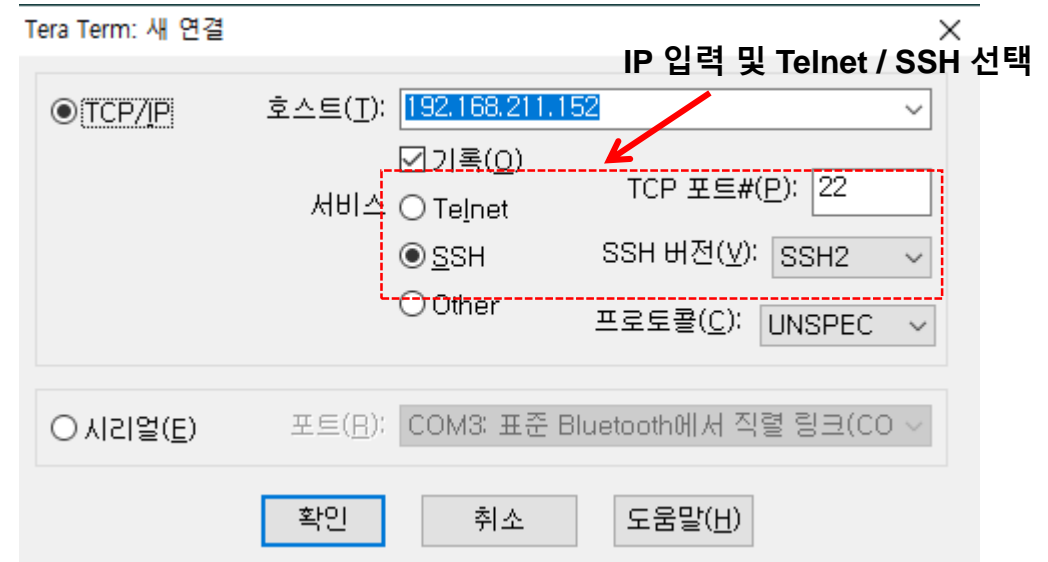
Console/Telnet 장비접속

› Tera Term Program Telnet/SSH 접속 방법



Telnet/SSH 접속 절차

1. Tera Term Program 실행
2. Category에서 Session 선택
3. Telnet/SSH 접속 방법 선택
4. 접속 할 IP 입력



MEMO

Part# LAB Test

LAB TEST

LAB Test

IPT Network 구성

1. IPT Network 물리적 네트워크 환경 구성 방법

- a. 환경에 맞게 물리적 구성

2. IPT Network 논리적 네트워크 환경 구성 방법

- a. Data 와 구분되는 Voice 전용 Network 생성

3. PoE 지원 스위치

- a. IP Phone의 전력 요구량 및 수량 확인

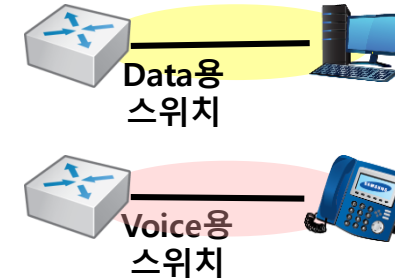
LAB TEST

LAB Test

› IPT Network 물리적 네트워크 환경 구성 방법

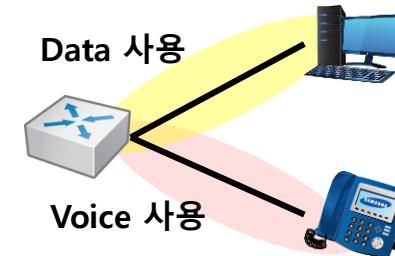
1. Data / Voice Network 별도 구성

- a. 장점: 보안 및 성능이 가장 좋다.
- b. 단점: 비용이 많이 들고, 관리가 힘들다.



2. 동일 스위치에 서로 다른 Interface 구성

- a. 장점: Data/Voice 별도로 구성 하는 방법 보다 비용이 감소, 손쉽게 구성 가능 .
- b. 단점: Data/Voice 별도로 구성하는 방법과 마찬가지로 많은 수의 Interface가 필요로 하므로 비용 적인 면이 1안과 비슷 함



3. 동일 스위치에 동일 포트로 Data/Voice 구성

- a. 장점: 구성 방안 중 가장 적은 비용이 필요 하며 관리가 용이하다.
- b. 단점: IPT 구성 시 설정이 복잡하다.



