NSH-3424

24-port 10/100/1000Base-T Gigabit Web Smart Switch

User Manual

Version 1.1   March 28, 2016

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FCC WARNING

This equipment has been tested and found to comply with the limits for a class A device, pursuant to part 15 of FCC rules. These limits are designed to provide reasonable protection against harmful interference in a commercial installation. This equipment generates uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communication. Operation of this equipment in a residential area is likely to cause harmful interference, in which case, the user will be required to correct the interference at the user's own expense.

CE

This is a Class A product. In a domestic environment, this product may cause radio interference in which case the user may be required to take adequate measures.

CAUTION

Take special care to read and understand all the content in the warning boxes:

Warning

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1. About this Guide

1.1. Welcome

The NSH-3424 is the latest generation of Volktek Gigabit Web Smart Switch offers powerful L2 features, enhanced performance and usability. By offering optimization for network efficient, operational cost saving and ease management, the NSH-3424 allows quick deployment and seamless upgradable. Targeting small and medium sized business, the switch offers up to 24 ports in both Fast Ethernet and Gigabit Ethernet, those purposely designed for converged networks where voice, video, data… are all carried on a single network cable. The switch complies with IEEE 802.3az Energy Efficient Ethernet for better power saving consumption. All in one makes NSH-3424 to be an ideal solution for the best combination of features, performance and usability in very cost saving package

1.2. Purpose
This guide discusses how to install and configure your Managed Layer 2 Web Smart Switch.

1.3. Terms/Usage
In this guide, the term "Switch" (first letter upper case) refers to the NSH-3424 Switch, and "switch" (first letter lower case) refers to other switches.

1.4. Features

Network Function

Port-based Loop detection

Static/LACP Trunking

Spanning tree Protocol

Rapid Spanning Tree Protocol

Tag Based/Port-Based VLAN

IGMP Snooping v1/v2/v3

IEEE 802.1ab LLDP

Network Management

Telnet, Web-based GUI

Auto Logout Timer

SNMP v1/v2c

SNMP Trap

Email Alarm

RMON 1, 2, 3, and 9

Private MIB

Local/Remote Syslog support

Configuration Backup/Restore

User Security

ARP Inspection

ACL (L2/L3/L4)

DHCP Snooping

Traffic Management & QoS

256 Active VLAN Support

MAC-based VLAN

Port isolation

802.1p Priority Queues per port

Traffic Classification

Network Storm Control

QoS Scheduler SP/WRR/WFQ

Management VLAN

802.3x Flow Control

1.5. Specifications

IEEE Standards

IEEE 802.3	10Base-T
IEEE 802.3u	100Base-TX
IEEE 802.3ab	1000Base-T
IEEE 802.3x	Flow Control
IEEE 802.1d	Spanning Tree Protocol
IEEE 802.1w	Rapid Spanning Tree Protocol
IEEE 802.1q	VLAN Tagging
IEEE 802.1p	Class of Service
IEEE 802.1ab	Link Layer Discovery Protocol
IEEE 802.3ad	Port Trunk with LACP
IEEE 802.3az	Energy Efficient Ethernet

Performance

Switching fabric	48 Gbps
L2 forwarding	35.7 Mpps
MAC Entries	8 K
Jumbo frame	10 K
Throughput	14,880pps to 10Mbps ports
	148,800pps to 100Mbps ports
	1,488,000pps to 1000Mbps ports

Physical ports

24 x 10/100/1000Base-T

Mechanical & Environmental

Operating temperature	0°C to 50°C
Storage temperature	-40°C to 70°C
Operating humidity	10% to 95% RH (no-condensing)
Storage humidity	5% to 95% RH (no-condensing)
Case Material	Metal housing
Dimension (WxDxH)	267x162x42mm

Power

AC Power input	100~240VAC, 50~60Hz

2. Hardware Description

The following figure shows the front panel of the switch.
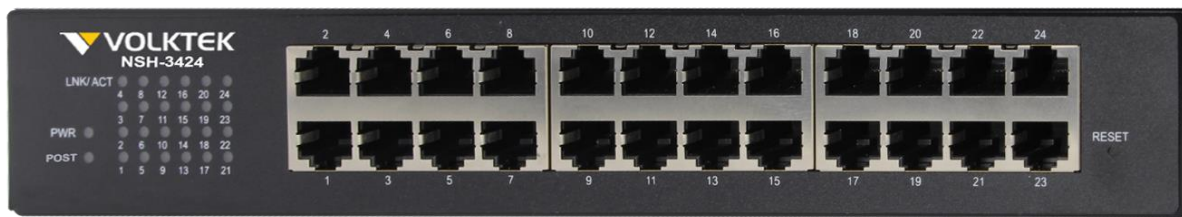
The following figure shows the rear panel of the switch.

2.1. 10/100/1000Base-T Ports

The 10/100/1000Base-T ports support network speeds of 10Mbps, 100Mbps or 1000Mbps, and can operate in half- and full-duplex transfer modes. These ports also offer automatic MDI/MDI-X crossover detection that gives true "plug-n-play" capability – just plug the network cables into the ports and the ports will adjust according to the end-node devices. The following are recommended cabling for the RJ-45 connectors: (1) 10Mbps – Cat 3 or better; (2) 1000Mbps – Cat 5e or better.

2.2. Installation

This switch can be placed on your desktop directly, or mounted in a rack. Please refer to the instructions for installation.

Before installing the switch, we recommend:
- ✓ The switch is placed with appropriate ventilation environment. A minimum 25 mm space around the unit is recommended.
- ✓ The switch and the relevant components are away from sources of electrical noise such as radios, transmitters and broadband amplifiers
- ✓ The switch is away from environments beyond recommend moisture

Desktop Installation
- ✓ Install the switch on a level surface that can support the weight of the unit and the relevant components.
- ✓ Plug the switch with the female end of the provided power cord and plug the male end to the power outlet.

Rack-mount Installation

The switch may be standalone, or mounted in a rack. Rack mounting facilitate to an orderly installation when you are going to install series of networking devices.

Procedures to Rack-mount the switch:
- ✓ Disconnect all the cables from the switch before continuing.
- ✓ Place the unit the right way up on a hard, flat surface with the front facing you.
- ✓ Locate a mounting bracket over the mounting holes on one side of the unit.
- ✓ Insert the screws and fully tighten with a suitable screwdriver.
- ✓ Repeat the two previous steps for the other side of the unit.
- ✓ Insert the unit into the rack and secure with suitable screws.
- ✓ Reconnect all the cables.

Installing Network Cables

- ✓ Crossover or straight-through cable: All the ports on the switch support Auto-MDI/MDI-X functionality. Both straight-through or crossover cables can be used as the media to connect the switch with PCs as well as other devices like switches, hubs or router.

- ✓ Category 3, 4, 5 or 5e, 6 UTP/STP cable: To make a valid connection and obtain the optimal performance, an appropriate cable that corresponds to different transmitting/receiving speed is required. To choose a suitable cable, please refer to the following table.

Media	Speed	Wiring
10/100/1000 Mbps copper	10 Mbps	Category 3,4,5 UTP/STP
	100 Mbps	Category 5 UTP/STP
	1000 Mbps	Category 5e, 6 UTP/STP

Connect Power

- ✓ The Switch uses an AC power supply 100~240VAC, 50~60 Hz. The Switch's power supply automatically self-adjusts to the local power source and may be powered on without having any or all LAN segment cables connected.

- ✓ Verify basic switch operation by checking the system LEDs. When operating normally, the POST and PWR LEDs should both be on green.

Notice: Turn off the power before connecting modules or wires.

- *The correct power supply voltage is listed on the product label. Check the voltage of your power source to make sure that you are using the correct voltage. Do NOT use a voltage greater than what is specified on the product label.*

- *Calculate the maximum possible current in each power wire and common wire. Observe all electrical codes dictating the maximum current allowable for each wire size. If current go above the maximum ratings, the wiring could overheat, causing serious damage to your equipment.*

- *Before connecting the switch to AC power, the grounding terminal screw on the*

switch rear panel must be connected to earth.

2.3. Reset/Factory Default Button

There has "Reset" button in front of Switch which can help to manually hardware reboot or reset to factory default settings.

- ✓ Press the "Reset" button for less than 5 seconds → Restart the system software using the current configuration file settings.

- ✓ Press the "Reset" button for greater than 5 seconds → Restart the system software using factory default settings.

2.4. LED Indicators

This Switch is equipped with Unit LEDs to enable you to determine the status of the Switch, as well as Port LEDs to display what is happening in all your connections. They are as follows:

LED	Condition	Status
POWER (Green)	Illuminated	Power on
	Off	Power off or failed
POST (Green)	Illuminated	System ready to use
	Blinking	Power on self-test
	Off	Power off or test fail
LNK/ACT (Green) (1~24th Copper ports)	Illuminated	Ethernet link-up
	Blinking	Activity (receiving or transmitting data)
	Off	Port disconnected or link failed

3. Management options

3.1. Management via console port (Onboard Pin header connector for RD debug)

Access the Switch via a terminal emulator (such as Hyper Terminal) attached to the console port. The console port is set at the factory with the following default COM port properties. Configure your own terminal to match the following:

Setting	Default Value
Terminal Emulation	VT100
Baud Rate	38400
Parity	None
Data Bits	8
Stop Bits	1
Flow Control	None

Note: Ensure   that   the   terminal   or   PC   you   are   using   to   make   this connection   is configured to match the above settings. Otherwise the connection will not work.

Then press [ENTER] to open the login screen with the "Default Value" for Username and Password as "admin".

3.2. Management by Telnet

Activate your workstation's command prompt program and access your Switch via the Internet by typing in the correct IP address (factory default IP address is 192.168.0.254 - connect directly via console port to configure a unique IP address). Your command prompt program will allow use of the Telnet protocol.

1. Connect your computer to one of the Ethernet ports.
2. Open a Telnet session to the Switch's IP address. If this is your first login, use the default values.

Setting	Default Value
IP Address	192.168.0.254
Subnet Mask	255.255.255.0
Default Gateway	0.0.0.0
Management VLAN	1
Default Username	admin
Default Password	admin

3. Make sure your computer IP address is in the same subnet, unless you are accessing the Switch through one or more routers.

3.3. How to enter the CLI?

Press [Enter] key to enter the login command prompt when below message is displayed on

the screen.
Please press Enter to activate this console

Input "***admin***" to enter the CLI mode when below message is displayed on the screen.
L2SWITCH login:

You can execute a few limited commands when CLI prompt is displayed as below.
L2SWITCH>

If you want to execute more powerful commands, you must enter the privileged mode.
Input command "***enable***"
L2SWITCH>enable

Input a valid username and password when below prompt are displayed.
user:admin
password:admin

L2SWITCH#

3.4. CLI command concept

Node	Command	Description
enable	show hostname	This command displays the system's network name.
configure	reboot	This command reboots the system.
eth0	ip address A.B.C.D/M	This command configures a static IP and subnet mask for the system.
interface	show	This command displays the current port configurations.
vlan	show	This command displays the current VLAN configurations.

The Node type:
- enable
  Its command prompt is "***L2SWITCH#".***
  It means these commands can be executed in this command prompt.

- configure
  Its command prompt is "***L2SWITCH(config)#".***
  It means these commands can be executed in this command prompt.
  In ***Enable*** code, executing command "***configure terminal***" enter the configure node.
  L2SWITCH# configure terminal

- eth0
  Its command prompt is "***L2SWITCH(config-if)#".***
  It means these commands can be executed in this command prompt.
  In ***Configure*** code, executing command "***interface eth0***" enter the eth0 interface node.
  L2SWITCH(config)#interface eth0

L2SWITCH(config-if)#

- interface
  Its command prompt is "***L2SWITCH(config-if)#***".
  It means these commands can be executed in this command prompt.
  In ***Configure*** code, executing command "***interface gigaethernet1/0/5***" enter the interface port 5.
  Or
  In ***Configure*** code, executing command "***interface fastethernet1/0/5***" enter the interface port 5.
  Note: depend on your port speed, gigaethernet1/0/5 for gigabit Ethernet ports and fastethernet1/0/5 for fast Ethernet ports.
  L2SWITCH(config)#interface gigaethernet1/0/5
  L2SWITCH(config-if)#

- vlan
  Its command prompt is "***L2SWITCH(config-vlan)#***".
  It means these commands can be executed in this command prompt.
  In ***Configure*** code, executing command "***vlan 2***" enter the vlan 2 node.
  Note: where the "2" is the vlan ID.
  L2SWITCH(config)#vlan 2
  L2SWITCH(config-vlan)#

3.5. Management via Internet Browser Interface

From a PC, open your Web browser, type the following in the Web address (or location) box: *http://192.168.0.254* and then press <Enter>.
This is the factory default IP address for the switch. A login dialog is displayed, as shown in the figure:

Enter your user name/password, and then click OK.
Use the defaults the first time you log into the program. You can change the password at any time through CLI interface.
   Default:
      User name: admin,
      Password: admin.

3.6. System Information

The System Information window appears each time you log into the program. Alternatively, this window can be accessed by clicking System Status > System Information

3.6.1. CLI Configuration

Node	Command	Description
enable	show hostname	This command displays the system's network name.
enable	show interface eth0	This command displays the current Eth0 configurations.
enable	show model	This command displays the system information.
enable	show running-config	This command displays the current operating configurations.
enable	show system-info	This command displays the system's CPU loading and memory information.
enable	show uptime	This command displays the system up time.

3.6.2. Web Configuration

Parameter	Description
Model Name	This field displays the model name of the Switch.
Host name	This field displays the name of the Switch.
Boot Code Version	This field displays the boot code version.
Firmware Version	This field displays the firmware version.
Built Date	This field displays the built date of the firmware.
DHCP Client	This field displays whether the DHCP client is enabled on the Switch.

IP Address	This field indicates the IP address of the Switch.
Subnet Mask	This field indicates the subnet mask of the Switch.
Default Gateway	This field indicates the default gateway of the Switch.
MAC Address	This field displays the MAC (Media Access Control) address of the Switch.
Serial Number	The serial number assigned by manufacture for identification of the unit.
Management VLAN	This field displays the VLAN ID that is used for the Switch management purposes.
CPU Loading	This field displays the percentage of your Switch's system load.
Memory Information	This field displays the total memory the Switch has and the memory which is currently available (**Free**) and occupied (**Usage**).
Current Time	This field displays current date (yyyy-mm-dd) and time (hh:mm:ss).
Refresh	Click this button to update the information in this screen.

4. Basic Settings

4.1. General Settings

4.1.1. System

4.1.1.1. Introduction

Management VLAN

To specify a VLAN group which can access the Switch.
- The valid VLAN range is from 1 to 4094.
- If you want to configure a management VLAN, the management VLAN should be created first and the management VLAN should have at least one member port.

Host Name
The **hostname** is same as the SNMP system name. Its length is up to 64 characters.
The first 16 characters of the hostname will be configured as the CLI prompt.

Default Settings
- ✓ The default Hostname is L2SWITCH
- ✓ The default DHCP client is disabled.
- ✓ The default Static IP is 192.168.0.254
- ✓ Subnet Mask is 255.255.255.0
- ✓ Default Gateway is 0.0.0.0
- ✓ Management VLAN is 1.

4.1.1.2. CLI Configuration

Node	Command	Description
enable	ping IPADDR [–c COUNT]	This command sends an echo request to the destination host. The –c parameter allow user to specific the packet count. The default count is 4.
enable	ping IPADDR [–s SIZE]	This command sends an echo request to the destination host. The –s parameter allow user to specific the packet size. Valid range: 0 ~ 1047 bytes.
enable	ping IPADDR [–c COUNT –s SIZE]	This command sends an echo request to the destination host. The –c parameter allow user to specific the packet count. The default count is 4. The –s parameter allow user to specific the packet size. Valid range: 0 ~ 1047 bytes.
enable	ping IPADDR [-s SIZE –c COUNT]	This command sends an echo request to the destination host. The –c parameter allow user to specific the packet count. The default count is 4. The –s parameter allow user to specific the packet size. Valid range: 0 ~ 1047 bytes.
configure	reboot	This command reboots the system.
configure	hostname STRINGS	This command sets the system's network name.
configure	interface eth0	This command enters the eth0 interface node to configure the system IP.

configure	configure terminal	This command changes the mode to config mode.
configure	interface eth0	This command changes the mode to eth0 mode.
eth0	show	This command displays the eth0 configurations.
eth0	ip address A.B.C.D/M	This command configures a static IP and subnet mask for the system.
eth0	ip address default-gateway A.B.C.D	This command configures the system default gateway.
eth0	ip dhcp client (disable|enable|renew)	This command configures a DHCP client function for the system. Disable: Use a static IP address on the switch. Enable & Renew: Use DHCP client to get an IP address from DHCP server.
eth0	management vlan VLANID	This command configures the management vlan.

Example: The procedures to configure an IP address for the Switch.

➢ To enter the configure node.
L2SWITCH#configure terminal
L2SWITCH(config)#

➢ To enter the ETH0 interface node.
L2SWITCH(config)#interface eth0
L2SWITCH(config-if)#

➢ To get an IP address from a DHCP server.
L2SWITCH(config-if)#ip dhcp client enable

➢ To configure a static IP address for the Switch.
L2SWITCH(config-if)#ip address 192.168.202.111/24
L2SWITCH(config-if)#ip address default-gateway 192.168.202.1

4.1.1.3. Web Configuration

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Parameter	Description
Hostname	Enter up to 64 alphanumeric characters for the name of your Switch. The hostname should be the combination of the digit or the alphabet or hyphens (-) or underscores (_).
Management VLAN	Enter a VLAN ID used for Switch management purposes.
IPv4 Settings	
DHCP Client	Select **Enable** to allow the Switch to automatically get an IP address from a DHCP server. Click **Renew** to have the Switch reget an IP address from the DHCP server. Select **Disable** if you want to configure the Switch's IP address manually.
Static IP Address	Configures a IPv4 address for your Switch in dotted decimal notation. For example, 192.168.0.254.
Subnet Mask	Enter the IP subnet mask of your Switch in dotted decimal notation for example 255.255.255.0.
Default Gateway	Enter the IP address of the default outgoing gateway in dotted decimal notation, for example 192.168.1.1.
Apply	Click this button to take effect the settings.
Refresh	Click this button to reset the fields to the last setting.

4.1.2. Jumbo Frame
4.1.2.1. Introduction
Jumbo frames are Ethernet frames with a payload greater than 1500 bytes. Jumbo frames can enhance data transmission efficiency in a network. The bigger the frame size, the better the performance.

Notice:
- ✓ The jumbo frame settings will apply to all ports.
- ✓ If the size of a packet exceeds the jumbo frame size, the packet will be dropped.
- ✓ The available values are 10240, 1522, 1536, 1552, 9216.

Default Setting: The default jumbo frame is 10240 bytes.

4.1.2.2. CLI Configuration

Node	Command	Description
enable	show jumboframe	This command displays the current jumbo frame settings.
configure	jumboframe (10240|1522|1536|1552|9010|9216)	This command configures the maximum number of bytes of frame size for all ports.

Example: The procedures to configure the Jumbo frame size.

➢ To enter the configure node.
L2SWITCH#configure terminal
L2SWITCH(config)#

➢ To configure 9216 as the jumbo frame size for all ports.
L2SWITCH(config)#jumboframe 9216

4.1.2.3. Web Configuration

Parameter	Description
Frame Size	This field configures the maximum number of bytes of frame size.
Apply	Click this button to take effect the settings.
Refresh	Click this button to reset the fields to the last setting.