LAB TEST

LAB Test

› IPT Network 물리적 네트워크 환경 구성 방법

1. Data / Voice Network 동일 구성

- a. 장점: 스위치 설정이 간단하고 IP Phone에 추가설정 필요 없음.
- b. 단점: Data Traffic 증가 시 Voice 품질 떨어짐.



단일 VLAN으로
Data/Voice 모두 Untag 통신

2. Data / Voice Network 별도 구성

- a. 장점: Data와 Voice의 Traffic 분류를 통해 Voice 품질을 보장 받을 수 있다.
- b. 단점: 스위치 설정이 복잡해지고 IP Phone에 추가 설정이 필요.



서로 다른 VLAN으로
Data는 Untag 통신
Voice는 Tag 통신

LAB TEST

LAB Test

› PoE 지원 스위치

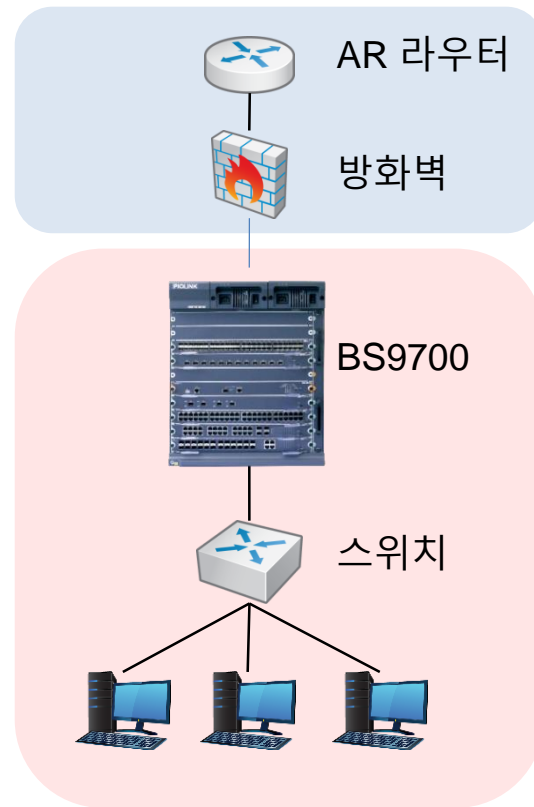
1. PoE 스위치란?

- a. Power of Ethernet
- b. 802.3af: 15.4W, 802.3at: 30W
- c. Interface에서 UTP Cable을 통해 최소 15.4W, 최대 30W의 전원을 공급 할 수 있는 스위치
- d. UTP Cable로 연결되는 장비를 확인, 전원이 필요한 장비에만 전원을 공급

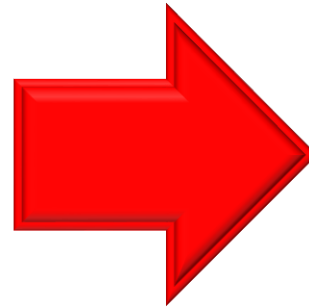
LAB TEST

LAB Test

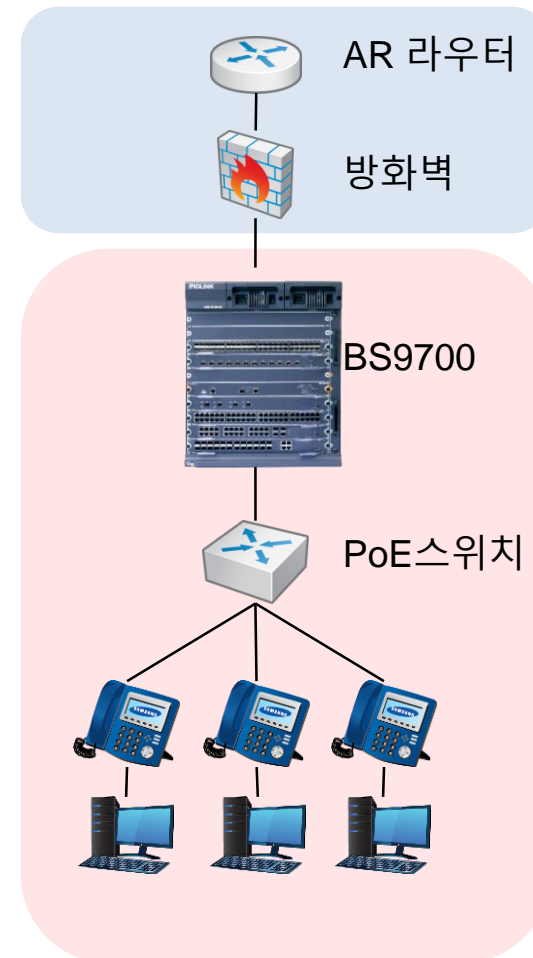
› Data Network -> IPT Network 변경 구축



AR Router
추가 설정 필요



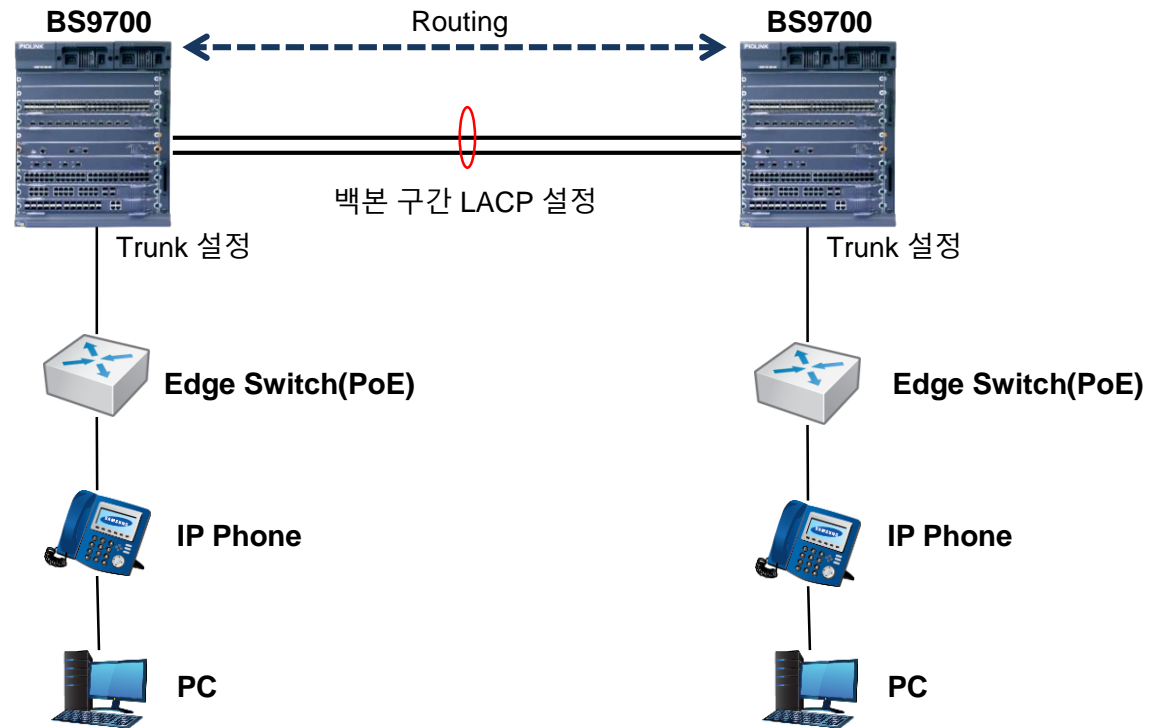
구성 변경 필요



LAB TEST

LAB Test

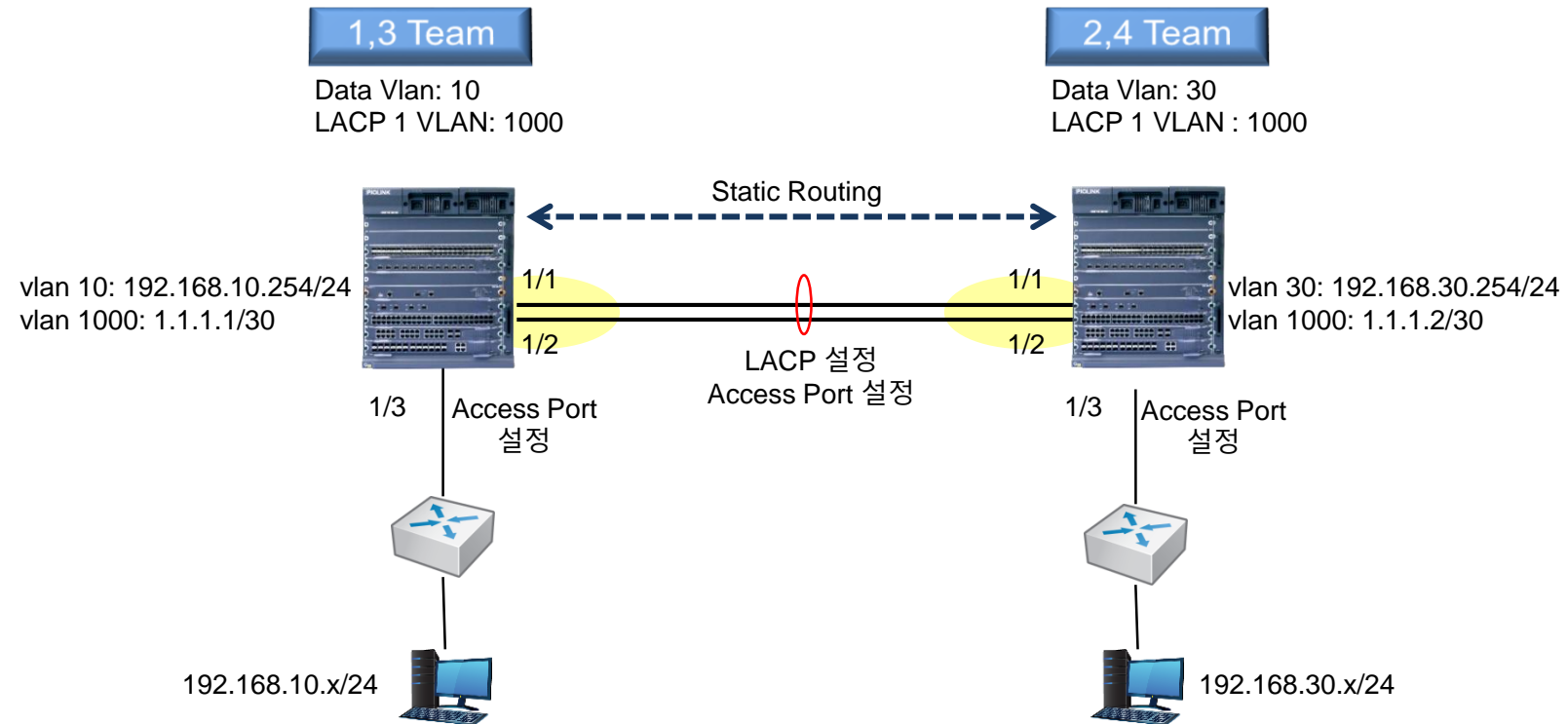
LAB 전체 구성도



LAB TEST

LAB Test