4.1.3.   SNTP
4.1.3.1. Introduction
The Network Time Protocol (NTP) is a protocol for synchronizing the clocks of computer systems over packet-switched, variable-latency data networks. A less complex implementation of NTP, using the same protocol but without requiring the storage of state over extended periods of time is known as the **Simple Network Time Protocol** (**SNTP**). NTP provides Coordinated Universal Time (UTC). No information about time zones or daylight saving time is transmitted; this information is outside its scope and must be obtained separately.
UDP Port: 123.

Daylight saving is a period from late spring to early fall when many countries set their clocks ahead of normal local time by one hour to give more daytime light in the evening.

Note:
1. The SNTP server always replies the UTC current time.
2. When the Switch receives the SNTP reply time, the Switch will adjust the time with the time zone configuration and then configure the time to the Switch.
3. If the time server's IP address is not configured, the Switch will not send any SNTP request packets.
4. If no SNTP reply packets, the Switch will retry every 10 seconds forever.

5. If the Switch has received SNTP reply, the Switch will re-get the time from NTP server every 24 hours.
6. If the time zone and time NTP server have been changed, the Switch will repeat the query process.
7. No default SNTP server.

Default Settings
Current Time:

   Time: 0:3:51 (UTC)
   Date: 1970-1-1

Time Server Configuration:

   Time Zone : +00:00
   IP Address: 0.0.0.0

DayLight Saving Time Configuration:

   State   : disabled
   Start Date: None.
   End Date : None.

4.1.3.2. CLI Configuration

Node	Command	Description
enable	show time	This command displays current time and time configurations.
configure	time HOUR:MINUTE:SECOND	Sets the current time on the Switch. *hour*: 0-23 *min*: 0-59 *sec*: 0-59 Note: If you configure Daylight Saving Time after you configure the time, the switch will apply Daylight Saving Time.
configure	time date YEAR/MONTH/DAY	Sets the current date on the Switch. *year*: 1970- *month*: 1-12 *day*: 1-31
configure	time daylight-saving-time	This command enables the daylight saving time.
configure	no time daylight-saving-time	This command disables daylight saving on the Switch.
configure	time daylight-saving-time start-date(first|second|third|fourth|last) (Sunday|Monday|Tuesday|Wednesday	This command sets the start time of the Daylight Saving Time.

	|Thursday|Friday|Saturday) MONTH HOUR	
configure	time daylight-saving-time end-date(first|second|third|fourth|last) (Sunday|Monday|Tuesday|Wednesday |Thursday|Friday|Saturday) MONTH HOUR	This command sets the end time of the Daylight Saving Time.
configure	time ntp-server (disable|enable)	This command disables / enables the NTP server state.
configure	time ntp-server IP_ADDRESS	This command sets the IP address of your time server.
configure	time ntp-server domain-name STRING	This command sets a domain name of your time server.
configure	time timezone STRING	Configures the time difference between UTC (formerly known as GMT) and your time zone. Valid Range: -1200 ~ +1200.

Example:
   L2SWITCH(config)#*time ntp-server 192.5.41.41*
   L2SWITCH(config)#*time timezone +0800*
   L2SWITCH(config)#*time ntp-server enable*
   L2SWITCH(config)#time daylight-saving-time start-date first Monday 6 0
   L2SWITCH(config)#time daylight-saving-time end-date last Saturday 10 0

4.1.3.3. Web Configuration

Parameter	Description
Current Time and Date	
Current Time	This field displays the time you open / refresh this menu.
Current Date	This field displays the date you open / refresh this menu.
Time and Date Setting	
Manual	Select this option if you want to enter the system date and time manually.
New Time	Enter the new date in year, month and day format and time in hour, minute and second format. The new date and time then appear in the **Current Date** and **Current Time** fields after you click **Apply**.
Enable Network Time Protocol	Select this option to use Network Time Protocol (NTP) for the time service.
NTP Server	Select a pre-designated time server or type the IP address of your time server. The Switch searches for the timeserver for up to 60 seconds.
Time Zone	Select the time difference between UTC (Universal Time Coordinated,

	formerly known as GMT, Greenwich Mean Time) and your time zone.
Daylight Saving Settings	
State	Select **Enable** if you want to use Daylight Saving Time. Otherwise, select **Disable** to turn it off.
Start Date	Configure the day and time when Daylight Saving Time starts if you enabled Daylight Saving Time. The time is displayed in the 24 hour format. Here are a couple of examples: Daylight Saving Time starts in most parts of the United States on the second Sunday of March. Each time zone in the United States starts using Daylight Saving Time at 2 A.M. local time. So in the United States you would select **Second**, **Sunday**, 3(**March)** and **2:00**. Daylight Saving Time starts in the European Union on the last Sunday of March. All of the time zones in the European Union start using Daylight Saving Time at the same moment (1 A.M. GMT or UTC). So in the European Union you would select **Last**, **Sunday**, 3(**March)** and the last field depends on your time zone. In Germany for instance, you would select **2:00** because Germany's time zone is one hour ahead of GMT or UTC (GMT+1).
End Date	Configure the day and time when Daylight Saving Time ends if you enabled Daylight Saving Time. The time field uses the 24 hour format. Here are a couple of examples: Daylight Saving Time ends in the United States on the last Sunday of October. Each time zone in the United States stops using Daylight Saving Time at 2 A.M. local time. So in the United States you would select **First**, **Sunday**, 11(**November)** and **2:00**. Daylight Saving Time ends in the European Union on the last Sunday of October. All of the time zones in the European Union stop using Daylight Saving Time at the same moment (1 A.M. GMT or UTC). So in the European Union you would select **Last**, **Sunday**, 10(**October)** and the last field depends on your time zone. In Germany for instance, you would select **2:00** because Germany's time zone is one hour ahead of GMT or UTC (GMT+1).
Apply	Click Apply to take effect the settings.
Refresh	Click Refresh to begin configuring this screen afresh.

4.1.4.   Management Host
4.1.4.1. Introduction
The feature limits the hosts which can manage the Switch. The default has no management host. That is, any hosts can manage the Switch via **telnet** or **web browser**. If user has configured one or more management host, the Switch can be managed by these hosts only. The feature allow user to configure management IP up to 3 entries.

Default Settings
   This feature allows user to configure management host up to 3 entries.
   The default is none, any host can manage the Switch via telnet or web browser.

4.1.4.2. CLI Configuration

Node	Command	Description
enable	show interface eth0	The command displays the all of the interface *eth0* configurations.
eth0	show	The command displays the all of the interface *eth0* configurations.
eth0	management host A.B.C.D	The command adds a management host address.
eth0	no management host A.B.C.D	The command deletes a management host address.

Example: The procedures to configure management host.
➢ To enter the configure node.
   L2SWITCH#configure terminal
   L2SWITCH(config)#

➢ To enter the interface ETH0 node.
   L2SWITCH#interface eth0
   L2SWITCH(config-if)#

➢ To configure a management host.
   L2SWITCH(config-if)#management host 192.168.200.106

➢ To remove a management host.
   L2SWITCH(config-if)#no management host 192.168.200.106

4.1.4.3. Web Configuration

Parameter	Description
Management Host	This field configures the management host.

Apply	Click this button to take effect the settings.
Refresh	Click this button to begin configuring this screen afresh.
Management Host List	
No.	This field displays a sequential number for each management host.
Management Host	This field displays the management host.
Action	Click the Delete button to remove the specified entry.

4.2. MAC Management

4.2.1. Introduction

Dynamic Address:
The MAC addresses are learnt by the switch. When the switch receives frames, it will record the source MAC, the received port and the VLAN in the address table with an age time. When the age time is expired, the address entry will be removed from the address table.

Static Address:
The MAC addresses are configured by users. The static addresses will not be aged out by the switch. The static address can be removed by user only.
The maximum static address entry is up to 256.

The switch supports up to 16K address table. The static address and the dynamic address share the same table.

The **MAC Table** (a MAC table is also known as a filtering database) shows how frames are forwarded or filtered across the Switch's ports. When a device (which may belong to a VLAN group) sends a packet which is forwarded to a port on the Switch, the MAC address of the device is shown on the Switch's MAC Table. It also shows whether the MAC address is dynamic (learned by the Switch) or static (manually entered).

The Switch uses the **MAC Table** to determine how to forward frames. See the following figure.
1. The Switch examines a received frame and learns the port from which this source MAC address came.
2. The Switch checks to see if the frame's destination MAC address matches a source MAC address already learnt in the **MAC Table**.
   ✓ If the Switch has already learnt the port for this MAC address, then it forwards the frame to that port.
   ✓ If the Switch has not already learnt the port for this MAC address, then the frame is flooded to all ports. Too much port flooding leads to network congestion.
   ✓ If the Switch has already learnt the port for this MAC address, but the destination port is the same as the port it came in on, then it filters the frame.
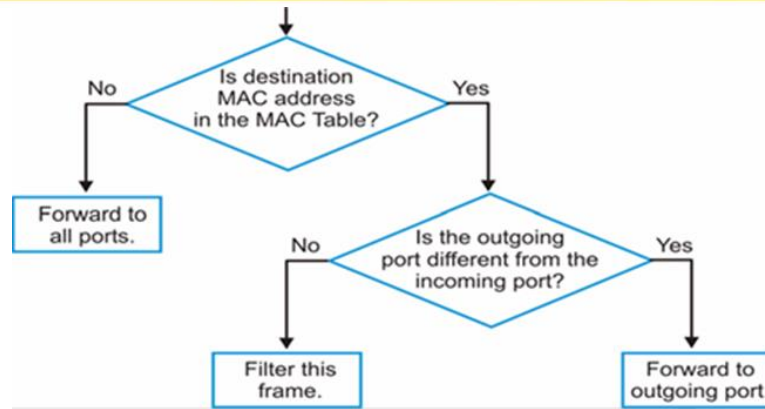
Figure: MAC Table Flowchart

Default Settings

The default MAC address table age time is 300 seconds.
The Maximum static address entry is 256.

4.2.2.　　CLI Configuration

Node	Command	Description
enable	show mac-address-table aging-time	This command displays the current MAC address table age time.
enable	show mac-address-table (static|dynamic)	This command displays the current static/dynamic unicast address entries.
enable	show mac-address-table mac MACADDR	This command displays information of a specific MAC.
enable	show mac-address-table port PORT_ID	This command displays the current unicast address entries learnt by the specific port.
configure	mac-address-table static MACADDR vlan VLANID port PORT_ID	This command configures a static unicast entry.
configure	no mac-address-table static MACADDR vlan VLANID	This command removes a static unicast entry from the address table.
configure	mac-address-table aging-time VALUE	This command configures the mac table aging time.
configure	clear mac address-table dynamic	This command clears the dynamic address entries.

Example: L2SWITCH(config)#mac-address-table static 00:11:22:33:44:55 vlan 1 port 1

4.2.3.　　Web Configuration

Static MAC

A static Media Access Control (MAC) address is an address that has been manually entered in the MAC address table. Static MAC addresses do not age out. When you set up static MAC address rules, you are setting static MAC addresses for a port. This may reduce the need for broadcasting.

Parameter	Description
Static MAC Settings	
MAC Address	Enter the MAC address of a computer or device that you want to add to the MAC address table. Valid format is hh:hh:hh:hh:hh:hh.
VLAN ID	Enter the VLAN ID to apply to the computer or device.
Port	Enter the port number to which the computer or device is connected.
Apply	Click Apply to take effect the settings.
Refresh	Click this to update the information in the MAC table.
Static MAC Table	
MAC Address	This field displays the MAC address of a manually entered MAC address entry.
VLAN ID	This field displays the VID of a manually entered MAC address entry.
Port	This field displays the port number of a manually entered MAC address entry. The MAC address with port CPU means the Switch's MAC address itself.
Action	Click **Delete** to remove this manually entered MAC address entry from the MAC address table. You cannot delete the Switch's MAC address from the static MAC address table.

MAC Table

Parameter	Description
Show Type Apply	Select **All, Static**, **Dynamic, Port or MAC** and then click **Apply** to display the corresponding MAC address entries on this screen.
Refresh	Click this to update the information in the MAC table.
MAC Address	This field displays a MAC address.
Type	This field displays whether this entry was entered manually (Static) or whether it was learned by the Switch (Dynamic).
VLAN ID	This field displays the VLAN ID of the MAC address entry.
Port	This field displays the port number the MAC address entry is associated. It displays CPU if it is the entry for the Switch itself. The CPU means that it is the Switch's MAC.
Total Counts	This field displays the total entries in the MAC table.

Age Time Settings

Parameter	Description
Age Time	Configure the age time, the valid range is from 20 to 500 seconds. The default value is 300 seconds.
Apply	Click Apply to take effect the settings.

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Refresh	Click this to update the information in the MAC table.

4.3. Port Mirror

4.3.1. Introduction

Port-based Mirroring
The Port-Based Mirroring is used on a network switch to send a copy of network packets sent/received on one or a range of switch ports to a network monitoring connection on another switch port (**Monitor-to Port**). This is commonly used for network appliances that require monitoring of network traffic, such as an intrusion-detection system.

Port Mirroring, together with a network traffic analyzer, helps to monitor network traffic. Users can monitor the selected ports (**Source Ports**) for egress and/or ingress packets.

Source Mode:
      Ingress   : The received packets will be copied to the monitor port.
      Egress   : The transmitted packets will be copied to the monitor port.
      Both   : The received and transmitted packets will be copied to the monitor port.

Note:
1. The monitor port cannot be a trunk member port.
2. The monitor port cannot be ingress or egress port.
3. If the Port Mirror function is enabled, the Monitor-to Port can receive mirrored packets only.
4. If a port has been configured as a source port and then user configures the port as a destination port, the port will be removed from the source ports automatically.

Default Settings
Mirror Configurations:
  State   : Disable
  Monitor port   : 1
  Ingress port(s)   : None
  Egress port(s)   : None

4.3.2. CLI Configuration

Node	Command	Description
enable	show mirror	This command displays the current port mirroring configurations.
configure	mirror (disable|enable)	This command disables / enables the port mirroring on the switch.
configure	mirror destination port PORT_ID	This command specifies the **monitor port** for the port mirroring.
configure	mirror source ports PORT_LIST mode *(both|ingress|egress)*	This command **adds** a port or a range of ports as the source ports of the port mirroring.

configure	no mirror source ports PORT_LIST	This command **removes** a port or a range of ports from the source ports of the port mirroring.

Example:

L2SWITCH#*configure terminal*
L2SWITCH(config)#mirror enable
L2SWITCH(config)#mirror destination port 2
L2SWITCH(config)#mirror source ports 3-6 mode both

4.3.3. Web Configuration

Parameter	Description
State	Select **Enable** to turn on port mirroring or select **Disable** to turn it off.
Monitor to Port	Select the port which connects to a network traffic analyzer.
All Ports	Settings in this field apply to all ports. Use this field only if you want to make some settings the same for all ports. Use this field first to set the common settings and then make adjustments on a port-by-port basis.

Source Port	This field displays the number of a port.
Mirror Mode	Select **Ingress**, **Egress** or **Both** to only copy the ingress (incoming), egress (outgoing) or both (incoming and outgoing) traffic from the specified source ports to the monitor port. Select **Disable** to not copy any traffic from the specified source ports to the monitor port.
Apply	Click Apply to take effect the settings.
Refresh	Click Refresh to begin configuring this screen afresh.

4.4. Port Settings

4.4.1. Introduction

✓ **Duplex mode**

A **duplex** communication system is a system composed of two connected parties or devices that can communicate with one another in both directions.

Half Duplex:

A *half-duplex* system provides for communication in both directions, but only one direction at a time (not simultaneously). Typically, once a party begins receiving a signal, it must wait for the transmitter to stop transmitting, before replying.
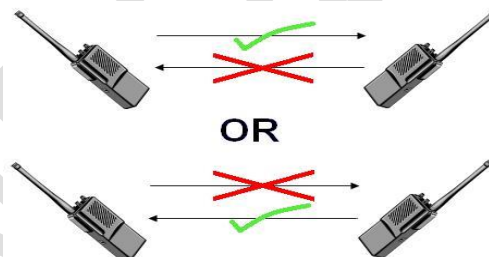
Full Duplex:

A *full-duplex*, or sometimes *double-duplex* system, allows communication in both directions, and, unlike half-duplex, allows this to happen simultaneously. Land-line telephone networks are full-duplex, since they allow both callers to speak and be heard at the same time.
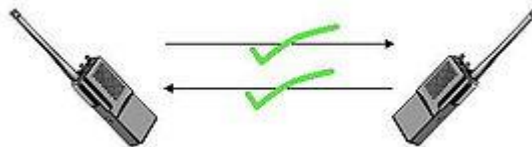
✓ **Loopback Test**

A loopback test is a test in which a signal in sent from a communications device and returned (looped back) to it as a way to determine whether the device is working right or as a way to pin down a failing node in a network. One type of loopback test is performed using a special plug, called a **wrap plug**, that is inserted in a port on a communications device. The effect of

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a wrap plug is to cause transmitted (output) data to be returned as received (input) data, simulating a complete communications circuit using a single computer.

✓ **Auto MDI-MDIX**

Auto-MDIX (**automatic medium-dependent interface crossover**) is a computer networking technology that automatically detects the required cable connection type (straight-through or crossover) and configures the connection appropriately, thereby removing the need for crossover cables to interconnect switches or connecting PCs peer-to-peer. When it is enabled, either type of cable can be used and the interface automatically corrects any incorrect cabling. For Auto-MDIX to operate correctly, the speed on the interface and duplex setting must be set to "auto". Auto-MDIX was developed by HP engineers Dan Dove and Bruce Melvin.

The original "HP Auto-MDIX" invention was spawned one day when Bruce was looking for a cross-over cable in the lab. His efforts were being hampered and out of frustration he asked Dan "Can't you invent a way so I don't need these "cross-over cables" His inspiration led Dan to develop the method which utilizes a pseudo-random number generator to decide whether or not a network port will attach its transmitter, or its receiver to each of the twisted pairs used to Auto-Negotiate the link.

Subsequently, Dan went on to promote Auto-MDIX within the IEEE-802.3ab (1000BASE-T) standard and also develop patented algorithms for "**Forced Mode Auto-MDIX**" which allows a link to be automatically established even if the port does not auto-negotiate.

✓ **Auto Negotiation**

Auto (auto-negotiation) allows one port to negotiate with a peer port automatically to obtain the connection speed and duplex mode that both ends support. When auto-negotiation is turned on, a port on the Switch negotiates with the peer automatically to determine the connection speed and duplex mode.

If the peer port does not support auto-negotiation or turns off this feature, the Switch determines the connection speed by detecting the signal on the cable and using **half duplex** mode. When the Switch's auto-negotiation is turned off, a port uses the pre-configured speed and duplex mode when making a connection, thus requiring you to make sure that the settings of the peer port are the same in order to connect.

✓ **Flow Control**

A concentration of traffic on a port decreases port bandwidth and overflows buffer memory causing packet discards and frame losses. Flow Control is used to regulate transmission of signals to match the bandwidth of the receiving port.
The Switch uses IEEE802.3x flow control in full duplex mode and backpressure flow control in half duplex mode.

IEEE802.3x flow control is used in full duplex mode to send a pause signal to the sending port, causing it to temporarily stop sending signals when the receiving port memory buffers fill.

Back Pressure flow control is typically used in half duplex mode to send a "collision" signal to the sending port (mimicking a state of packet collision) causing the sending port to temporarily stop sending signals and resend later.

✓ **Cable Test**
This feature determines the quality of the cables, shorts, cable impedance mismatch, bad connectors, termination mismatch, and bad magnetics. The feature can work on the copper Ethernet cable only.