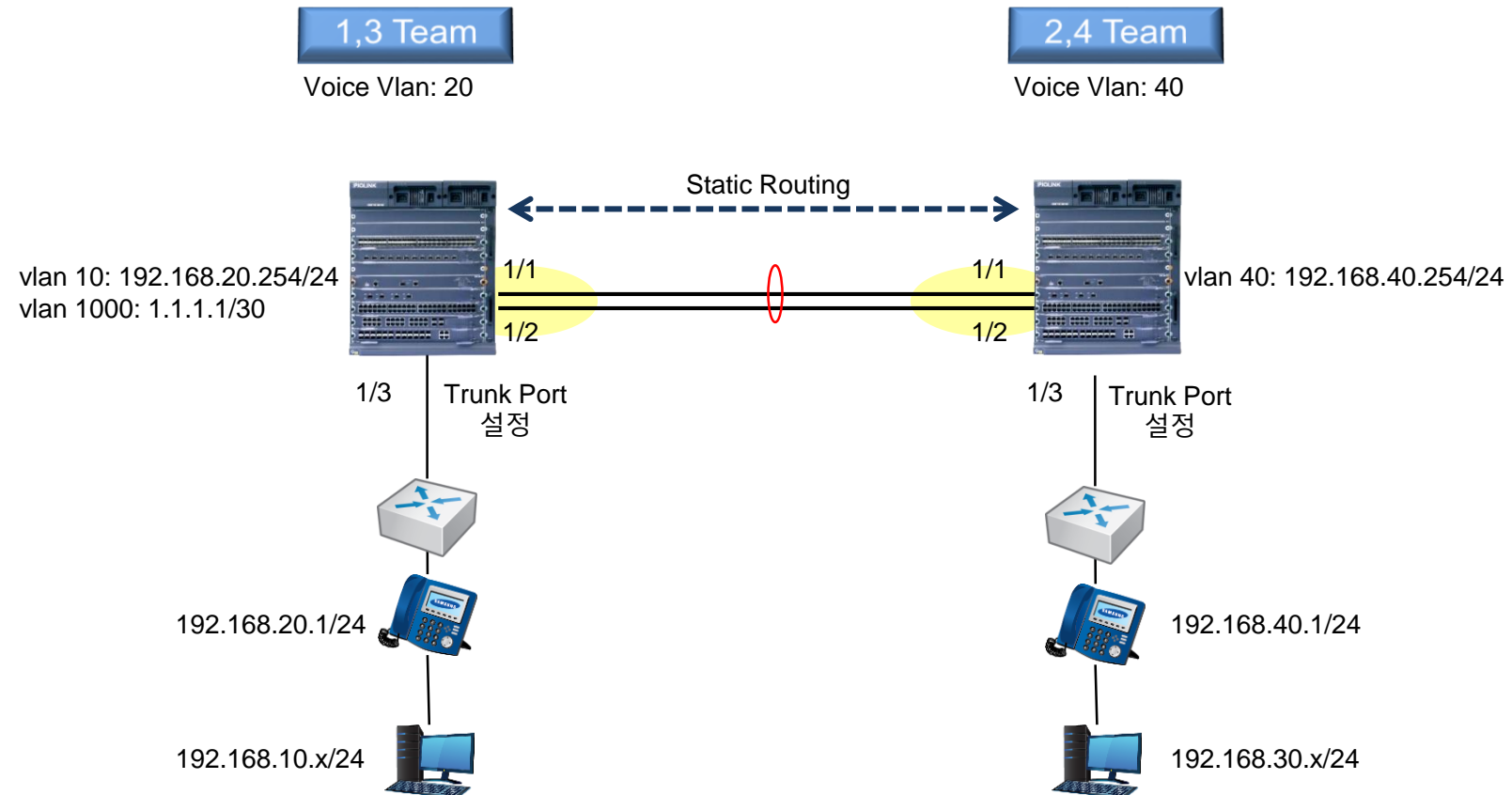
LAB 상세 구성도-Data Network



LAB TEST

LAB Test

LAB 상세 구성도-IPT Network



LAB TEST

LAB Test

› LAB 구성 방안

1. Data Network 구성 방법

- a. Data Network Vlan 생성
- b. Data Vlan 관리 IP, Gateway 설정
- c. Interface 설정(Interface Mode/Vlan 할당)
- d. Static Routing 설정
- e. 통신 확인

2. IPT Network 변경 구성 방법

- a. Voice Network Vlan 생성
- b. Voice Vlan 관리 IP, Gateway 설정
- c. Interface 설정(Interface Mode/Vlan 할당)
- d. 통신 확인

LAB TEST

LAB Test

› LAB 구성 필수 과제

1. Hostname 설정

- a. 각각 할당된 Team 번호 설정(EX: 1Team)

2. Spanning-Tree 설정

- a. Spanning-Tree 기능 활성화
- b. Spanning-Tree Mode RSTP 변경
- c. Spanning-Tree Priority 값 0 설정으로 Root 스위치 선정