Default Settings
The default port Speed & Duplex is auto for all ports.
The default port Flow Control is Off for all ports.

4.4.2. CLI Configuration

Node	Command	Description
enable	show interface IFNAME	This command displays the current port configurations.
configure	interface IFNAME	This command enters the interface configure node.
interface	show	This command displays the current port configurations.
interface	loopback (none | mac)	This command tests the loopback mode of operation for the specific port.
interface	flowcontrol (off | on)	This command disables / enables the flow control for the port.
interface	speed (auto|10-full||10-half|100-full|100-half|1000-full)	This command configures the speed and duplex for the port.
interface	shutdown	This command disables the specific port.
interface	no shutdown	This command enables the specific port.
interface	description STRING	This command configures a description for the specific port.
interface	no description	This command configures the default port description.
interface	cable-test start	This command starts to diagnostics the Ethernet cable.
interface	show cable-test result	This command displays the test result of the Ethernet cable test.
configure	interface range gigabitethernet1/0/ PORTLISTS	This command enters the interface configure node.
if-range	description STRINGs	This command configures a description for the specific ports.
if-range	no description	This command configures the default port description for the specific ports.
if-range	shutdown	This command disables the specific

		ports.
if-range	no shutdown	This command enables the specific ports.
if-range	speed (auto|10-full||10-half| 100-full|100-half|1000-full)	This command configures the speed and duplex for the port.

4.4.3.   Web Configuration

General Settings:

Parameter	Description
Port	Select a port or a range ports you want to configure on this screen.

State	Select **Enable** to activate the port or **Disable** to deactivate the port.
Speed/Duplex	Select the speed and duplex mode of the port. The choices are: • **Auto** • **10 Mbps / Full Duplex** • **10 Mbps / Half Duplex** • **100 Mbps / Full Duplex** • **100 Mbps / Half Duplex** • **1000 Mbps / Full Duplex**
Flow Control	Select **On** to enable access to buffering resources for the port thus ensuring lossless operation across network switches. Otherwise, select **Off** to disable it.
Apply	Click Apply to take effect the settings.
Refresh	Click Refresh to begin configuring this screen afresh.
Port	This field displays the port number.
State	This field displays whether the port is enabled or disabled.
Speed/Duplex	This field displays the speed either **10M**, **100M** or **1000M** and the duplex mode **Full** or **Half**.
Flow Control	This field displays whether the port's flow control is **On** or **Off**.
Link Status	This field displays the link status of the port. If the port is up, it displays the port's speed, duplex and flow control setting. Otherwise, it displays **Link Down** if the port is disabled or not connected to any device.

Information:

Parameter	Description
Port	Select a port or a range ports you want to configure on this screen.
Description	Configures a meaningful name for the port(s).
Port Status	
Port	This field displays the port number.
Description	The meaningful name for the port.

Status	The field displays the detail port status if the port is blocked by some protocol.
Uptime	The sustained time from last link up.
Medium Mode	The current working medium mode, copper or fiber, for the port.

5. Advanced Settings

5.1. Bandwidth Control

5.1.1. QoS
5.1.1.1. Introduction

Each egress port can support up to 8 transmit queues. Each egress transmit queue contains a list specifying the packet transmission order. Every incoming frame is forwarded to one of the 8 egress transmit queues of the assigned egress port, based on its priority. The egress port transmits packets from each of the 8 transmit queues according to a configurable scheduling algorithm, which can be a combination of Weighted Fair Queuing (WFQ), Strict Priority (SP) and/or Weighted Round Robin (WRR).

Typically, networks operate on a best-effort delivery basis, which means that all traffic has equal priority and an equal chance of being delivered in a timely manner. When congestion occurs, all traffic has an equal chance of being dropped.

When you configure the QoS feature, you can select specific network traffic, prioritize it according to its relative importance, and use congestion-management and congestion-avoidance techniques to give preferential treatment. Implementing QoS in your network makes network performance more predictable and bandwidth utilization more effective.

The Switch supports 802.1p priority queuing. The Switch has 8 priority queues. These priority queues are numbered from 7 (Class 7) — the highest priority queue — to 0 (Class 0) — the lowest priority queue.
The eight priority tags specified in IEEE 802.1p (p0 to p7) are mapped to the Switch's priority queues as follows:

```
Priority  : 0  1  2  3  4  5  6  7
Queue     : 2  0  1  3  4  5  6  7
```

Priority scheduling is implemented by the priority queues stated above. The Switch will empty the four hardware priority queues in order, beginning with the highest priority queue, 7, to the lowest priority queue, 0. Each hardware queue will transmit all of the packets in its buffer before permitting the next lower priority to transmit its packets. When the lowest hardware priority queue has finished transmitting all of its packets, the highest hardware priority queue will begin transmitting any packets it may have received.

QoS Enhancement

You can configure the Switch to prioritize traffic even if the incoming packets are not marked with IEEE 802.1p priority tags or change the existing priority tags based on the criteria you select. The Switch allows you to choose one of the following methods for assigning priority to incoming packets on the Switch:

✓ **802.1p Tag Priority**   - Assign priority to packets based on the packet's 802.1p tagged priority.
✓ **Port Based QoS**   - Assign priority to packets based on the incoming port on the

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Switch.
- ✓ **DSCP Based QoS** - Assign priority to packets based on their Differentiated Services Code Points (DSCPs).

Note: Advanced QoS methods only affect the internal priority queue mapping for the Switch. The Switch does not modify the IEEE 802.1p value for the egress frames. You can choose one of these ways to alter the way incoming packets are prioritized or you can choose not to use any QoS enhancement setting on the Switch.

802.1p Priority
When using 802.1p priority mechanism, the packet is examined for the presence of a valid 802.1p priority tag. If the tag is present, the packet is assigned to a programmable egress queue based on the value of the tagged priority. The tagged priority can be designated to any of the available queues.

Ethernet Packet:

6	6	2	42-1496	4
DA	SA	Type / Length	Data	FCS

6	6	4	2	42-1496	4
DA	SA	802.1Q Tag	Type / Length	Data	FCS

802.1Q Tag:

2 bytes		2 bytes		
Tag Protocol Identifier (TPID)		Tag Control Information (TCI)		
16 bits		3 bits	1 bit	12 bits
TPID (0x8100)		Priority	CFI	VID

- ✓ Tag Protocol Identifier (TPID): a 16-bit field set to a value of **0x8100** in order to identify the frame as an IEEE 802.1Q-tagged frame.
- ✓ Tag Control Information (TCI)
  - ■ Priority Code Point (PCP): a 3-bit field which refers to the IEEE 802.1p priority. It indicates the frame priority level from **0 (lowest) to 7 (highest)**, which can be used to prioritize different classes of traffic (voice, video, data, etc).
  - ■ Canonical Format Indicator (CFI): a 1-bit field. If the value of this field is 1, the MAC address is in non-canonical format. If the value is 0, the MAC address is in canonical format. It is always set to zero for Ethernet switches. CFI is used for compatibility between Ethernet and Token Ring networks. If a frame received at an Ethernet port has a CFI set to 1, then that frame should not be bridged to an untagged port.
  - ■ VLAN Identifier (VID): a 12-bit field specifying the VLAN to which the frame belongs. A value of 0 means that the frame doesn't belong to any VLAN; in this case the 802.1Q tag specifies only a priority and is referred to as a **priority tag.** A value of hex 0xFFF is reserved for implementation use. All other values may be used as VLAN identifiers, allowing up to 4094 VLANs. On bridges, VLAN 1 is often reserved for management.

Priority Levels:
PCP: Priority Code Point.

PCP	Network Priority	Traffic Characteristics
1	0 (lowest)	Background
0	1	Best Effort
2	2	Excellent Effort
3	3	Critical Applications
4	4	Video, <100 ms latency
5	5	Video, < 10 ms latency
6	6	Internetwork Control
7	7 (highest)	Network Control

DiffServ (DSCP)

Differentiated Services or **DiffServ** is a computer networking architecture that specifies a simple, scalable and coarse-grained mechanism for classifying, managing network traffic and providing Quality of Service (**QoS**) guarantees on modern IP networks. DiffServ can, for example, be used to provide low-latency, guaranteed service (**GS**) to critical network traffic such as voice or video while providing simple best-effort traffic guarantees to non-critical services such as web traffic or file transfers.

Differentiated Services Code Point (**DSCP**) is a 6-bit field in the header of IP packets for packet classification purposes. DSCP replaces the outdated IP precedence, a 3-bit field in the Type of Service byte of the IP header originally used to classify and prioritize types of traffic.

When using the DiffServ priority mechanism, the packet is classified based on the DSCP field in the IP header. If the tag is present, the packet is assigned to a programmable egress queue based on the value of the tagged priority. The tagged priority can be designated to any of the available queues.

Version	IHL	**Type of Service**	Total Length	
Identification			Flags	Fragment Offset
Time to Live		Protocol	Header Checksum	
Source Address				
Destination Address				
Options			Padding	

Example Internet Datagram Header

IP Header Type of Service: 8 bits

The Type of Service provides an indication of the abstract parameters of the quality of service desired. These parameters are to be used to guide the selection of the actual service parameters when transmitting a datagram through a particular network. Several networks offer service precedence, which somehow treats high precedence traffic as more important than other traffic (generally by accepting only traffic above a certain precedence at time of high load). The major choice is a three way tradeoff between low-delay, high-reliability, and high-throughput.

Bits 0-2:   Precedence.
Bit   3:   0 = Normal Delay,   1 = Low Delay.
Bits   4:   0 = Normal Throughput,   1 = High Throughput.
Bits   5:   0 = Normal Reliability,   1 = High Reliability.
Bit   6-7: Reserved for Future Use.

```
      0     1     2     3     4     5     6     7
   +-----+-----+-----+-----+-----+-----+-----+-----+
   |    PRECEDENCE   |  D  |  T  |  R  |  0  |  0  |
   +-----+-----+-----+-----+-----+-----+-----+-----+
```
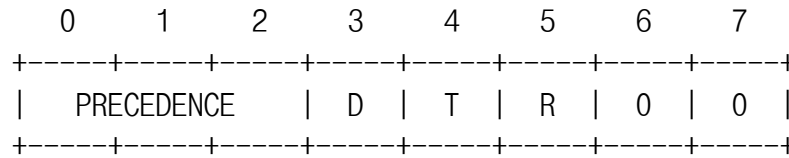
   Precedence
      111 - Network Control
      110 - Internetwork Control
      101 - CRITIC/ECP
      100 - Flash Override
      011 - Flash
      010 - Immediate
      001 - Priority
      000 - Routine

The use of the Delay, Throughput, and Reliability indications may increase the cost (in some sense) of the service.   In many networks better performance for one of these parameters is coupled with worse performance on another. Except for very unusual cases at most two of these three indications should be set.

The type of service is used to specify the treatment of the datagram during its transmission through the internet system. Example mappings of the internet type of service to the actual service provided on networks such as AUTODIN II, ARPANET, SATNET, and PRNET is given in "Service Mappings".

The Network Control precedence designation is intended to be used within a network only. The actual use and control of that designation is up to each network. The Internetwork Control designation is intended for use by gateway control originators only.

If the actual use of these precedence designations is of concern to a particular network, it is the responsibility of that network to control the access to, and use of, those precedence designations.

DSCP	Priority	DSCP	Priority	DSCP	Priority
0	0	1	0	2	0

. . .

DSCP	Priority	DSCP	Priority	DSCP	Priority
60	0	61	0	62	0
63	0				

Example:

         IP Header

  DSCP=50 ➔ 45 **C8** . . .

Queuing Algorithms

Queuing algorithms allow switches to maintain separate queues for packets from each individual source or flow and prevent a source from monopolizing the bandwidth.

✓ **Strict-Priority (SPQ)**
Strict-Queuing will empty the four hardware priority queues in order, beginning with the highest priority queue, 3, to the lowest priority queue, 0. Each hardware queue will transmit all of the packets in its buffer before permitting the next lower priority to transmit its packets. When the lowest hardware priority queue has finished transmitting all of its packets, the highest hardware priority queue will begin transmitting any packets it may have received.

✓ **Weighted Fair Queuing** (**WFQ**)
WFQ is a data packet scheduling technique allowing different scheduling priorities to statistically multiplexed data flows. It provides traffic priority management that automatically sorts among individual traffic streams without requiring an access list. WFQ decides which queue is selected in one slot time to guarantee the minimal packet rate of one queue. Thus, WFQ allows Internet operators to define traffic classes and then assign different bandwidth proportions.

✓ **Weighted round robin (WRR)**
Round Robin scheduling services queues on a rotating basis and is activated only when a port has more traffic than it can handle. A queue is given an amount of bandwidth irrespective of the incoming traffic on that port. This queue then moves to the back of the list. The next queue is given an equal amount of bandwidth, and then moves to the end of the list; and so on, depending on the number of queues being used. This works in a looping fashion until a queue is empty.

Weighted Round Robin (WRR) scheduling uses the same algorithm as round robin scheduling, but services queues based on their priority and queue weight (the number you configure in the queue **Weight** field) rather than a fixed amount of bandwidth. WRR is activated only when a port has more traffic than it can handle. Queues with larger weights get more service than queues with smaller weights. This queuing mechanism is highly efficient in that it divides any available bandwidth across the different traffic queues and returns to queues that have not yet emptied.

Default Settings

Qos mode   : High First (SPQ)
The mappings of the Priority to Queue are:
       PRIO 0 ==> COSQ 2
       PRIO 1 ==> COSQ 0
       PRIO 2 ==> COSQ 1

```
                    PRIO 3 ==> COSQ 3
                    PRIO 4 ==> COSQ 4
                    PRIO 5 ==> COSQ 5
                    PRIO 6 ==> COSQ 6
                    PRIO 7 ==> COSQ 7
```

The DiffServ is disabled on the switch.

DSCP	Priority	DSCP	Priority	DSCP	Priority	DSCP	Priority
00	0	01	0	02	0	03	0
04	0	05	0	06	0	07	0
08	0	09	0	10	0	11	0
12	0	13	0	14	0	15	0
16	0	17	0	18	0	19	0
20	0	21	0	22	0	23	0
24	0	25	0	26	0	27	0
28	0	29	0	30	0	31	0
32	0	33	0	34	0	35	0
36	0	37	0	38	0	39	0
40	0	41	0	42	0	43	0
44	0	45	0	46	0	47	0
48	0	49	0	50	0	51	0
52	0	53	0	54	0	55	0
56	0	57	0	58	0	59	0
60	0	61	0	62	0	63	0

Note: If the DiffServ is disabled, the 802.1p tag priority will be used.

5.1.1.2. CLI Configuration

Node	Command	Description
enable	show queue cos-map	This command displays the current 802.1p priority mapping to the service queue.
enable	show qos mode	This command displays the current QoS scheduling mode of IEEE 802.1p.
configure	queue cos-map PRIORITY QUEUE_ID	This command configures the 802.1p priority mapping to the service queue.
configure	no queue cos-map	This command configures the 802.1p priority mapping to the service queue to default.
configure	qos mode high-first	This command configures the QoS scheduling mode to high_first, each hardware queue will transmit all of the packets in its buffer before permitting the next lower priority to transmit its packets.
configure	qos mode wrr-queue weights VALUE	This command configures the QoS scheduling mode to Weighted Round Robin.

	VALUE VALUE VALUE VALUE VALUE VALUE VALUE	
configure	qos mode wfr-queue weights VALUE VALUE VALUE VALUE VALUE VALUE VALUE VALUE VALUE	This command configures the QoS scheduling mode to Weighted fair scheduling.
interface	default-priority	This command allows the user to specify a default priority handling of untagged packets received by the Switch. The priority value entered with this command will be used to determine which of the hardware priority queues the packet is forwarded to. Default: 0.
interface	no default-priority	This command configures the default priority for the specific port to default (0).
enable	show diffserv	This command displays DiffServ configurations.
configure	diffserv (disable|enable)	This command disables / enables the DiffServ function.
configure	diffserv dscp VALUE priority VALUE	This command sets the DSCP-to-IEEE 802.1q mappings.

5.1.1.3. Web Configuration

Port Priority

Parameter	Description
All Ports 802.1p priority	Use this field to set a priority for all ports. The value indicates packet priority and is added to the priority tag field of incoming packets. The values range from 0 (lowest priority) to 7 (highest priority).
Port	This field displays the number of a port.
802.1p Priority	Select a priority for packets received by the port. Only packets without a 802.1p priority tagged will be applied the priority you set here.
Apply	Click Apply to take effect the settings.
Refresh	Click Refresh to begin configuring this screen afresh.

IP DiffServ (DSCP)

Parameter	Description
Mode	"Tag Over DSCP" or "DSCP Over Tag". "Tag Over DSCP" means the

	802.1p tag has higher priority than DSCP.
Priority	This field displays each priority level. The values range from 0 (lowest priority) to 7 (highest priority).
Apply	Click Apply to take effect the settings.
Refresh	Click Refresh to begin configuring this screen afresh.

Priority/Queue Mapping

Parameter	Description
Reset to Default	Click this button to reset the priority to queue mappings to the defaults.
Priority	This field displays each priority level. The values range from 0 (lowest priority) to 7 (highest priority).
Queue ID	Select the number of a queue for packets with the priority level.
Apply	Click Apply to take effect the settings.
Refresh	Click Refresh to begin configuring this screen afresh.

Schedule Mode

Parameter	Description
Schedule Mode	Select **Strict Priority** (SP) or **Weighted Round Robin** (**WRR**) or **Weighted Fair Queuing** (**WFQ**). *Note: Queue weights can only be changed when **Weighted Round Robin (WRR)** or **Weighted Fair Queuing (WFQ)** is selected.*
Queue ID	This field indicates which Queue (0 to 7) you are configuring. Queue 0 has the lowest priority and Queue 7 the highest priority.
Weight Value	You can only configure the queue weights when *Weighted Round Robin (WRR) or Weighted Fair Queuing (WFQ)* is selected. Bandwidth is divided across the different traffic queues according to their weights.
Apply	Click Apply to take effect the settings.
Refresh	Click Refresh to begin configuring this screen afresh.

5.1.2. Rate Limitation

5.1.2.1. Storm Control

5.1.2.1.1. Introduction

A broadcast storm means that your network is overwhelmed with constant broadcast or multicast traffic. Broadcast storms can eventually lead to a complete loss of network connectivity as the packets proliferate.

Storm Control protects the Switch bandwidth from flooding packets, including broadcast

packets, multicast packets, and destination lookup failure (DLF). The **Rate** is a threshold that limits the total number of the selected type of packets. For example, if the broadcast and multicast options are selected, the total amount of packets per second for those two types will not exceed the limit value.

Broadcast storm control limits the number of broadcast, multicast and unknown unicast (also referred to as Destination Lookup Failure or DLF) packets the Switch receives per second on the ports. When the maximum number of allowable broadcast, multicast and unknown unicast packets is reached per second, the subsequent packets are discarded. Enable this feature to reduce broadcast, multicast and unknown unicast packets in your network.

Storm Control unit: pps.

Default Settings
    Broadcast Storm Control   : 300 pps.
    Multicast Storm Control   : None.
    DLF Storm Control   : 300 pps.

5.1.2.1.2. CLI Configuration

Node	Command	Description
enable	show storm-control	This command displays the current storm control configurations.
configure	storm-control rate RATE_LIMIT type (broadcast | multicast |DLF) ports PORTLISTS	This command enables the bandwidth limit for broadcast or multicast or DLF packets and set the limitation.
configure	no storm-control type (broadcast | multicast |DLF) ports PORTLISTS	This command disables the bandwidth limit for broadcast or multicast or DLF packets.