3. Loop-Detection 설정

- a. 스위치가 연결되는 Interface에 Loop-Detection 기능 활성화

LAB TEST

LAB Test

› LAB 구성 필수 과제

4. NMS 연동 설정

- a. Snmp-server 기능 활성화
- b. Snmp-server Community 값 kepc0123으로 설정

5. 장애 분석 및 트래픽 분석용 설정

- a. 전체 Traffic Mirroring 설정
- b. Source Port 1, Destination Port 1

LAB TEST

LAB Test

› (공통)LAB 구성 필수 과제 Sample Configuration

– Hostname 설정

- BS9700_config#hostname test
- test_config#

– Spanning-Tree 설정

- BS9700_config#spanning-tree mode rstp
- BS9700_config#spanning-tree
- BS9700_config#spanning-tree rstp priority 0

– Loop-Detection 설정

- BS9700_config#loopback-detection
- BS9700_config#interface gi1/1
- BS9700_config_g1/1#loopback-detection enable
- BS9700_config_g1/1#loopback-detection hello-time 10

LAB TEST

LAB Test

› (공통)LAB 구성 필수 과제 Sample Configuration

– NMS 연동 설정(SNMP)

- BS9700_config#snmp-server enable
- BS9700_config#snmp-server community public rw

– 장애 분석 및 트래픽 분석용 설정 (Mirroring)

- BS9700_config#mirror session 1 source interface gi1/1 both
- BS9700_config#mirror session 1 destination interface gi1/2

LAB TEST

LAB Test

› (공통)LAB 구성 필수 과제 설정 결과 값 확인

– Hostname 확인

BS9700#show run | inc hostname

Building configuration...

Current configuration:

hostname BS9700

Spanning-Tree 확인

BS9700#show spanning-tree

Spanning tree **enabled** protocol **RSTP**(2004)

RSTP

Root ID Priority 0

Address FCFA.F744.6FB0

This bridge is the root

Hello Time 2 sec Max Age 20 sec Forward Delay 15 sec

Bridge ID **Priority** 0

Address FCFA.F744.6FB0

Hello Time 2 sec Max Age 20 sec Forward Delay 15 sec

Interface	Role	Sts	Cost	Pri.Nbr	Type
-----------	------	-----	------	---------	------

g1/13	Desg	FWD	20000	128.102	Edge
-------	------	-----	-------	---------	------

BS9700#

LAB TEST

LAB Test

› (공통)LAB 구성 필수 과제 설정 결과 값 확인

– Loop-Detection 확인

```
BS9700#show loopback-detection
```

```
Loopback-detection is enable
```

```
Loopback-detection packet's sys Mac address: fcfa.f744.6fb0
```

```
Interface state information
```

```
Port    Status  dest MacAddress Control  VLAN
```

```
-----
```

```
g2/1 no-loop 0180.c200.000a  WARNING
```

```
g2/2 no-loop 0180.c200.000a  WARNING
```

```
g2/3 looped 0180.c200.000a  WARNING
```

– NMS 연동설정(SNMP) 확인

```
BS9700#show running-config | inc snmp-server
```

```
Building configuration...
```

```
Current configuration:
```

```
!
```

```
snmp-server community 0 kepc0123 RW
```

```
BS9700#
```

LAB TEST

LAB Test

› (공통)LAB 구성 필수 과제 설정 결과 값 확인

– 트래픽 분석용 연동 설정(Mirroring) 확인

BS9700#show mirror session 1

Session 1

Destination Ports: g1/2

Source Ports:

RX Only: None

TX Only: None

Both: g1/1

BS9700#

LAB TEST

LAB Test

› (1,3팀)Data Network Sample Config

– Interface 설정(Interface Mode/Vlan 할당)

- BS9700_config#interface gi1/3
- BS9700_config_g1/1#switchport mode access
- BS9700_config_g1/1#switchport pvid 10
- BS9700_config#interface port-aggregator 1
- BS9700_config_p1#switchport mode access
- BS9700_config_p1#switchport pvid 1000