Example:
    L2SWITCH#configure terminal
    L2SWITCH(config)#storm-control rate 1 type bcast ports 1-6
    L2SWITCH(config)#storm-control rate 1 type mcast ports 1-6
    L2SWITCH(config)#storm-control rate 1 type DLF ports 1-6

5.1.2.1.3. Web Configuration

Parameter	Description
Port	Select the port number for which you want to configure storm control settings.
Rate	Select the number of packets (of the type specified in the **Type** field) per second the Switch can receive per second.
Type	Select **Broadcast** - to specify a limit for the amount of broadcast packets received per second. **Multicast** - to specify a limit for the amount of multicast packets received per second. **DLF** - to specify a limit for the amount of DLF packets received per second.
Apply	Click Apply to take effect the settings.
Refresh	Click Refresh to begin configuring this screen afresh.

5.1.2.2. Bandwidth Limitation
5.1.2.2.1. Introduction
The rate limitation is used to control the rate of traffic sent or received on a network interface.

Rate Limitation unit: 16Kbs.

Default Setting: All ports' Ingress and Egress rate limitation are disabled.

5.1.2.2.2. CLI Configuration

Node	Command	Description
enable	show bandwidth-limit	This command displays the current rate control configurations.
configure	bandwidth-limit egress RATE_LIMIT ports PORTLISTS	This command enables the bandwidth limit for outgoing packets and set the limitation.
configure	no bandwidth-limit egress ports PORTLISTS	This command disables the bandwidth limit for outgoing packets.
configure	bandwidth-limit ingress RATE_LIMIT ports PORTLISTS	This command enables the bandwidth limit for incoming packets and set the limitation.
configure	no bandwidth-limit ingress ports PORTLISTS	This command disables the bandwidth limit for incoming packets.

Example:
L2SWITCH#configure terminal
L2SWITCH(config)#bandwidth-limit egress 1 ports 1-6
L2SWITCH(config)#bandwidth-limit ingress 1 ports 1-6

5.1.2.2.3. Web Configuration

Parameter	Description
Port	Selects a port that you want to configure.
Ingress	Configures the rate limitation for the ingress packets.
Egress	Configures the rate limitation for the egress packets.
Apply	Click Apply to take effect the settings.
Refresh	Click Refresh to begin configuring this screen afresh.

5.2. IGMP Snooping

5.2.1. IGMP Snooping
5.2.1.1. Introduction

The IGMP snooping is for multicast traffic. The Switch can passively snoop on IGMP packets transferred between IP multicast routers/switches and IP multicast hosts to learn the IP multicast group membership. IGMP snooping allows the Switch to learn multicast groups without you having to manually configure them.

The Switch can passively snoop on IGMP packets transferred between IP multicast

routers/switches and IP multicast hosts to learn the IP multicast group membership. It checks IGMP packets passing through it, picks out the group registration information, and configures multicasting accordingly. IGMP snooping allows the Switch to learn multicast groups without you having to manually configure them.

The Switch forwards multicast traffic destined for multicast groups (that it has learned from IGMP snooping or that you have manually configured) to ports that are members of that group. IGMP snooping generates no additional network traffic, allowing you to significantly reduce multicast traffic passing through your Switch.

The Switch can perform IGMP snooping on up to 4094 VLANs. You can configure the Switch to automatically learn multicast group membership of any VLANs. The Switch then performs IGMP snooping on the first VLANs that send IGMP packets.

This is referred to as auto mode. Alternatively, you can specify the VLANs that IGMP snooping should be performed on. This is referred to as fixed mode. In fixed mode the Switch does not learn multicast group membership of any VLANs other than those explicitly added as an IGMP snooping VLAN.

Immediate Leave

When you enable IGMP Immediate-Leave processing, the switch immediately removes a port when it detects an IGMP version 2 leave message on that port. You should use the Immediate-Leave feature only when there is a single receiver present on every port in the VLAN. (Immediate Leave is only supported on IGMP Version 2 hosts).

The switch uses IGMP snooping Immediate Leave to remove from the forwarding table an interface that sends a leave message without the switch sending group-specific queries to the interface. The VLAN interface is pruned from the multicast tree for the multicast group specified in the original leave message. Immediate Leave ensures optimal bandwidth management for all hosts on a switched network, even when multiple multicast groups are simultaneously in use.

Fast Leave

The switch allow user to configure a delay time. When the delay time is expired, the switch removes the interface from the multicast group.

Last Member Query Interval

Last Member Query Interval: The Last Member Query Interval is the Max Response Time inserted into Group-Specific Queries sent in response to Leave Group messages, and is also the amount of time between Group-Specific Query messages.

Without Immediate Leave, when the switch receives an IGMP leave message from a subscriber on a receiver port, it sends out an IGMP specific query on that port and waits for IGMP group membership reports. If no reports are received in a configured time period, the receiver port is removed from multicast group membership.

IGMP Querier

There is normally only one Querier per physical network. All multicast routers start up as a Querier on each attached network. If a multicast router hears a Query message from a router

with a lower IP address, it MUST become a Non-Querier on that network. If a router has not heard a Query message from another router for [Other Querier Present Interval], it resumes the role of Querier. Routers periodically [Query Interval] send a General Query on each attached network for which this router is the Querier, to solicit membership information. On startup, a router SHOULD send [Startup Query Count] General Queries spaced closely together [Startup Query Interval] in order to quickly and reliably determine membership information. A General Query is addressed to the all-systems multicast group (224.0.0.1), has a Group Address field of 0, and has a Max Response Time of [Query Response Interval].

Port IGMP Querier Mode
✓ **Auto:**
   The Switch uses the port as an IGMP query port if the port receives IGMP query packets.

✓ **Fixed:**
   The Switch always treats the port(s) as IGMP query port(s). This is for when connecting an IGMP multicast server to the port(s).
   The Switch always forwards the client's **report/leave** packets to the port.
   Normally, the port is connected to an IGMP server.

✓ **Edge:**
   The Switch does not use the port as an IGMP query port.
   The IGMP query packets received by this port will be dropped.
   Normally, the port is connected to an IGMP client.

Note: The Switch will forward the IGMP join and leave packets to the query port.

Configurations: Users can enable / disable the IGMP Snooping on the Switch. Users also can enable / disable the IGMP Snooping on a specific VLAN. If the IGMP Snooping on the Switch is disabled, the IGMP Snooping is disabled on all VLANs even some of the VLAN IGMP Snooping are enabled.

Default Settings
✓ If received packets are not received after 400 seconds, all multicast entries will be deleted.
✓ The default global IGMP snooping state is disabled.
✓ The default VLAN IGMP snooping state is disabled for all VLANs.
✓ The unknown multicast packets will be Dropped.
✓ The default port Immediate Leave state is disabled for all ports.
✓ The default port Querier Mode state is auto for all ports.
✓ The IGMP snooping Report Suppression is disabled.

Notices: There are a global state and per VLAN states.
✓ When the global state is disabled, the IGMP Snooping on the Switch is disabled even per VLAN states are enabled.
✓ When the global state is enabled, user must enable per VLAN states to enable the IGMP Snooping on the specific VLAN.

Node	Command	Description
enable	show igmp-snooping	This command displays the current IGMP snooping configurations.
enable	show igmp-snooping querier	This command displays the current IGMP Queriers and the querier configurations.
enable	show igmp-counters (port|vlan)	This command displays the current IGMP snooping counters per port or per vlan.
enable	show multicast	This command displays the multicast group in IP format.
configure	clear igmp-snooping counters	This command clears all of the IGMP snooping counters.
configure	igmp-snooping (disable | enable)	This command disables / enables the IGMP snooping on the switch.
configure	igmp-snooping vlan VLANID	This command enables the IGMP snooping function on a VLAN or range of VLANs.
configure	no igmp-snooping vlan VLANID	This command disables the IGMP snooping function on a VLAN or range of VLANs.
configure	igmp-snooping unknown-multicast (drop|flooding)	This command configures the process for unknown multicast packets when the IGMP snooping function is enabled. *drop:* Drop all of the unknown multicast packets.
interface	igmp-querier-mode (auto|fixed|edge)	This command specifies whether or not and under what conditions the port(s) is (are) IGMP query port(s). The Switch forwards IGMP join or leave packets to an IGMP query port, treating the port as being connected to an IGMP multicast router (or server). You must enable IGMP snooping as well. (Default:auto)
interface	igmp-immediate-leave	This command enables the IGMP Snooping immediate leave function for the specific port.
interface	no igmp-immediate-leave	This command disables the IGMP Snooping immediate leave function for the specific port.
interface	igmp-snooping group-limit VALUE	This command configures the maximum groups for the specific port.
interface	no igmp-snooping group-limit	This command removes the limitation of the maximum groups for the specific port.
configure	interface range gigabitethernet1/0/ PORTLISTS	This command enters the interface configure node.
if-range	igmp-immediate-leave	This command enables the IGMP Snooping immediate leave function for the specific ports.
if-range	no igmp-immediate-leave	This command disables the IGMP Snooping immediate leave function for the specific ports.

if-range	igmp-snooping group-limit VALUE	This command configures the maximum groups for the specific ports.
if-range	no igmp-snooping group-limit	This command removes the limitation of the maximum groups for the specific ports.
if-range	igmp-querier-mode (auto|fixed|edge)	This command specifies whether or not and under what conditions the ports is (are) IGMP query port(s). The Switch forwards IGMP join or leave packets to an IGMP query port, treating the port as being connected to an IGMP multicast router (or server). You must enable IGMP snooping as well. (Default:auto)

Example:
L2SWITCH(config)#*igmp-snooping enable*
L2SWITCH(config)#*igmp-snooping vlan 1*
L2SWITCH(config)#*interface 1/0/1*
L2SWITCH(config-if)#*igmp-immediate-leave*
L2SWITCH(config-if)#igmp-querier-mode fixed
L2SWITCH(config-if)#igmp-snooping group-limit 20

5.2.1.3. Web Configuration

General Settings

Parameter	Description
IGMP Snooping State	Select **Enable** to activate IGMP Snooping to forward group multicast traffic only to ports that are members of that group. Select **Disable** to deactivate the feature.
IGMP Snooping VLAN State	Select **Add** and enter VLANs upon which the Switch is to perform IGMP snooping. The valid range of VLAN IDs is between 1 and 4094. Use a comma (,) or hyphen (-) to specify more than one

	VLANs. Select **Delete** and enter VLANs on which to have the Switch not perform IGMP snooping.
Unknown Multicast Packets	Specify the action to perform when the Switch receives an unknown multicast frame. Select **Drop** to discard the frame(s). Select **Flooding** to send the frame(s) to all ports.
Apply	Click Apply to configure the settings.
Refresh	Click this to reset the fields to the last setting.
IGMP Snooping State	This field displays whether IGMP snooping is globally enabled or disabled.
IGMP Snooping VLAN State	This field displays VLANs on which the Switch is to perform IGMP snooping. None displays if you have not enabled IGMP snooping on any port yet.
Unknown Multicast Packets	This field displays whether the Switch is set to discard or flood unknown multicast packets.

Port Settings

Parameter	Description

Querier Mode	Select the desired setting, **Auto**, **Fixed**, or **Edge**. **Auto** means the Switch uses the port as an IGMP query port if the port receives IGMP query packets. **Fixed** means the Switch always treats the port(s) as IGMP query port(s). This is for when connecting an IGMP multicast server to the port(s). **Edge** means the Switch does not use the port as an IGMP query port. In this case, the Switch does not keep a record of an IGMP router being connected to this port and the Switch does not forward IGMP join or leave packets to this port.
Immediate Leave	Select individual ports on which to enable immediate leave.
Group Limit	Configures the maximum group for the port or a range of ports.
Apply	Click Apply to apply the settings.
Refresh	Click this to reset the fields.
Port	The port ID.
Querier Mode	The Querier mode setting for the specific port.
Immediate Leave	The Immediate Leave setting for the specific port.
Group Counts	The current joining group count and the maximum group count.

5.2.2. Multicast Address
5.2.2.1. Introduction

A multicast address is associated with a group of interested receivers. According to RFC 3171, addresses 224.0.0.0 to 239.255.255.255, the former Class D addresses, are designated as multicast addresses in IPv4.

The IANA owns the OUI MAC address 01:00:5e, therefore multicast packets are delivered by using the Ethernet MAC address range 01:00:5e:00:00:00 - 01:00:5e:7f:ff:ff. This is 23 bits of available address space.

The first octet (01) includes the broadcast/multicast bit. The lower 23 bits of the 28-bit multicast IP address are mapped into the 23 bits of available Ethernet address space. This means that there is ambiguity in delivering packets. If two hosts on the same subnet each subscribe to a different multicast group whose address differs only in the first 5 bits, Ethernet packets for both multicast groups will be delivered to both hosts, requiring the network software in the hosts to discard the unrequired packets.

Class	Address Range	Supports
Class A	1.0.0.1 to 126.255.255.254	Supports 16 million hosts on each of 127 networks.

Class B	128.1.0.1 to 191.255.255.254	Supports 65,000 hosts on each of 16,000 networks.
Class C	192.0.1.1 to 223.255.254.254	Supports 254 hosts on each of 2 million networks.
Class D	224.0.0.0 to 239.255.255.255	Reserved for multicast groups.
Class E	240.0.0.0 to 254.255.255.254	Reserved for future use, or Research and Development Purposes.
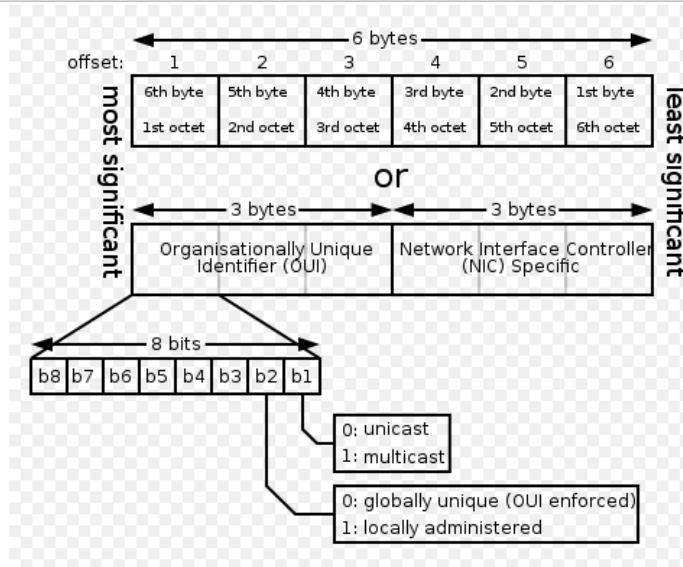
IP multicast address	Description
224.0.0.0	Base address (reserved)
224.0.0.1	The All Hosts multicast group that contains all systems on the same network segment
224.0.0.2	The All Routers multicast group that contains all routers on the same network segment
224.0.0.5	The Open Shortest Path First (OSPF) AllSPFRouters address. Used to send Hello packets to all OSPF routers on a network segment
224.0.0.6	The OSPF AllDRouters address. Used to send OSPF routing information to OSPF designated routers on a network segment
224.0.0.9	The RIP version 2 group address. Used to send routing information using the RIP protocol to all RIP v2-aware routers on a network segment
224.0.0.10	EIGRP group address. Used to send EIGRP routing information to all EIGRP routers on a network segment
224.0.0.13	PIM Version 2 (Protocol Independent Multicast)
224.0.0.18	Virtual Router Redundancy Protocol
224.0.0.19 - 21	IS-IS over IP

224.0.0.22	IGMP Version 3 (Internet Group Management Protocol)
224.0.0.102	Hot Standby Router Protocol Version 2
224.0.0.251	Multicast DNS address
224.0.0.252	Link-local Multicast Name Resolution address
224.0.1.1	Network Time Protocol address
224.0.1.39	Cisco Auto-RP-Announce address
224.0.1.40	Cisco Auto-RP-Discovery address
224.0.1.41	H.323 Gatekeeper discovery address

5.2.2.2. CLI Configuration

Node	Command	Description
enable	show mac-address-table multicast	This command displays the current static/dynamic multicast address entries.
enable	show mac-address-table multicast vlan VLANID	This command displays the current static/dynamic multicast address entries with a specific vlan.
configure	mac-address-table multicast MACADDR vlan VLANID ports PORTLIST	This command configures a static multicast entry.
configure	no mac-address-table multicast MACADDR	This command removes a static multicast entry from the address table.

5.2.2.3. Web Configuration

Parameter	Description
VLAN ID	Configures the VLAN that you want to configure.
MAC Address	Configures the multicast MAC which will not be aged out. Valid format is hh:hh:hh:hh:hh:hh.

Port	Configures the member port for the multicast address.
Apply	Click Apply to save your changes back to the Switch.
Refresh	Click Refresh to begin configuring this screen afresh.

5.3. VLAN

5.3.1. Port Isolation
5.3.1.1. Introduction
The port isolation is a port-based virtual LAN feature. It partitions the switching ports into virtual private domains designated on a per port basis. Data switching outside of the port's private domain is not allowed. It will ignore the packets' tag VLAN information.

This feature is a per port setting to configure the egress port(s) for the specific port to forward its received packets. If the CPU port (port 0) is not an egress port for a specific port, the host connected to the specific port cannot manage the Switch.

If you wish to allow two subscriber ports to talk to each other, you must define the egress port for both ports. **CPU** refers to the Switch management port. By default it forms a VLAN with all Ethernet ports. If it does not form a VLAN with a particular port then the Switch cannot be managed from that port.

Example: If you want to allow port-1 and port-3 to talk to each other, you must configure as below:
```
L2SWITCH(config)#interface 1/0/1
L2SWITCH(config-if)#port-isolation ports 3
L2SWITCH(config-if)#exit
   ; Allow the port-1 to send its ingress packets to port-3.

L2SWITCH(config)#interface 1/0/3
L2SWITCH(config-if)#port-isolation ports 1
L2SWITCH(config-if)#exit
   ; Allow the port-3 to send its ingress packets to port-1
```

5.3.1.2. CLI Configuration

Node	Command	Description
enable	show port-isolation	This command displays the current port isolation configurations. "V" indicates the port's packets can be sent to that port. "-" indicates the port's packets cannot be sent to that port.
interface	port-isolation ports PORTLISTS	This command configures a port or a range of ports to egress traffic from the specific port.
interface	no port-isolation	This command configures all ports to egress traffic from

		the specific port.

5.3.1.3. Web Configuration

Parameter	Description
Port	Select a port number to configure its port isolation settings. Select **All Ports** to configure the port isolation settings for all ports on the Switch.

Egress Port	An egress port is an outgoing port, that is, a port through which a data packet leaves. Selecting a port as an outgoing port means it will communicate with the port currently being configured.
Select All/ Deselect All	Click **Select All** to mark all ports as egress ports and permit traffic. Click **Deselect All** to unmark all ports and isolate them. Deselecting all ports means the port being configured cannot communicate with any other port.
Apply	Click Apply to configure the settings.
Refresh	Click this to reset the fields to the last setting.
Port Isolation Status	"V" indicates the port's packets can be sent to that port. "-" indicates the port's packets cannot be sent to that port.

5.3.2.   802.1Q VLAN
5.3.2.1. Introduction

A virtual LAN, commonly known as a VLAN, is a group of hosts with a common set of requirements that communicate as if they were attached to the Broadcast domain, regardless of their physical location. A VLAN has the same attributes as a physical LAN, but it allows for end stations to be grouped together even if they are not located on the same network switch. Network reconfiguration can be done through software instead of physically relocating devices.

VID- VLAN ID is the identification of the VLAN, which is basically used by the standard 802.1Q. It has 12 bits and allow the identification of 4096 (2^12) VLANs. Of the 4096 possible VIDs, a VID of 0 is used to identify priority frames and value 4095 (FFF) is reserved, so the maximum possible VLAN configurations are 4,094.

A tagged VLAN uses an explicit tag (VLAN ID) in the MAC header to identify the VLAN membership of a frame across bridges - they are not confined to the switch on which they were created. The VLANs can be created statically by hand or dynamically through GVRP. The VLAN ID associates a frame with a specific VLAN and provides the information that switches need to process the frame across the network. A tagged frame is four bytes longer than an untagged frame and contains two bytes of TPID (Tag Protocol Identifier, residing within the type/length field of the Ethernet frame) and two bytes of TCI (Tag Control Information, starts after the source address field of the Ethernet frame).

The CFI (Canonical Format Indicator) is a single-bit flag, always set to zero for Ethernet switches. If a frame received at an Ethernet port has a CFI set to 1, then that frame should not be forwarded as it is to an untagged port. The remaining twelve bits define the VLAN ID, giving a possible maximum number of 4,096 VLANs. Note that user priority and VLAN ID are independent of each other. A frame with VID (VLAN Identifier) of null (0) is called a priority frame, meaning that only the priority level is significant and the default VID of the

ingress port is given as the VID of the frame. Of the 4096 possible VIDs, a VID of 0 is used to identify priority frames and value 4095 (FFF) is reserved, so the maximum possible VLAN configurations are 4,094.

TPID	User Priority	CFI	VLAN ID
2 bytes	3 bits	1 bit	12 bits

✓ **Forwarding Tagged and Untagged Frames**
Each port on the Switch is capable of passing tagged or untagged frames. To forward a frame from an 802.1Q VLAN-aware switch to an 802.1Q VLAN-unaware switch, the Switch first decides where to forward the frame and then strips off the VLAN tag. To forward a frame from an 802.1Q VLAN-unaware switch to an 802.1Q VLAN-aware switch, the Switch first decides where to forward the frame, and then inserts a VLAN tag reflecting the ingress port's default VID. The default PVID is VLAN 1 for all ports, but this can be changed.

A broadcast frame (or a multicast frame for a multicast group that is known by the system) is duplicated only on ports that are members of the VID (except the ingress port itself), thus confining the broadcast to a specific domain.

✓ **802.1Q Port base VLAN**
With port-based VLAN membership, the port is assigned to a specific VLAN independent of the user or system attached to the port. This means all users attached to the port should be members of the same VLAN. The network administrator typically performs the VLAN assignment. The port configuration is static and cannot be automatically changed to another VLAN without manual reconfiguration.
As with other VLAN approaches, the packets forwarded using this method do not leak into other VLAN domains on the network. After a port has been assigned to a VLAN, the port cannot send to or receive from devices in another VLAN without the intervention of a Layer 3 device.

The device that is attached to the port likely has no understanding that a VLAN exists. The device simply knows that it is a member of a subnet and that the device should be able to talk to all other members of the subnet by simply sending information to the cable segment. The switch is responsible for identifying that the information came from a specific VLAN and for ensuring that the information gets to all other members of the VLAN. The switch is further responsible for ensuring that ports in a different VLAN do not receive the information.

This approach is quite simple, fast, and easy to manage in that there are no complex lookup tables required for VLAN segmentation. If port-to-VLAN association is done with an application-specific integrated circuit (ASIC), the performance is very good. An ASIC allows the port-to-VLAN mapping to be done at the hardware level.

Default Settings
  ✓ The default PVID is 1 for all ports.
  ✓ The default Acceptable Frame is All for all ports.
  ✓ All ports join in the VLAN 1.

5.3.2.2. CLI Configuration

Node	Command	Description
enable	show vlan VLANID	This command displays the VLAN configurations.
configure	vlan <1~4094>	This command enables a VLAN and enters the VLAN node.
configure	no vlan <1~4094>	This command deletes a VLAN.
vlan	show	This command displays the current VLAN configurations.
vlan	name STRING	This command assigns a name for the specific VLAN. The VLAN name should be the combination of the digit or the alphabet or hyphens (-) or underscores (_). The maximum length of the name is 16 characters.
vlan	no name	This command configures the vlan name to default. Note: The default vlan name is "VLAN"+vlan_ID, VLAN1, VLAN2,…
vlan	add PORTLISTS	This command adds a port or a range of ports to the vlan.
vlan	fixed PORTLISTS	This command assigns ports for permanent member of the vlan.
vlan	no fixed PORTLISTS	This command removes all fixed member from the vlan.
vlan	tagged PORTLISTS	This command assigns ports for tagged member of the VLAN group. The ports should be one/some of the permanent members of the vlan.
vlan	no tagged PORTLISTS	This command removes all tagged member from the vlan.
vlan	untagged PORTLISTS	This command assigns ports for untagged member of the VLAN group. The ports should be one/some of the permanent members of the vlan.
vlan	no untagged PORTLISTS	This command removes all untagged member from the vlan.
interface	acceptable frame type (all|tagged|untagged)	This command configures the acceptable frame type. all - acceptable all frame types. tagged - acceptable tagged frame only. untagged – acceptable untagged frame only.
interface	pvid VLANID	This command configures a VLAN ID for the port default VLAN ID.
interface	no pvid	This command configures 1 for the port default VLAN ID.
configure	interface range gigabitethernet1/0/ PORTLISTS	This command enters the interface configure node.
if-range	pvid VLANID	This command configures a VLAN ID for the port default VLAN ID.

if-range	no pvid	This command configures 1 for the port default VLAN ID.
configure	vlan range STRINGS	This command configures a range of vlans.
configure	no vlan range STRINGS	This command removes a range of vlans.
vlan-range	add PORTLISTS	This command adds a port or a range of ports to the vlans.
vlan-range	fixed PORTLISTS	This command assigns ports for permanent member of the VLAN group.
vlan-range	no fixed PORTLISTS	This command removes all fixed member from the vlans.
vlan-range	tagged PORTLISTS	This command assigns ports for tagged member of the VLAN group. The ports should be one/some of the permanent members of the vlans.
vlan-range	no tagged PORTLISTS	This command removes all tagged member from the vlans.
vlan-range	untagged PORTLISTS	This command assigns ports for untagged member of the VLAN group. The ports should be one/some of the permanent members of the vlans.
vlan-range	no untagged PORTLISTS	This command removes all untagged member from the vlans.

Example:
```
L2SWITCH#configure terminal
L2SWITCH(config)#vlan 2
L2SWITCH(config-vlan)#fixed 1-4
L2SWITCH(config-vlan)#tagged 1-3
```

5.3.2.3. Web Configuration

VLAN Settings

Parameter	Description
VLAN ID	Enter the VLAN ID for this entry; the valid range is between 1 and 4094.
VLAN Name	Enter a descriptive name for the VLAN for identification purposes. The VLAN name should be the combination of the digit or the alphabet or

	hyphens (-) or underscores (_). The maximum length of the name is 16 characters.
Member Port	Enter the port numbers you want the Switch to assign to the VLAN as members. You can designate multiple port numbers individually by using a comma (,) and by range with a hyphen (-).
Apply	Click Apply to save your changes back to the Switch.
Refresh	Click Refresh to begin configuring this screen afresh.
VLAN List	
VLAN ID	This field displays the index number of the VLAN entry. Click the number to modify the VLAN.
VLAN Name	This field displays the name of the VLAN.
VLAN Status	This field displays the status of the VLAN. **Static** or **Dynamic** (802.1Q VLAN).
Member Port	This field displays which ports have been assigned as members of the VLAN. This will display **None** if no ports have been assigned.
Action	Click **Delete** to remove the VLAN. The VLAN 1 cannot be deleted.

Tag Settings

Parameter	Description
VLAN ID	Select a VLAN ID to configure its port tagging settings.
Tag Port	Selecting a port which is a member of the selected VLAN ID will make it a tag port. This means the port will tag all outgoing frames transmitted

	with the VLAN ID.
Select All	Click **Select All** to mark all member ports as tag ports.
Deselect All	Click **Deselect All** to mark all member ports as untag ports.
Apply	Click Apply to save your changes back to the Switch.
Refresh	Click Refresh to begin configuring this screen afresh.
Tag Status	
VLAN ID	This field displays the VLAN ID.
Tag Ports	This field displays the ports that have been assigned as tag ports.
Untag Ports	This field displays the ports that have been assigned as untag ports.

Port Settings

Parameter	Description
Port	Select a port number to configure from the drop-down box. Select **All** to configure all ports at the same time.
PVID	Select a **PVID** (Port VLAN ID number) from the drop-down box.

Acceptable Frame	Specify the type of frames allowed on a port. Choices are **All**, **VLAN Untagged Only** or **VLAN Tagged Only**. Select **All** from the drop-down list box to accept all untagged or tagged frames on this port. This is the default setting. Select **VLAN Tagged Only** to accept only tagged frames on this port. All untagged frames will be dropped. Select VLAN Untagged Only to accept only untagged frames on this port. All tagged frames will be dropped.
Apply	Click Apply to save your changes back to the Switch.
Refresh	Click Refresh to begin configuring this screen afresh.
Port Status	
Port	This field displays the port number.
PVID	This field displays the Port VLAN ID number.
Acceptable Frame	This field displays the type of frames allowed on the port. This will either display **All** or **VLAN Tagged Only or VLAN Untagged Only.**

5.3.3. MAC-based VLAN

5.3.3.1. Introduction

The MAC base VLAN allows users to create VLAN with MAC address. The MAC address can be the leading three or more bytes of the MAC address.
For example, 00:0b:04 or 00:03:04:05 or 00:01:02:03:04:05.

When the Switch receives packets, it will compare MAC-based VLAN configures. If the SA is matched the MAC-based VLAN configures, the Switch replace the VLAN with user configured and them forward them.
For example:
　　Configurations: 00:0B:04, VLAN=23, Priority=2.
　　The packets with SA=00:0B:04:xx:xx:xx will be forwarded to VLAN 22 member ports.

Notices: The 802.1Q port base VLAN should be created first.

5.3.3.2. CLI Configuration

Node	Command	Description
enable	show mac-vlan	This command displays the all of the mac-vlan configurations.
configure	mac-vlan STRINGS vlan VLANID priority <0-7>	This command creates a mac-vlan entry with the leading three or more bytes of mac address and the VLAN and the priority.
configure	no mac-vlan entry STRINGS	This command deletes a mac-vlan entry.

| configure | no mac-vlan all | This command deletes all of the mac-vlan entries. |

Where the STRINGS is the leading three bytes or more bytes of the mac address.
For example:
    00:0B:04
    00:0B:04:11
    00:0B:04:11:22
    00:0B:04:11:22:33

Example:
L2SWITCH(config)#vlan 22
L2SWITCH(config-vlan)#fixed 1-4
L2SWITCH(config-vlan)#exit
L2SWITCH(config)#mac-vlan 00:0B:04:11:22 vlan 22 priority 1

5.3.3.3. Web Configuration

Parameter	Description
MAC Address	Configures the leading three or more bytes of the MAC address.
VLAN	Configures the VLAN.
Priority	Configures the 802.1Q priority.
Action	Click the "Delete" button to delete the protocol VLAN profile.

5.4. DHCP Relay

5.4.1. Introduction

Because the *DHCPDISCOVER message is a broadcast message,* and broadcasts only cross other segments when they are explicitly routed, you might have to configure a DHCP Relay Agent on the router interface so that all DHCPDISCOVER messages can be forwarded to your DHCP server. Alternatively, you can configure the router to forward DHCP messages and BOOTP message. *In a routed network, you would need DHCP Relay Agents if you plan to implement only one DHCP server.*

The DHCP Relay that either a host or an IP router that listens for DHCP client messages being broadcast on a subnet and then forwards those DHCP messages directly to a configured DHCP server. The DHCP server sends DHCP response messages directly back to the DHCP relay agent, which then forwards them to the DHCP client. The DHCP administrator uses DHCP relay agents to centralize DHCP servers, avoiding the need for a DHCP server on each subnet.

Most of the time in small networks DHCP uses broadcasts however there are some circumstances where unicast addresses will be used. A router for such a subnet receives the DHCP broadcasts, converts them to unicast (with a destination MAC/IP address of the configured DHCP server, source MAC/IP of the router itself). The field identified as the GIADDR in the main DHCP page is populated with the IP address of the interface on the router it received the DHCP request on. The DHCP server uses the **GIADDR** field to identify the subnet the device and select an IP address from the correct pool. The DHCP server then sends the DHCP OFFER back to the router via unicast which then converts it back to a broadcast and out to the correct subnet containing the device requesting an address.

Configurations:
Users can enable/disable the DHCP Relay on the Switch. Users also can enable/disable the DHCP Relay on a specific VLAN. If the DHCP Relay on the Switch is disabled, the DHCP Relay is disabled on all VLANs even some of the VLAN DHCP Relay are enabled.

Applications
- Application-1 (Over a Router)
  The DHCP cleint-1 and DHCP client-2 are located in different IP segments. But they allocate IP address from the same DHCP server.

DHCP Client-1   Switch   Router   Switch   DHCP Client-2
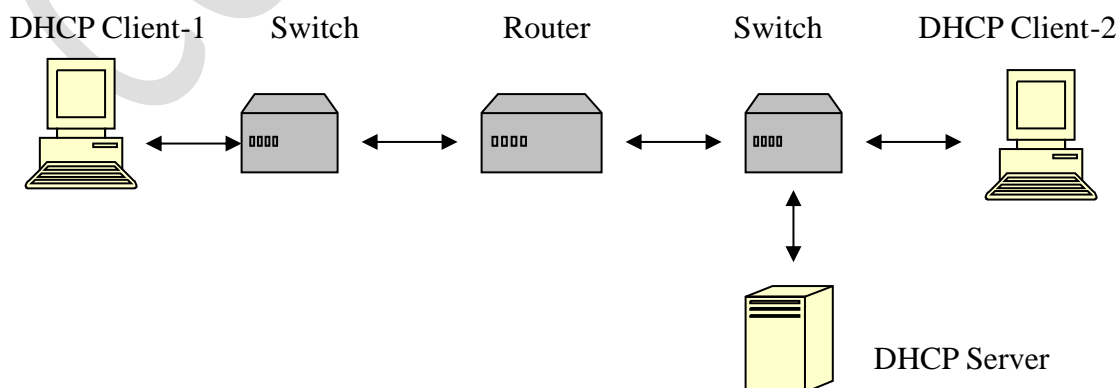
DHCP Server

- **Application-2 (Local in different VLANs)**
  The DHCP cleint-1 and DHCP client-2 are located in different VLAN. But they allocate IP address from the same DHCP server.

Switch DHCP Relay agent

| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |

Server   client   client   client   client   client   client   client
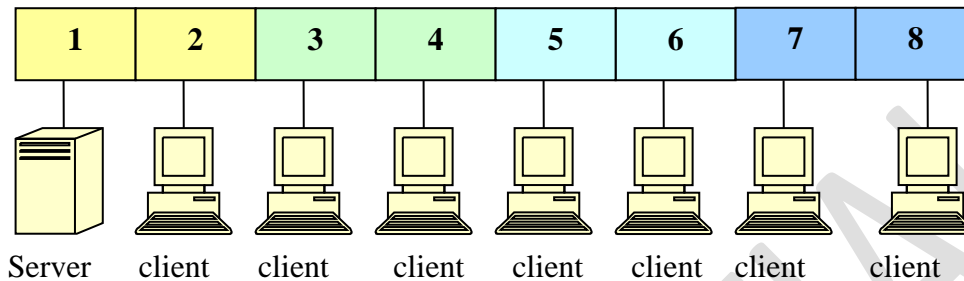
VLAN 1: port 1,2 (Management VLAN)
VLAN 2: port 3, 4
VLAN 3: port 5, 6
VLAN 4: port 7, 8

DHCP Server ➔ Port 1.
DHCP Client ➔ Port 2, 3, 4, 5, 6, 7, 8.

Result: Hosts connected to port 2,3,4,5,6,7,8 can get IP from DHCP server.

Note: The DHCP Server must connect to the management VLAN member ports.
          The DHCP Relay in management VLAN should be enabled.

Default Settings
- The default global DHCP relay state is disabled.
- The default VLAN DHCP relay state is disabled for all VLANs.
- The default DHCP server is 0.0.0.0

5.4.2.   CLI Configuration

Node	Command	Description
enable	show dhcp relay	This command displays the current configurations for the DHCP relay.
configure	dhcp relay (disable | enable)	This command disables/enables the DHCP relay on the switch.
configure	dhcp relay vlan VLAN_RANGE	This command enables the DHCP relay function on a VLAN or a range of VLANs.
configure	no dhcp relay vlan VLAN_RANGE	This command disables the DHCP relay function on a VLAN or a range of VLANs.
configure	dhcp helper-address IP_ADDRESS	This command configures the DHCP server's IP address.
configure	no dhcp helper-address	This command removes the DHCP server's IP

		address.

Example:
> L2SWITCH#*configure terminal*
> L2SWITCH(config)#*interface eth0*
> L2SWITCH(config-if)#*ip address 172.20.1.101/24*
> L2SWITCH(config-if)#*ip address default-gateway 172.20.1.1*
> L2SWITCH(config)#*dhcp relay enable*
> L2SWITCH(config)#*dhcp relay vlan 1*
> L2SWITCH(config)# *dhcp helper-address 172.20.1.1*

5.4.3. Web Configuration

Parameter	Description
State	Enables/ disables the DHCP relay for the Switch.
VLAN State	Enables / disables the DHCP relay on the specific VLAN(s).
DHCP Server IP	Configures the DHCP server's IP address.

5.5. DHCP Options 82

5.5.1. Introduction
DHCP Option 82 is the "DHCP Relay Agent Information Option". Option 82 was designed to allow a DHCP Relay Agent to insert circuit specific information into a request that is being forwarded to a DHCP server. Specifically the option works by setting two sub-options: Circuit ID and Remote ID.

The DHCP option 82 is working on the DHCP snooping or/and DHCP relay.
The switch will monitor the DHCP packets and append some information as below to the

DHCPDISCOVER and DHCPREQUEST packets. The switch will remove the DHCP Option 82 from the DHCPOFFER and DHCPACK packets. The DHCP server will assign IP domain to the client dependent on these information.

The maximum length of the information is 32 characters.