– Static Routing 설정

- BS9700_config#ip route 0.0.0.0 0.0.0.0 1.1.1.2

LAB TEST

LAB Test

› (1,3팀)Data Network Sample Config

– VLAN 확인

BS9700#show vlan

VLAN	Status	Name	Ports
1	Static	Default	g2/1, g2/2, g2/3, g2/4, g2/5 g2/6, g2/7, g2/8, g2/9, g2/10 g2/11, g2/12, g2/13, g2/14, g2/15 ...
10	Static	VLAN0010	g1/3
1000	Static	VLAN1000	g1/1, g1/2, p1

– Vlan IP 확인

BS9700#sh ip int brief

Interface	IP-Address	Method Protocol-Status
GigaEthernet6/0	unassigned	manual down
Null0	unassigned	manual up
VLAN1	unassigned	manual down
VLAN10	192.168.10.254	manual up
VLAN100	1.1.1.1	manual up

BS9700#

LAB TEST

LAB Test

› (1,3팀)Data Network Sample Config

– static routing 확인

BS9700#sh ip route

Codes: C - connected, S - static, R - RIP, B - BGP, BC - BGP connected

D - BEIGRP, DEX - external BEIGRP, O - OSPF, OIA - OSPF inter area

ON1 - OSPF NSSA external type 1, ON2 - OSPF NSSA external type 2

OE1 - OSPF external type 1, OE2 - OSPF external type 2

DHCP - DHCP type, L1 - IS-IS level-1, L2 - IS-IS level-2, IA - ISIS inter-level

I - IPSEC type

VRF ID: 0

S 0.0.0.0/0 [1,0] via 1.1.1.2(on VLAN1000)

C 192.168.100.0/24 is directly connected, VLAN100

BS9700#

LAB TEST

LAB Test

› (2,4팀)Data Network Sample Config

– Vlan 생성 및 Description 설정

- BS9700_config#vlan 30,1000
- BS9700_config#interface vlan30
- BS9700_config_v30#description Data Network
- BS9700_config#interface vlan1000
- BS9700_config_v1000#description Routing Port

– VLAN 관리 IP 설정(Gateway IP 설정)

- BS9700_config#interface vlan30
- BS9700_config_v30#ip add 192.168.30.254 255.255.255.0
- BS9700_config#interface vlan1000
- BS9700_config_v1000#ip add 1.1.1.2 255.255.255.252

– LACP(Link-Aggregation) 설정

- BS9700_config#interface port-aggregator 1
- BS9700_config_p1#interface range gi1/1-2
- BS9700_config_if_range#aggregator-group 1 mode lacp active

LAB TEST

LAB Test

› (2,4팀)Data Network Sample Config

– Interface 설정(Interface Mode/Vlan 할당)

- BS9700_config#interface gi1/3
- BS9700_config_g1/1#switchport mode access
- BS9700_config_g1/1#switchport pvid 30
- BS9700_config#interface port-aggregator 1
- BS9700_config_p1#switchport mode access
- BS9700_config_p1#switchport pvid 1000

– Static Routing 설정

- BS9700_config#ip route 0.0.0.0 0.0.0.0 1.1.1.1

LAB TEST

LAB Test

› (2,4팀)Data Network Sample Config

– VLAN 확인

BS9700#show vlan

VLAN	Status	Name	Ports
1	Static	Default	g2/1, g2/2, g2/3, g2/4, g2/5 g2/6, g2/7, g2/8, g2/9, g2/10 g2/11, g2/12, g2/13, g2/14, g2/15 ...
30	Static	VLAN0030	g1/3
1000	Static	VLAN1000	g1/1, g1/2, p1

BS9700#

– Vlan IP 확인

BS9700#sh ip int b

Interface	IP-Address	Method	Protocol-Status
GigaEthernet6/0	unassigned	manual	down
Null0	unassigned	manual	down
VLAN1	unassigned	manual	down
VLAN30	192.168.30.254	manual	up
VLAN1000	1.1.1.2	manual	up