In residential, metropolitan Ethernet-access environments, DHCP can centrally manage the IP address assignments for a large number of subscribers. When the DHCP option-82 feature is enabled on the switch, a subscriber device is identified by the switch port through which it connects to the network (in addition to its MAC address). Multiple hosts on the subscriber LAN can be connected to the same port on the access switch and are uniquely identified.
When you enable the DHCP snooping information option 82 on the switch, this sequence of events occurs:

- The host (DHCP client) generates a DHCP request and broadcasts it on the network.
- When the switch receives the DHCP request, it adds the option-82 information in the packet. The option-82 information contains the switch MAC address (the remote-ID sub option) and the port identifier, vlan-mod-port, from which the packet is received (the circuit-ID suboption).
- If the IP address of the relay agent is configured, the switch adds the IP address in the DHCP packet.
- The switch forwards the DHCP request that includes the option-82 field to the DHCP server.
- The DHCP server receives the packet. If the server is option-82 capable, it can use the remote ID, the circuit ID, or both to assign IP addresses and implement policies, such as restricting the number of IP addresses that can be assigned to a single remote ID or circuit ID. Then the DHCP server **echoes** the option-82 field in the DHCP reply.
- The DHCP server unicasts the reply to the switch if the request was relayed to the server by the switch. When the client and server are on the same subnet, the server broadcasts the reply. The switch verifies that it originally inserted the option-82 data by inspecting the remote ID and possibly the circuit ID fields. The switch **removes** the option-82 field and forwards the packet to the switch port that connects to the DHCP client that sent the DHCP request**.**

Option Frame Format:

Code	Len	Agent Information Field					
82	N	i1	i2	i3	i4	. . .	iN

The Agent Information field consists of a sequence of SubOpt/Length/Value tuples for each sub-option, encoded in the following manner:

Sub-Option	Len	Sub-Option Value					
1	N	s1	s2	s3	s4	. . .	sN

```
        DHCP Agent              Sub-Option Description
        Sub-option Code
        ---------------         ----------------------
        1                       Agent Circuit ID Sub-option
```

Circuit ID Sub-option Format:

Sub option Type	Length	Information
0x01		Circuit Form

Remote ID Sub option Frame Format:

Sub option Type	Length	Type	Length	MAC Address
0x02	8	0	6	6

Circuit Form:
The circuit form is a flexible architecture. It allows user to combine any information or the system configurations into the circuit sub-option.
The Circuit Form is a string format. And its maximum length is 100 characters.
The keyword, %SPACE, will be replaced with a space character.
The other keywords get system configurations from the system and then replace the keyword and its leading code in the Circuit form. Eventually, the content of the circuit form is part of the payload on the DHCP option 82 packet.

Rules:
- The keyword must have a leading code '%'. For example: *%HOSTNAME*.
- If there are any characters following the keywords, you must add '+' between the keyword and character. For example: *%HOSTNAME+/*.
- If there are any characters before the keyword, you must add '+' between the character and the keyword. For example: *Test+%HOSTNAME*.

Keyword:
HOSTNAME - Add the system name into the Circuit sub-option..
SPACE   - Add a space character.
SVLAN   - Add the service provider VLAN ID into the Circuit sub-option.
                 If the service provider VLAN is not defined, the system will return PVLAN.
CVLAN   - Add the customer VLAN ID into the Circuit sub-option.
                 If the CVLAN is not defined, the system return 0.
PORT   - Add the transmit port ID into the Circuit sub-option.
FRAME   - Add the frame ID into the Circuit sub-option.
                 The frame ID is configured with the CLI command, "dhcp-options option82 circuit_frame VALUE". Or GUI Circuit Frame.
SHELF   - Add the shelf ID into the Circuit sub-option.
                 The shelf ID is configured with the CLI command, "dhcp-options option82 circuit_shelf VALUE". Or GUI Circuit Shelf.
SLOT   - Add the slot ID into the Circuit sub-option.
                 The slot ID is configured with the CLI command, "dhcp-options option82 circuit_slot VALUE". Or GUI Circuit Slot.

For Example:
HOSTNAME=L2SWITCH.

SVLAN=44.
CVLAN=32.
Circuit Form=RD+%SPACE+Department+%SPACE+%HOSTNAME+%SPACE+%PORT+_+%SVLAN+.+%CVLAN
The circuit sub-option result is: RD Department L2SWITCH 1_44.32

Default Setting
DHCP Option 82 state   : disabled.
Circuit Frame : 1.
Circuit Shelf   : 0.
Circuit Slot   : 0.
Circuit ID String: %HOSTNAME+%SPACE+eth/+%FRAME+/+%SHELF+/+%SLOT+:+%PORT+_+%SVLAN+:+%CVLAN
Remote ID String: %HOSTNAME+%SPACE+eth/+%FRAME+/+%SHELF+/+%SLOT+:+%PORT+_+%SVLAN+:+%CVLAN

5.5.2. CLI Configuration

Node	Command	Description
enable	show dhcp-options	This command displays the DHCP options configurations.
configure	dhcp-options option82 (disable | enable)	This command disables / enables the DHCP option 82on the Switch.
configure	dhcp-options option82 circuit_id	This command configures the information of the circuit ID sub-option.
configure	dhcp-options option82 remote_id	This command configures the information of the remote ID sub-option.
configure	dhcp-options option82 circuit_frame VALUE	This command configures the frame ID for the circuit sub-option.
configure	dhcp-options option82 circuit_shelf VALUE	This command configures the shelf ID for the circuit sub-option.
configure	dhcp-options option82 circuit_slot VALUE	This command configures the slot ID for the circuit sub-option.

5.5.3. Web Configuration

Parameter	Description
State	Select this option to enable / disable the DHCP option 82 on the Switch.
Circuit Frame	The frame ID for the circuit sub-option.
Circuit Shelf	The shelf ID for the circuit sub-option.
Circuit Slot	The slot ID for the circuit sub-option.
Circuit-ID String	The String of the circuit ID sub-option information.
Remote-ID String	The String of the remote ID sub-option information.

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Apply	Click **Apply** to save your changes to the Switch.
Refresh	Click **Refresh** to begin configuring this screen afresh.
DHCP Option 82 Port Settings	
Port	The port ID.
Circuit-ID String	The String of the circuit ID sub-option information for the specific port.
Remote-ID String	The String of the remote ID sub-option information for the specific port.
DHCP Option 82 Port Status	
	The field displays all of the ports' configurations.

5.6. EEE (Energy Efficient Ethernet)

5.6.1. Introduction

The Energy Efficient Ethernet (EEE) is an IEEE 802.3az standard that is designed to reduce power consumption in Ethernet networks during idle periods.

EEE can be enabled on devices that support low power idle (LPI) mode. Such devices can save power by entering LPI mode during periods of low utilization. In LPI mode, systems on both ends of the link can save power by shutting down certain services. EEE provides the protocol needed to transition into and out of LPI mode in a way that is transparent to upper layer protocols and applications.

Notice: This feature is for Ethernet copper ports only.

Default Settings
All ports' EEE states are disabled.

5.6.2. CLI Configuration

Node	Command	Description
enable	show interface [IFNAME]	This command displays the current port configurations.
interface	power efficient-ethernet auto	The command enables EEE on the specified interface. When EEE is enabled, the device advertises and auto negotiates EEE to its link partner.
interface	no power efficient-ethernet auto	The command disables EEE on the specified interface.

Example:
  L2SWITCH#*configure terminal*

L2SWITCH(config-if)#interface gigabitethernet1/0/1
L2SWITCH(config-if)#power efficient-ethernet auto
L2SWITCH(config-if)#no power efficient-ethernet auto

5.6.3. Web Configuration

Parameter	Description
EEE Port State	Click a port to enable IEEE 802.3az Energy Efficient Ethernet on that port.
Select All	Click this to enable IEEE 802.3az Energy Efficient Ethernet across all ports.
Deselect All	Click this to disable IEEE 802.3az Energy Efficient Ethernet across all ports.
Apply	Click Apply to configure the settings.
Refresh	Click this to reset the fields to the last setting.

5.7. Link Aggregation

5.7.1. Static Trunk
5.7.1.1. Introduction

Link Aggregation (Trunking) is the grouping of physical ports into one logical higher-capacity link. You may want to trunk ports if for example, it is cheaper to use multiple lower-speed links than to under-utilize a high-speed, but more costly, single-port link.

However, the more ports you aggregate then the fewer available ports you have. A trunk group is one logical link containing multiple ports. The Switch supports both static and dynamic link aggregation.

Note: In a properly planned network, it is recommended to implement static link aggregation only. This ensures increased network stability and control over the trunk groups on your Switch.

Default Settings

- ✓ The default group Link Aggregation state is disabled for all groups.
- ✓ The default group Link Aggregation load balance is source MAC and destination MAC for all groups.
- ✓ Maximum link aggregation group   : 8.
- ✓ Maximum port in link aggregation group   : 8.

5.7.1.2. CLI Configuration

Node	Command	Description
enable	show link-aggregation	The command displays the current trunk configurations.
configure	link-aggregation [GROUP_ID] (disable | enable)	The command disables / enables the trunk on the specific trunk group.
configure	link-aggregation [GROUP_ID] interface PORTLISTS	The command adds ports to a specific trunk group.
configure	no link-aggregation [GROUP_ID] interface PORTLISTS	The commands delete ports from a specific trunk group.

Example:
L2SWITCH#*configure terminal*
L2SWITCH(config)#*link-aggregation 1 enable*
L2SWITCH(config)#*link-aggregation 1 ports 1-4*

5.7.1.3. Web Configuration

Parameter	Description
Group State	Select the group ID to use for this trunk group, that is, one logical link containing multiple ports. Select **Enable** to use this static trunk group.
Member Ports	Select the ports to be added to the static trunk group.
Apply	Click Apply to configure the settings.
Refresh	Click this to reset the fields to the last setting.
Trunk Group Status	
Group ID	This field displays the group ID to identify a trunk group, that is, one logical link containing multiple ports.
State	This field displays if the trunk group is enabled or disabled.
Member Ports	This field displays the assigned ports that comprise the static trunk group.

5.7.2.   LACP

5.7.2.1. Introduction

The Switch adheres to the IEEE 802.3ad standard for static and dynamic (LACP) port trunking. The IEEE 802.3ad standard describes the Link Aggregation Control Protocol (LACP) for dynamically creating and managing trunk groups. When you enable LACP link aggregation on a port, the port can automatically negotiate with the ports at the remote end of a link to establish trunk groups.

LACP also allows port redundancy, that is, if an operational port fails, then one of the "standby" ports become operational without user intervention. Please note that:
- ✓ You must connect all ports point-to-point to the same Ethernet switch and configure the ports for LACP trunking.
- ✓ LACP only works on full-duplex links.
- ✓ All ports in the same trunk group must have the same media type, speed, and duplex mode and flow control settings.
- ✓ Configure trunk groups or LACP before you connect the Ethernet switch to avoid causing network topology loops.

System Priority:
The switch with the lowest system priority (and lowest port number if system priority is the same) becomes the LACP "server". The LACP "server" controls the operation of LACP setup. Enter a number to set the priority of an active port using Link Aggregation Control Protocol (LACP). The smaller the number, the higher the priority level.

System ID:
The LACP system ID is the combination of the LACP system priority value and the MAC

Administrative Key:
The administrative key defines the ability of a port to aggregate with other ports. A port's ability to aggregate with other ports is determined by these factors:
- ✓ Port physical characteristics, such as data rate, duplex capability, and point-to-point or shared medium.
- ✓ Configuration restrictions that you establish.

Port Priority:
The port priority determines which ports should be put in standby mode when there is a hardware limitation that prevents all compatible ports from aggregating.

Default Settings
- ✓ The default System Priority is 32768.
- ✓ The default group LACP state is disabled for all groups.

5.7.2.2. CLI Configuration

Node	Command	Description
enable	show lacp counters [GROUP_ID]	This command displays the LACP counters for the specific group or all groups.
enable	show lacp internal [GROUP_ID]	This command displays the LACP internal information for the specific group or all groups.
enable	show lacp neighbor [GROUP_ID]	This command displays the LACP neighbor's information for the specific group or all groups.
enable	show lacp port_priority	This command c displays the port priority for the LACP.
enable	show lacp sys_id	This command displays the actor's and partner's system ID.
configure	lacp (disable | enable)	This command disables / enables the LACP on the switch.
configure	lacp GROUP_ID (disable | enable)	This command disables / enables the LACP on the specific trunk group.
configure	clear lacp counters [PORT_ID]	This command clears the LACP statistics for the specific port or all ports.
configure	lacp system-priority <1-65535>	This command configures the system priority for the LACP. Note: The default value is 32768.
configure	no lacp system-priority	This command configures the default for the system priority for the LACP.
interface	lacp port_priority <1-65535>	This command configures the priority for the specific port. Note: The default value is 32768.
interface	no lacp port_priority	This command configures the default for the priority for the specific port.
configure	interface range gigabitethernet1/0/	This command enters the interface configure node.

	PORTLISTS	
if-range	lacp port_priority <1-65535>	This command configures the priority for the specific ports. Note: The default value is 32768.
if-range	no lacp port_priority	This command configures the default for the priority for the specific ports.

5.7.2.3. Web Configuration

LACP Settings

Parameter	Description
State	Select **Enable** from the drop down box to enable Link Aggregation Control Protocol (LACP). Select **Disable** to not use LACP.
System Priority	LACP system priority is a number between 1 and 65,535. The switch with the lowest system priority (and lowest port number if system priority is the same) becomes the LACP "server". The LACP "server" controls the operation of LACP setup. Enter a number to set the priority of an active port using Link Aggregation Control Protocol (LACP). The smaller the number, the higher the priority level.
Group LACP	Select a trunk group ID and then select whether to **Enable** or **Disable** Group Link Aggregation Control Protocol for that trunk group.
Port Priority	Select a port or a range of ports to configure its (their) LACP priority.
Apply	Click Apply to configure the settings.
Refresh	Click this to reset the fields to the last setting.
LACP Group Status	
Group ID	The field identifies the LACP group ID.
LACP State	This field displays if the group has LACP enabled.
LACP Port Priority Status	
Port	The field identifies the port ID.
Priority	The field identifies the port's LACP priority.

LACP Information.

Parameter	Description
Group ID	Select a LACP group that you want to view.
Neighbors Information	
Port	The LACP member port ID.
System Priority	LACP system priority is used to determine link aggregation group (LAG) membership, and to identify this device to other switches during LAG negotiations. (Range: 0-65535; Default: 32768)
System ID	The neighbor Switch's system ID.
Port	The direct connected port Id of the neighbor Switch.
Age	The available time period of the neighbor Switch LACP information.
Port State	The direct connected port's state of the neighbor Switch.
Port Priority	The direct connected port's priority of the neighbor Switch.
Oper Key	The Oper key of the neighbor Switch.

Internal Information	
Port	The LACP member port ID.
Port Priority	The port priority of the LACP member port.
Admin Key	The Admin key of the LACP member port.
Oper Key	The Oper key of the LACP member port.
Port State	The port state of the LACP member port.

5.8. Link Layer Discovery Protocol (LLDP)

5.8.1. Introduction

The Link Layer Discovery Protocol (LLDP) specified in this standard allows stations attached to an IEEE 802® LAN to advertise, to other stations attached to the same IEEE 802 LAN, the major capabilities provided by the system incorporating that station, the management address or addresses of the entity or entities that provide management of those capabilities, and the identification of the station's point of attachment to the IEEE 802 LAN required by those management entity or entities.

The information distributed via this protocol is stored by its recipients in a standard Management Information Base (MIB), making it possible for the information to be accessed by a Network Management System (NMS) using a management protocol such as the Simple Network Management Protocol (SNMP).

Default Settings
The LLDP on the Switch is disabled.

```
Tx Interval    :    30 seconds.
Tx Hold        :      4 times.
Time To Live   :   120 seconds.

Port   Status        Port   Status
----   -------       ----   -------
  1    Enable          2    Enable
  3    Enable          4    Enable
  5    Enable          6    Enable
  7    Enable          8    Enable
  9    Enable         10    Enable
 11    Enable         12    Enable
 13    Enable         14    Enable
 15    Enable         16    Enable
 17    Enable         18    Enable
 19    Enable         20    Enable
```

5.8.2.   CLI Configuration

Node	Command	Description
enable	show lldp	This command displays the LLDP configurations.
enable	show lldp neighbor	This command displays all of the ports' neighbor information.
configure	lldp (disable|enable)	This command globally enables / disables the LLDP function on the Switch.
configure	lldp tx-interval	This command configures the interval to transmit the LLDP packets.
configure	lldp tx-hold	This command configures the tx-hold time which determines the TTL of the Switch's message. (TTL=tx-hold * tx-interval)
interface	lldp-agent (disable|enable|rx-only|tx-only)	This command configures the LLDP agent function. disable – Disable the LLDP on the specific port. enable – Transmit and Receive the LLDP packet on the specific port. tx-only – Transmit the LLDP packet on the specific port only. rx-only – Receive the LLDP packet on the specific port.
configure	interface range (gigabitethernet1/0/) PORTLISTS	This command enters the interface configure node.
if-range	lldp-agent (disable|enable|rx-only|tx-only)	This command configures the LLDP agent function. disable – Disable the LLDP on the specific port. enable – Transmit and Receive the LLDP packet on the specific port. tx-only – Transmit the LLDP packet on the specific port only. rx-only – Receive the LLDP packet on the specific port.

5.8.3. Web Configuration

Settings

Parameter	Description
State	Globally enables / disables the LLDP on the Switch.
Tx Interval	Configures the interval to transmit the LLDP packets.
Tx Hold	Configures the tx-hold time which determines the TTL of the Switch's message. (TTL=tx-hold * tx-interval)
Time To Live	The hold time for the Switch's information.
Port	The port range which you want to configure.
State	Enables / disables the LLDP on these ports.
LLDP Status	

Port	The Port ID.
State	The LLDP state for the specific port.

Neighbor

Parameter	Description
Port	Select the port(s) which you want to display the port's neighbor information.
Local Port	The local port ID.
Remote Port ID	The connected port ID.
Chassis ID	The neighbor's chassis ID.
System Name	The neighbor's system name.
System Description	The neighbor's system description.
System Capabilities	The neighbor's capability.
Management Address	The neighbor's management address.
Time To Live	The hold time for the neighbor's information.

5.9. Loop Detection

5.9.1. Introduction

Loop detection is designed to handle loop problems on the edge of your network. This can occur when a port is connected to a Switch that is in a loop state. Loop state occurs as a result of human error. It happens when two ports on a switch are connected with the same cable. When a switch in loop state sends out broadcast messages the messages loop back to the switch and are re-broadcast again and again causing a broadcast storm.

The difference between the Loop Detection and STP:
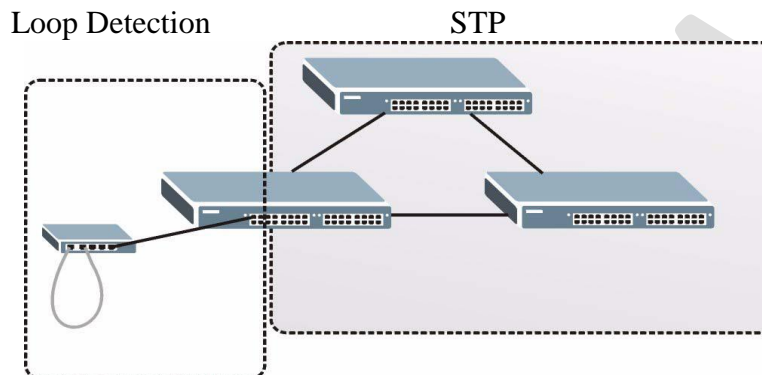
The loop detection function sends probe packets periodically to detect if the port connect to a network in loop state. The Switch shuts down a port if the Switch detects that probe packets loop back to the same port of the Switch.

Loop Recovery:
When the loop detection is enabled, the Switch will send one probe packets every two seconds and then listen this packet. If it receives the packet at the same port, the Switch will disable this port. After the time period, *recovery time***,** the Switch will enable this port and do loop detection again.

The Switch generates syslog, internal log messages as well as SNMP traps when it shuts down a port via the loop detection feature.

For the access Switch, it may not enable the STP function. To guarantee the network topology is loop free, the Loop detection function also need detect below scenario.

Default Settings
> The default global Loop-Detection state is disabled.
> The default Loop Detection Destination MAC is `00:0b:04:AA:AA:AB`
> The default Port Loop-Detection state is disabled for all ports.
> The default Port Loop-Detection status is unblocked for all ports.
> The loop detection on the Switch is disabled.
> Loop Detection Destination MAC=00:0b:04:aa:aa:ab

Port	State	Status	State	Recovery Time	Port	State	Status	State	Recovery Time

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1	Disabled	Normal	Enabled	1	2	Disabled	Normal	Enabled	1
3	Disabled	Normal	Enabled	1	4	Disabled	Normal	Enabled	1
5	Disabled	Normal	Enabled	1	6	Disabled	Normal	Enabled	1
7	Disabled	Normal	Enabled	1	8	Disabled	Normal	Enabled	1
9	Disabled	Normal	Enabled	1	10	Disabled	Normal	Enabled	1
11	Disabled	Normal	Enabled	1	12	Disabled	Normal	Enabled	1
13	Disabled	Normal	Enabled	1	14	Disabled	Normal	Enabled	1
15	Disabled	Normal	Enabled	1	16	Disabled	Normal	Enabled	1
17	Disabled	Normal	Enabled	1	18	Disabled	Normal	Enabled	1
19	Disabled	Normal	Enabled	1	20	Disabled	Normal	Enabled	1
21	Disabled	Normal	Enabled	1	22	Disabled	Normal	Enabled	1
23	Disabled	Normal	Enabled	1	24	Disabled	Normal	Enabled	1

5.9.2.　CLI Configuration

Node	Command	Description
enable	show loop-detection	This command displays the current loop detection configurations.
configure	loop-detection (disable | enable)	This command disables / enables the loop detection on the switch.
configure	loop-detection address MACADDR	This command configures the destination MAC for the loop detection special packets.
configure	no loop-detection address	This command configures the destination MAC to default (00:0b:04:AA:AA:AB).
interface	loop-detection (disable | enable)	This command disables / enables the loop detection on the port.
interface	no shutdown	This command enables the port. It can unblock port blocked by loop detection.
interface	loop-detection recovery (disable | enable)	This command enables / disables the recovery function on the port.
interface	loop-detection recovery time VALUE	This command configures the recovery period time.
configure	interface range gigabitethernet1/0/ PORTLISTS	This command enters the interface configure node.
if-range	loop-detection (disable | enable)	This command disables / enables the loop detection on the ports.
if-range	loop-detection recovery (disable | enable)	This command enables / disables the recovery function on the port.
if-range	loop-detection recovery time VALUE	This command configures the recovery period time.

Example: The procedures to enable the Loop Detection on port 1
✓　To enable the global Loop Detection.

L2SWITCH(config)#loop-detect enable

✓ To select the port 1 you want to configure.
L2SWITCH(config)#interface gigabitethernet1/0/1

5.9.3. Web Configuration

Parameter	Description
State	Select this option to enable loop guard on the Switch.
MAC Address	Enter the destination MAC address the probe packets will be sent to. If

![VOLKTEK]

	the port receives these same packets the port will be shut down.
Port	Select a port on which to configure loop guard protection.
State	Select **Enable** to use the loop guard feature on the Switch.
Loop Recovery	Select **Enable** to reactivate the port automatically after the designated recovery time has passed.
Recovery Time	Specify the recovery time in minutes that the Switch will wait before reactivating the port. This can be between 1 to 60 minutes.
Apply Refresh Loop Guard Status	Click **Apply** to save your changes to the Switch. Click **Refresh** to begin configuring this screen afresh.
Port	This field displays a port number.
State	This field displays if the loop guard feature is enabled.
Status	This field displays if the port is blocked.
Loop Recovery	This field displays if the loop recovery feature is enabled.
Recovery Time (min)	This field displays the recovery time for the loop recovery feature.

5.10. Spanning Tree Protocol (STP/RSTP)

5.10.1. Introduction

(R)STP detects and breaks network loops and provides backup links between switches, bridges or routers. It allows a Switch to interact with other (R)STP compliant switches in your network to ensure that only one path exists between any two stations on the network.

The Switch supports Spanning Tree Protocol (STP) and Rapid Spanning Tree Protocol (RSTP) as defined in the following standards.
- ✓ IEEE 802.1D Spanning Tree Protocol
- ✓ IEEE 802.1w Rapid Spanning Tree Protocol

The Switch uses IEEE 802.1w RSTP (Rapid Spanning Tree Protocol) that allows faster convergence of the spanning tree than STP (while also being backwards compatible with STP-only aware bridges). In RSTP, topology change information is directly propagated throughout the network from the device that generates the topology change. In STP, a longer delay is required as the device that causes a topology change first notifies the root bridge and then the root bridge notifies the network. Both RSTP and STP flush unwanted learned addresses from the filtering database.

In STP, the port states are Blocking, Listening, Learning, Forwarding.
In RSTP, the port states are Discarding, Learning, and Forwarding.
Note: In this document, "STP" refers to both STP and RSTP.

STP Terminology
- ✓ The root bridge is the base of the spanning tree.
- ✓ Path cost is the cost of transmitting a frame onto a LAN through that port. The recommended cost is assigned according to the speed of the link to which a port is attached. The slower the media, the higher the cost.

	LINK SPEED	RECOMMENDED VALUE	RECOMMENDED RANGE	ALLOWED RANGE
Path Cost	4Mbps	250	100 to 1000	1 to 65535
Path Cost	10Mbps	100	50 to 600	1 to 65535
Path Cost	16Mbps	62	40 to 400	1 to 65535
Path Cost	100Mbps	19	10 to 60	1 to 65535
Path Cost	1Gbps	4	3 to 10	1 to 65535
Path Cost	10Gbps	2	1 to 5	1 to 65535

- ✓ On each bridge, the bridge communicates with the root through the root port. The root port is the port on this Switch with the lowest path cost to the root (the root path cost). If there is no root port, then this Switch has been accepted as the root bridge of the spanning tree network.
- ✓ For each LAN segment, a designated bridge is selected. This bridge has the lowest cost to the root among the bridges connected to the LAN.

Forward Time (Forward Delay):
This is the maximum time (in seconds) the Switch will wait before changing states. This delay is required because every switch must receive information about topology changes before it starts to forward frames. In addition, each port needs time to listen for conflicting information that would make it return to a blocking state; otherwise, temporary data loops might result. The allowed range is 4 to 30 seconds.

Max Age:
This is the maximum time (in seconds) the Switch can wait without receiving a BPDU before attempting to reconfigure. All Switch ports (except for designated ports) should receive BPDUs at regular intervals. Any port that age out STP information (provided in the last BPDU) becomes the designated port for the attached LAN. If it is a root port, a new root port is selected from among the Switch ports attached to the network. The allowed range is 6 to 40 seconds.

Hello Time:
This is the time interval in seconds between BPDU (Bridge Protocol Data Units) configuration message generations by the root switch. The allowed range is 1 to 10 seconds.

PathCost:
Path cost is the cost of transmitting a frame on to a LAN through that port. It is recommended to assign this value according to the speed of the bridge. The slower the media,

the higher the cost.

How STP Works?

After a bridge determines the lowest cost-spanning tree with STP, it enables the root port and the ports that are the designated ports for connected LANs, and disables all other ports that participate in STP. Network packets are therefore only forwarded between enabled ports, eliminating any possible network loops.

STP-aware switches exchange Bridge Protocol Data Units (BPDUs) periodically. When the bridged LAN topology changes, a new spanning tree is constructed. Once a stable network topology has been established, all bridges listen for Hello BPDUs (Bridge Protocol Data Units) transmitted from the root bridge. If a bridge does not get a Hello BPDU after a predefined interval (Max Age), the bridge assumes that the link to the root bridge is down. This bridge then initiates negotiations with other bridges to reconfigure the network to re-establish a valid network topology.

802.1D STP

The Spanning Tree Protocol (STP) is a link layer network protocol that ensures a loop-free topology for any bridged LAN. It is based on an algorithm invented by Radia Perlman while working for Digital Equipment Corporation. In the OSI model for computer networking, STP falls under the OSI layer-2. Spanning tree allows a network design to include spare (redundant) links to provide automatic backup paths if an active link fails, without the danger of bridge loops, or the need for manual enabling/disabling of these backup links. Bridge loops must be avoided because they result in flooding the network.

The Spanning Tree Protocol (STP) is defined in the IEEE Standard 802.1D. As the name suggests, it creates a spanning tree within a mesh network of connected layer-2 bridges (typically Ethernet switches), and disables those links that are not part of the tree, leaving a single active path between any two network nodes.

STP switch port states:
- ✓ Blocking - A port that would cause a switching loop, no user data is sent or received but it may go into forwarding mode if the other links in use were to fail and the spanning tree algorithm determines the port may transition to the forwarding state. BPDU data is still received in blocking state.
- ✓ Listening - The switch processes BPDUs and awaits possible new information that would cause it to return to the blocking state.
- ✓ Learning - While the port does not yet forward frames (packets) it does learn source addresses from frames received and adds them to the filtering database (switching database)
- ✓ Forwarding - A port receiving and sending data, normal operation. STP still monitors incoming BPDUs that would indicate it should return to the blocking state to prevent a loop.
- ✓ Disabled - Not strictly part of STP, a network administrator can manually disable a port

802.1w RSTP

In 1998, the IEEE with document 802.1w introduced an evolution of the Spanning Tree Protocol: Rapid Spanning Tree Protocol (RSTP), which provides for faster spanning tree convergence after a topology change. Standard IEEE 802.1D-2004 now incorporates RSTP and obsoletes STP. While STP can take 30 to 50 seconds to respond to a topology change, RSTP is typically able to respond to changes within a second.

RSTP bridge port roles:
- ✓ Root - A forwarding port that is the best port from Nonroot-bridge to Rootbridge
- ✓ Designated - A forwarding port for every LAN segment
- ✓ Alternate - An alternate path to the root bridge. This path is different than using the root port.
- ✓ Backup - A backup/redundant path to a segment where another bridge port already connects.
- ✓ Disabled - Not strictly part of STP, a network administrator can manually disable a port

Edge Port:

They are attached to a LAN that has no other bridges attached. These edge ports transition directly to the forwarding state. RSTP still continues to monitor the port for BPDUs in case a bridge is connected. RSTP can also be configured to automatically detect edge ports. As soon as the bridge detects a BPDU coming to an edge port, the port becomes a non-edge port.

Forward Delay:

The range is from 4 to 30 seconds. This is the maximum time (in seconds) the root device will wait before changing states (i.e., listening to learning to forwarding).

Transmission Limit:

This is used to configure the minimum interval between the transmissions of consecutive RSTP BPDUs. This function can only be enabled in RSTP mode. The range is from 1 to 10 seconds.

Hello Time:

Set the time at which the root switch transmits a configuration message. The range is from 1 to 10 seconds.

Bridge priority:

Bridge priority is used in selecting the root device, root port, and designated port. The device with the highest priority becomes the STA root device. However, if all devices have the same priority, the device with the lowest MAC address will become the root device.

Port Priority:

Set the port priority in the switch. Low numeric value indicates a high priority. A port with lower priority is more likely to be blocked by STP if a network loop is detected. The valid value is from 0 to 240.

Path Cost:
The valid value is from 1 to 200000000. Higher cost paths are more likely to be blocked by STP if a network loop is detected.

BPDU Guard
This is a per port setting. If the port is enabled in BPDU guard and receive any BPDU, the port will be set to disable to avoid the error environments. User must enable the port by manual.

BPDU Filter
It is a feature to filter sending or receiving BPDUs on a switch port. If the port receives any BPDUs, the BPDUs will be dropped.

Notice: If both of the BPDU filter and BPDU guard are enabled, the BPDU filter has the high priority.

Root Guard
The Root Guard feature forces an interface to become a designated port to prevent surrounding switches from becoming a root switch. In other words, Root Guard provides a way to enforce the root bridge placement in the network. The Root Guard feature prevents a Designated Port from becoming a Root Port. If a port on which the Root Guard feature receives a superior BPDU, it moves the port into a root-inconsistent state (effectively equal to a listening state), thus maintaining the current Root Bridge status. The port can be moved to forwarding state if no superior BPDU received by this port for three hello times.

Default Settings
- ✓ STP/RSTP : disabled.
- ✓ STP/RSTP mode : RSTP.
- ✓ Forward Time : 15 seconds.
- ✓ Hello Time : 2 seconds.
- ✓ Maximum Age : 20 seconds.
- ✓ System Priority : 32768.
- ✓ Transmission Limit : 3 seconds.
- ✓ Per port STP state : enabled.
- ✓ Per port Priority : 128.
- ✓ Per port Edge port : disabled.
- ✓ Per port BPDU filter : disabled.
- ✓ Per port BPDU guard : disabled.
- ✓ Per port BPDU Root guard: disabled.
- ✓ Per port Path Cost : depend on port link speed.
  Example: Bandwidth -> STP Port Cost Value
  - 10 Mbps -> 100
  - 100 Mbps-> 19
  - 1 Gbps -> 4
  - 10 Gbps -> 2

5.10.2. CLI Configuration

Node	Command	Description
enable	show spanning-tree active	This command displays the spanning tree information for only active port(s)
enable	show spanning-tree blockedports	This command displays the spanning tree information for only blocked port(s)
enable	show spanning-tree port detail PORT_ID	This command displays the spanning tree information for the interface port.
enable	show spanning-tree statistics PORT_ID	This command displays the spanning tree information for the interface port.
enable	show spanning-tree summary	This command displays the summary of port states and configurations
enable	clear spanning-tree counters	This command clears spanning-tree statistics for all ports.
enable	clear spanning-tree counters PORT_ID	This command clears spanning-tree statistics for a specific port.
configure	spanning-tree (disable | enable)	This command disables / enables the spanning tree function for the system.
configure	spanning-tree algorithm-timer forward-time TIME max-age TIME hello-time TIME	This command configures the bridge times (forward-delay,max-age,hello-time).
configure	no spanning-tree algorithm-timer	This command configures the default values for forward-time & max-age & hello-time.
configure	spanning-tree forward-time <4-30>	This command configures the bridge forward delay time (sec).
configure	no spanning-tree forward-time	This command configures the default values for forward-time.
configure	spanning-tree hello-time <1-10>	This command configures the bridge hello time (sec).
configure	no spanning-tree hello-time	This command configures the default values for hello-time.
configure	spanning-tree max-age <6-40>	This command configures the bridge message max-age time (sec).
configure	no spanning-tree max-age	This command configures the default values for max-age time.
configure	spanning-tree mode (rstp|stp)	This command configures the spanning mode.
configure	spanning-tree pathcost method (short|long)	This command configures the pathcost method.
configure	spanning-tree priority <0-61440>	This command configures the priority for the system.
configure	no spanning-tree priority	This command configures the default values for the system priority.

interface	spanning-tree (disable|enable)	This command configures enables/disables the STP functions for the specific port.
interface	spanning-tree bpdufilter (disable|enable)	This command configures enables/disables the bpdufilter function for the specific port.
interface	spanning-tree bpduguard (disable|enable)	This command configures enables/disables the bpduguard function for the specific port.
interface	spanning-tree rootguard (disable|enable)	This command enables/disables the BPDU Root guard port setting for the specific port.
interface	spanning-tree edge-port (disable|enable)	This command enables/disables the edge port setting for the specific port.
interface	spanning-tree cost VALUE	This command configures the cost for the specific port. Cost range: 16-bit based value range 1-65535, 32-bit based value range 1-200000000.
interface	no spanning-tree cost	This command configures the path cost to default for the specific port.
interface	spanning-tree port-priority <0-240>	This command configures the port priority for the specific port. Default: 128.
interface	no spanning-tree port-priority	This command configures the port priority to default for the specific port.
config	interface range gigabitethernet1/0/ PORTLISTS	This command enters the interface configure node.
if-range	spanning-tree (disable|enable)	This command configures enables/disables the STP functions for the specific port.
if-range	spanning-tree bpdufilter (disable|enable)	This command configures enables/disables the bpdufilter function for the specific port.
if-range	spanning-tree bpduguard (disable|enable)	This command configures enables/disables the bpduguard function for the specific port.
if-range	spanning-tree rootguard (disable|enable)	This command enables/disables the BPDU Root guard port setting for the specific port.
if-range	spanning-tree edge-port (disable|enable)	This command enables/disables the edge port setting for the specific port.
if-range	spanning-tree cost VALUE	This command configures the cost for the specific port. Cost range:

		16-bit based value range 1-65535, 32-bit based value range 1-200000000.
if-range	no spanning-tree cost	This command configures the path cost to default for the specific port.
if-range	spanning-tree port-priority <0-240>	This command configures the port priority for the specific port. Default: 128.
if-range	no spanning-tree port-priority	This command configures the port priority to default for the specific port.

5.10.3.   Web Configuration

General Settings

Parameter	Description
State	Select **Enabled** to use Spanning Tree Protocol (STP) or Rapid Spanning Tree Protocol (RSTP).
Mode	Select to use either Spanning Tree Protocol (STP) or Rapid Spanning Tree Protocol (RSTP).
Forward Time	This is the maximum time (in seconds) the Switch will wait before changing states. This delay is required because every switch must receive information about topology changes before it starts to forward frames. In addition, each port needs time to listen for conflicting information that would make it return to a blocking state; otherwise, temporary data loops might result. The allowed range is 4 to 30 seconds.
Max Age	This is the maximum time (in seconds) the Switch can wait without receiving a BPDU before attempting to reconfigure. All Switch ports (except for designated ports) should receive BPDUs at regular intervals. Any port that ages out STP information (provided in the last BPDU)

	becomes the designated port for the attached LAN. If it is a root port, a new root port is selected from among the Switch ports attached to the network. The allowed range is 6 to 40 seconds.
Hello Time	This is the time interval in seconds between BPDU (Bridge Protocol Data Units) configuration message generations by the root switch. The allowed range is 1 to 10 seconds.
Priority	Priority is used in determining the root switch, root port and designated port. The switch with the highest priority (lowest numeric value) becomes the STP root switch. If all switches have the same priority, the switch with the lowest MAC address will then become the root switch. Enter a value from 0~61440. The lower the numeric value you assign, the higher the priority for this bridge. Priority determines the root bridge, which in turn determines the Root Hello Time, Root Maximum Age and Root Forwarding Delay.
Pathcost	Path cost is the cost of transmitting a frame on to a LAN through that port. It is recommended to assign this value according to the speed of the bridge. The slower the media, the higher the cost.

Port Parameters

Spanning Tree Protocol

General Settings	Port Parameters	STP Status

Port Parameters Settings

Port		Path Cost	Priority	Edge Port	BPDU Filter	BPDU Guard	ROOT Guard
From: 1 ▼	To: 1 ▼	250	128	Disable ▼	Disable ▼	Disable ▼	Disable ▼

[Apply] [Refresh]

Port Status

Port	Role	Status	Path Cost	Priority	Edge Port	BPDU Filter	BPDU Guard	ROOT Guard
1	None	Discarding	250	128	Disabled	Disabled	Disabled	Disabled
2	None	Discarding	250	128	Disabled	Disabled	Disabled	Disabled
3	None	Discarding	250	128	Disabled	Disabled	Disabled	Disabled
4	None	Discarding	250	128	Disabled	Disabled	Disabled	Disabled
5	None	Discarding	250	128	Disabled	Disabled	Disabled	Disabled
6	None	Discarding	250	128	Disabled	Disabled	Disabled	Disabled
7	None	Discarding	250	128	Disabled	Disabled	Disabled	Disabled
8	None	Discarding	250	128	Disabled	Disabled	Disabled	Disabled
9	None	Discarding	250	128	Disabled	Disabled	Disabled	Disabled
10	None	Discarding	250	128	Disabled	Disabled	Disabled	Disabled
11	None	Discarding	250	128	Disabled	Disabled	Disabled	Disabled
12	None	Discarding	250	128	Disabled	Disabled	Disabled	Disabled
13	None	Discarding	250	128	Disabled	Disabled	Disabled	Disabled
14	None	Discarding	250	128	Disabled	Disabled	Disabled	Disabled
15	None	Discarding	250	128	Disabled	Disabled	Disabled	Disabled
16	None	Discarding	250	128	Disabled	Disabled	Disabled	Disabled
17	None	Discarding	250	128	Disabled	Disabled	Disabled	Disabled
18	None	Discarding	250	128	Disabled	Disabled	Disabled	Disabled
19	None	Discarding	250	128	Disabled	Disabled	Disabled	Disabled
20	None	Discarding	250	128	Disabled	Disabled	Disabled	Disabled
21	None	Discarding	250	128	Disabled	Disabled	Disabled	Disabled
22	None	Discarding	250	128	Disabled	Disabled	Disabled	Disabled
23	None	Discarding	250	128	Disabled	Disabled	Disabled	Disabled
24	None	Discarding	250	128	Disabled	Disabled	Disabled	Disabled

Parameter	Description
Port	Selects a port that you want to configure.
Active	Enables/Disables the spanning tree function for the specific port.
Path Cost	Configures the path cost for the specific port.
Priority	Configures the priority for the specific port.
Edge Port	Configures the port type for the specific port. Edge or Non-Edge.
BPDU Filter	Enables/Disables the BPDU filter function for the specific port.