BS9700#

LAB TEST

LAB Test

› (2,4팀)Data Network Sample Config

– static routing 확인

BS9700#sh ip route

Codes: C - connected, S - static, R - RIP, B - BGP, BC - BGP connected

D - BEIGRP, DEX - external BEIGRP, O - OSPF, OIA - OSPF inter area

ON1 - OSPF NSSA external type 1, ON2 - OSPF NSSA external type 2

OE1 - OSPF external type 1, OE2 - OSPF external type 2

DHCP - DHCP type, L1 - IS-IS level-1, L2 - IS-IS level-2, IA - ISIS inter-level

I - IPSEC type

VRF ID: 0

S 0.0.0.0/0 [1,0] via 1.1.1.1(on VLAN1000)

C 1.1.1.0/24 is directly connected, VLAN1000

BS9700#

LAB TEST

LAB Test

- › **(1,3팀) Voice Network 설정 결과 값 확인**
 - **Vlan 생성 및 Description 설정**
 - BS9700_config#vlan 20
 - BS9700_config#interface vlan20
 - BS9700_config_v20#description Voice Network
 - **VLAN 관리 IP 설정(Gateway IP 설정)**
 - BS9700_config#interface vlan20
 - BS9700_config_v20#ip add 192.168.20.254 255.255.255.0
 - **Interface 설정(Interface Mode/Vlan 할당)**
 - BS9700_config#interface gi1/3
 - BS9700_config_g1/3#switchport mode trunk
 - BS9700_config_g1/3#switchport trunk vlan-allowed add 10,20
 - BS9700_config_g1/3#no switchport pvid
 - BS9700_config_g1/3#switchport trunk vlan-untagged 10
 - BS9700_config_g1/3#switchport pvid 10

LAB TEST

LAB Test

› (1,3팀) Voice Network Sample Config

– VLAN 확인

BS9700#

BS9700#show vlan interface gigaEthernet 1/3

Interface	VLAN			
Name	Property	PVID	Vlan-Map	uTagg-Vlan-Map

GigaEthernet4/1	Trunk	10	10,20	10

BS9700#

LAB TEST

LAB Test

› (1,3팀) Voice Network Sample Config

– VLAN 확인

BS9700#

BS9700#show vlan interface gigaEthernet 1/3

Interface	VLAN		
Name	Property	PVID	Vlan-Map
			uTagg-Vlan-Map

GigaEthernet4/1	Trunk	10	10,20
			10

BS9700#

– Vlan IP 확인

BS9700#show ip interface brief

Interface	IP-Address	Method	Protocol-Status
GigaEthernet5/0	unassigned	manual	up
Null0	unassigned	manual	up
VLAN20	192.168.20.254	manual	down
VLAN10	192.168.10.254	manual	down
VLAN1000	1.1.1.1	manual	up

BS9700#

LAB TEST

LAB Test

› (2,4팀) Voice Network Sample Config

– VLAN 확인

BS9700#

BS9700#show vlan interface gigaEthernet 1/3

Interface	VLAN		
Name	Property	PVID	Vlan-Map
			uTagg-Vlan-Map

GigaEthernet1/3	Trunk	30	30,40
			30

BS9700#

– Vlan IP 확인

BS9700#show ip interface brief

Interface	IP-Address	Method	Protocol-Status
GigaEthernet5/0	unassigned	manual	up
Null0	unassigned	manual	up
VLAN40	192.168.40.254	manual	up
VLAN30	192.168.30.254	manual	up
VLAN1000	1.1.1.2	manual	up

BS9700#

LAB TEST

LAB Test

- › **(2,4팀) Voice Network 설정 결과 값 확인**
 - **Vlan 생성 및 Description 설정**
 - BS9700_config#vlan 40
 - BS9700_config#interface vlan 40
 - BS9700_config_v40#description Voice Network
 - **VLAN 관리 IP 설정(Gateway IP 설정)**
 - BS9700_config#interface vlan40
 - BS9700_config_v40#ip add 192.168.40.254 255.255.255.0
 - **Interface 설정(Interface Mode/Vlan 할당)**
 - BS9700_config#interface gi1/3
 - BS9700_config_g1/3#switchport mode trunk
 - BS9700_config_g1/3#switchport trunk vlan-allowed add 30,40
 - BS9700_config_g1/3#no switchport pvid
 - BS9700_config_g1/3#switchport trunk vlan-untagged 10
 - BS9700_config_g1/3#switchport pvid 30

THANK YOU

(주)파이오링크



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