BPDU Guard	Enables/Disables the BPDU guard function for the specific port.
ROOT Guard	Enables/Disables the BPDU root guard function for the specific port.
Port Status	
Active	The state of the STP function.
Role	The port role. Should be one of the Alternated / Designated / Root / Backup / None.
Status	The port's status. Should be one of the Discarding / Blocking / Listening / Learning / Forwarding / Disabled.
Path Cost	The port's path cost.
Priority	The port's priority.
Edge Port	The state of the edge function.
BPDU Filter	The state of the BPDU filter function.
BPDU Guard	The state of the BPDU guard function.
ROOT Guard	The state of the BPDU Root guard function.

STP Status

Parameter	Description
Current Root Status	
MAC address	This is the MAC address of the root bridge.
Priority	**Root** refers to the base of the spanning tree (the root bridge). This field displays the root bridge's priority. This Switch may also be the root bridge.

MAX Age	This is the maximum time (in seconds) the Switch can wait without receiving a configuration message before attempting to reconfigure.
Hello Time	This is the time interval (in seconds) at which the root switch transmits a configuration message. The root bridge determines Hello Time, Max Age and Forwarding Delay.
Forward Delay	This is the time (in seconds) the root switch will wait before changing states.
Current Bridge Status	
MAC address	This is the MAC address of the current bridge.
Priority	Priority is used in determining the root switch, root port and designated port. The switch with the highest priority (lowest numeric value) becomes the STP root switch. If all switches have the same priority, the switch with the lowest MAC address will then become the root switch. Priority determines the root bridge, which in turn determines the Root Hello Time, Root Maximum Age and Root Forwarding Delay.
MAX Age	This is the maximum time (in seconds) the Switch can wait without receiving a BPDU before attempting to reconfigure. All Switch ports (except for designated ports) should receive BPDUs at regular intervals. Any port that age out STP information (provided in the last BPDU) becomes the designated port for the attached LAN. If it is a root port, a new root port is selected from among the Switch ports attached to the network.
Hello Time	This is the time interval in seconds between BPDU (Bridge Protocol Data Units) configuration message generations by the root switch.
Forward Delay	This is the maximum time (in seconds) the Switch will wait before changing states. This delay is required because every switch must receive information about topology changes before it starts to forward frames. In addition, each port needs time to listen for conflicting information that would make it return to a blocking state; otherwise, temporary data loops might result.
Path Cost	Path cost is the cost of transmitting a frame on to a LAN through that port. It is recommended to assign this value according to the speed of the bridge. The slower the media, the higher the cost.
Root Cost	This is the number of the port on the Switch through which this Switch must communicate with the root of the Spanning Tree.

6. Security

6.1. IP Source Guard

IP Source Guard is a security feature that restricts IP traffic on untrusted Layer 2 ports by filtering traffic based on the DHCP snooping binding database or manually configured IP source bindings. This feature helps prevent IP spoofing attacks when a host tries to spoof and use the IP address of another host. Any IP traffic coming into the interface with a source IP address other than that assigned (via DHCP or static configuration) will be filtered out on the u-trusted Layer 2 ports.

The IP Source Guard feature is enabled in combination with the DHCP snooping feature on untrusted Layer 2 interfaces. It builds and maintains an IP source binding table that is learned by DHCP snooping or manually configured (static IP source bindings). An entry in the IP source binding table contains the IP address and the associated MAC and VLAN numbers. The IP Source Guard is supported on Layer 2 ports only, including access and trunk ports.

The IP Source Guard features include below functions:
1. DHCP Snooping.
2. DHCP Binding table.
3. ARP Inspection.
4. Blacklist Filter. (arp-inspection mac-filter table)

6.1.1. DHCP Snooping
6.1.1.1. Introduction
DHCP snooping is a DHCP security feature that provides network security by filtering un-trusted DHCP messages and by building and maintaining a DHCP snooping binding database, which is also referred to as a DHCP snooping binding table.

DHCP snooping acts like a firewall between un-trusted hosts and DHCP servers. You can use DHCP snooping to differentiate between un-trusted interfaces connected to the end user and trusted interfaces connected to the DHCP server or another switch.

The DHCP snooping binding database contains the MAC address, the IP address, the lease time, the binding type, the VLAN number, and the interface information that corresponds to the local un-trusted interfaces of a switch.

When a switch receives a packet on an un-trusted interface and the interface belongs to a VLAN in which DHCP snooping is enabled, the switch compares the source MAC address and the DHCP client hardware address. If addresses match (the default), the switch forwards the packet. If the addresses do not match, the switch drops the packet.

The switch drops a DHCP packet when one of these situations occurs:
- ✓ A packet from a DHCP server, such as a DHCPOFFER, DHCPACK, DHCPNAK, or DHCPLEASEQUERY packet, is received from the un-trusted port.
- ✓ A packet is received on an un-trusted interface, and the source MAC address and the DHCP client hardware address do not match any of the current bindings.

Use DHCP snooping to filter unauthorized DHCP packets on the network and to build the binding table dynamically. This can prevent clients from getting IP addresses from unauthorized DHCP servers.

Trusted vs. Untrusted Ports
Every port is either a trusted port or an untrusted port for DHCP snooping. This setting is independent of the trusted/untrusted setting for ARP inspection. You can also specify the maximum number for DHCP packets that each port (trusted or untrusted) can receive each second.

Trusted ports are connected to DHCP servers or other switches. The Switch discards DHCP packets from trusted ports only if the rate at which DHCP packets arrive is too high. The Switch learns dynamic bindings from trusted ports.
Note: The Switch will drop all DHCP requests if you enable DHCP snooping and there are no trusted ports.

Untrusted ports are connected to subscribers. The Switch discards DHCP packets from untrusted ports in the following situations:
✓ The packet is a DHCP server packet (for example, OFFER, ACK, or NACK).
✓ The source MAC address and source IP address in the packet do not match any of the current bindings.
✓ The packet is a RELEASE or DECLINE packet, and the source MAC address and source port do not match any of the current bindings.
✓ The rate at which DHCP packets arrive is too high.

DHCP Snooping Database
The Switch stores the binding table in volatile memory. If the Switch restarts, it loads static bindings from permanent memory but loses the dynamic bindings, in which case the devices in the network have to send DHCP requests again.

Configuring DHCP Snooping
Follow these steps to configure DHCP snooping on the Switch.
1. Enable DHCP snooping on the Switch.
2. Enable DHCP snooping on each VLAN.
3. Configure trusted and untrusted ports.
4. Configure static bindings.

Note:
The Switch will drop all DHCP requests if you enable DHCP snooping and there are no trusted ports.
If the port link down, the entries learned by this port in the DHCP snooping binding table will be deleted.
You must enable the global DHCP snooping and DHCP Snooping for vlan first.

The main purposes of the DHCP Snooping are:
1. Create and maintain a binding table for ARP Inspection function.
2. Filter the DHCP server's packets that the DHCP server connects to a un-trust port.
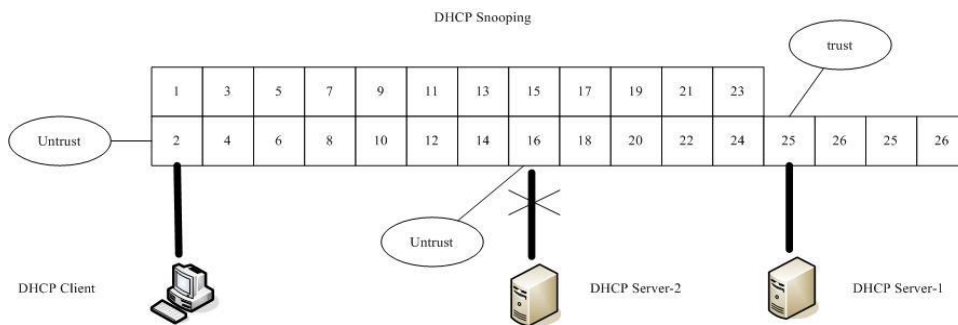
The DHCP server connected to an un-trusted port will be filtered.

Default Settings
  The DHCP snooping on the Switch is disabled.
  The DHCP snooping is enabled in VLAN(s): None.

		Maximum			Maximum
Port	Trusted	Host Count	Port	Trusted	Host Count
1	no	32	2	no	32
3	no	32	4	no	32
5	no	32	6	no	32
.	.	.	.	.	.

Notices
  There are a global state and per VLAN states.
  When the global state is disabled, the DHCP Snooping on the Switch is disabled even per VLAN states are enabled.
  When the global state is enabled, user must enable per VLAN states to enable the DHCP Snooping on the specific VLAN.

VLAN 1   : port 1-10.
DHCP Client-1 : connect to port 3.
DHCP Server   : connect to port 1.

Procedures:
 1. Default environments:
   A. DHCP Client-1: ipconfig /release
   B. DHCP Client-1: ipconfig /renew
     ➔ DHCP Client-1 can get an IP address.

 2. Enable the global DHCP Snooping.
   A. L2SWITCH(config)#dhcp-snooping
   B. DHCP Client-1: ipconfig /release
   C. DHCP Client-1: ipconfig /renew
     ➔ DHCP Client-1 can get an IP address.

3. Enable the global DHCP Snooping and VLAN 1 DHCP Snooping.
    A. L2SWITCH(config)#dhcp-snooping
    B. L2SWITCH(config)#dhcp-snooping vlan 1
    C. DHCP Client-1: ipconfig   /release
    D. DHCP Client-1: ipconfig   /renew
        ➔ DHCP Client-1 cannot get an IP address.
            ; Because the DHCP server connects to a un-trust port.

4. Enable the global DHCP Snooping and VLAN 1 DHCP Snooping.
    A. L2SWITCH(config)#dhcp-snooping
    B. L2SWITCH(config)#dhcp-snooping vlan 1
    C. L2SWITCH(config)#interface gi1/0/1
    D. L2SWITCH(config-if)#dhcp-snooping trust
    E. DHCP Client-1: ipconfig   /release
    F. DHCP Client-1: ipconfig   /renew
        ➔ DHCP Client-1 can get an IP address.

5. If you configure a static host entry in the DHCP snooping binding table, and then you want to change the host to DHCP client. The host will not get a new IP from DHCP server. You must delete the static host entry first.

6.1.1.2. CLI Configuration

Node	Command	Description
enable	show dhcp-snooping	This command displays the current DHCP snooping configurations.
configure	dhcp-snooping (disable|enable)	This command disables/enables the DHCP snooping on the switch.
configure	dhcp-snooping vlan VLANID	This command enables the DHCP snooping function on a VLAN or range of VLANs.
configure	no dhcp-snooping vlan VLANID	This command disables the DHCP snooping function on a VLAN or range of VLANs.
configure	dhcp-snooping server IPADDR	This command configures a valid DHCP server.
interface	dhcp-snooping host	This command configures the maximum host count for the specific port.
interface	no dhcp-snooping host	This command configures the maximum host count to default for the specific port.
interface	dhcp-snooping trust	This command configures the trust port for the specific port.
interface	no dhcp-snooping trust	This command configures the un-trust port for the specific port.
configure	interface range gigabitethernet1/0/ PORTLISTS	This command enters the interface configure node.
if-range	dhcp-snooping host	This command configures the maximum host count for

		the specific ports.
if-range	no dhcp-snooping host	This command configures the maximum host count to default for the specific ports.
if-range	dhcp-snooping trust	This command configures the trust port for the specific ports.
if-range	no dhcp-snooping trust	This command configures the un-trust port for the specific ports.

Example:

```
L2SWITCH#configure terminal
L2SWITCH(config)#dhcp-snooping enable
L2SWITCH(config)#dhcp-snooping vlan 1
L2SWITCH(config)#interface 1/0/1
L2SWITCH(config-if)#dhcp-snooping trust
```

6.1.1.3. Web Configuration

DHCP Snooping

Parameter	Description
State	Select **Enable** to use DHCP snooping on the Switch. You still have to enable DHCP snooping on specific VLANs and specify trusted ports. Note: The Switch will drop all DHCP requests if you enable DHCP snooping and there are no trusted ports. Select **Disable** to not use DHCP snooping.
VLAN State	Select **Add** and enter the VLAN IDs you want the Switch to enable DHCP snooping on. You can designate multiple VLANs individually by using a comma (,) and by range with a hyphen (-). Select **Delete** and enter the VLAN IDs you no longer want the Switch to use DHCP snooping on.

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Apply	Click **Apply** to take effect the settings.
Refresh	Click **Refresh** to begin configuring this screen afresh.
DHCP Snooping Status	
DHCP Snooping State	This field displays the current status of the DHCP snooping feature, **Enabled** or **Disabled**.
Enabled on VLAN	This field displays the VLAN IDs that have DHCP snooping enabled on them. This will display **None** if no VLANs have been set.

Port Settings

Parameter	Description
Port	Select a port number to modify its maximum host count.
Trust	Configures the specific port if it is a trust port.
Maximum Host Count	Enter the maximum number of hosts (1-32) that are permitted to simultaneously connect to a port.
Apply	Click Apply to take effect the settings.

Refresh	Click Refresh to begin configuring this screen afresh.

6.1.1.4. DHCP Server Screening

6.1.1.4.1. Introduction

The Switch supports DHCP Server Screening, a feature that denies access to rogue DHCP servers. That is, when one or more DHCP servers are present on the network and both provide DHCP services to different distinct groups of clients, the valid DHCP server's packets will be passed to the client.

If you want to enable this feature, you must enable the DHCP Snooping function first. The Switch allows users to configure up to three valid DHCP servers.

If no DHCP servers are configured, it means all DHCP server are valid.

6.1.1.4.2. CLI Configuration

Node	Command	Description
enable	show dhcp-snooping server	This command displays the valid DHCP server IP.
configure	dhcp-snooping server IPADDR	This command configures a valid DHCP server's IP.
configure	no dhcp-snooping server IPADDR	This command removes a valid DHCP server's IP.

6.1.1.4.3. Web Configuration

Parameter	Description
IP Address	This field configures the valid DHCP server's IP address.

Apply	Click **Apply** to configure the settings.
Refresh	Click **Refresh** to begin configuring this screen afresh.
Server Screening List	
No.	This field displays the index number of the DHCP server entry. Click the number to modify the entry.
IP Address	This field displays the IP address of the DHCP server.
Action	Click **Delete** to remove a configured DHCP server.

6.1.2. Binding Table

6.1.2.1. Introduction

The DHCP Snooping binding table records the host information learned by DHCP snooping function (dynamic) or set by user (static). The ARP inspection will use this table to forward or drop the ARP packets. If the ARP packets sent by invalid host, they will be dropped. If the Lease time is expired, the entry will be removed from the table.

Static bindings are uniquely identified by the MAC address and VLAN ID. Each MAC address and VLAN ID can only be in one static binding. If you try to create a static binding with the same MAC address and VLAN ID as an existing static binding, the new static binding replaces the original one.

6.1.2.2. CLI Configuration

Node	Command	Description
enable	show dhcp-snooping binding	This command displays the current DHCP snooping binding table.
configure	dhcp-snooping binding mac MAC_ADDR ip IP_ADDR vlan VLANID port PORT_NO	This command configures a static host into the DHCP snooping binding table.
configure	no dhcp-snooping binding mac MACADDR	This command removes a static host from the DHCP snooping binding table.

Example:
L2SWITCH#configure terminal
L2SWITCH(config)#dhcp-snooping binding mac 00:11:22:33:44:55 ip 1.1.1.1 vlan 1 port 2
L2SWITCH(config)#no dhcp-snooping binding mac 00:11:22:33:44:55
L2SWITCH#show dhcp-snooping binding

6.1.2.3. Web Configuration

Static Entry Settings

Parameter	Description
MAC Address	Enter the source MAC address in the binding.
IP Address	Enter the IP address assigned to the MAC address in the binding.
VLAN ID	Enter the source VLAN ID in the binding.
Port	Specify the port in the binding.
Static Binding Table	
No.	This field displays a sequential number for each binding. Click it to update an existing entry.
MAC Address	This field displays the source MAC address in the binding.
IP Address	This field displays the IP address assigned to the MAC address in the binding.
Lease (Hour)	This field displays how long the binding is valid.
VLAN	This field displays the source VLAN ID in the binding.
Port	This field displays the port number in the binding.
Type	This field displays how the Switch learned the binding. **Static**: This binding was learned from information provided manually by an administrator. **Dynamic**: This binding was learned by snooping DHCP packets.
Action	Click **Delete** to remove the specified entry.

Binding Table

Bindings are used by DHCP snooping and ARP inspection to distinguish between authorized and unauthorized packets in the network. The Switch learns the dynamic bindings by snooping DHCP packets and from information provided manually in the **Static Entry Settings** screen.

Parameter	Description
MAC Address	This field displays the source MAC address in the binding.
IP Address	This field displays the IP address assigned to the MAC address in the binding.
Lease	This field displays how long the binding is valid.
VLAN	This field displays the source VLAN ID in the binding.
Port	This field displays the port number in the binding. If this field is blank, the binding applies to all ports.
Type	This field displays how the Switch learned the binding. **Static**: This binding was learned from information provided manually by an administrator. **Dynamic**: This binding was learned by snooping DHCP packets.

6.1.3.   ARP Inspection

6.1.3.1. ARP Inspection

6.1.3.1.1. Introduction

Dynamic ARP inspection is a security feature which validates ARP packet in a network. Dynamic ARP inspections validates the packet by performing IP to MAC address binding inspection stored in a trusted database (the DHCP snooping database) before forwarding the packet. Dynamic ARP intercepts, logs, and discards ARP packets with invalid IP-to-MAC address bindings. This capability protects the network from certain man-in-the-middle attacks.

Dynamic ARP inspection ensures that only valid ARP requests and responses are relayed. The switch performs these activities:
- ✓ Intercepts all ARP requests and responses on un-trusted ports.
- ✓ Verifies that each of these intercepted packets has a valid IP-to-MAC address binding before it updates the local ARP cache or before it forwards the packet to the appropriate destination·

Trusted and un-trusted port
- ✓ This setting is independent of the trusted and un-trusted setting of the DHCP Snooping.
- ✓ The Switch does not discard ARP packets on trusted ports for any reasons.
- ✓ The Switch discards ARP packets on un-trusted ports if the sender's information in the ARP packets does not match any of the current bindings.
- ✓ Normally, the trusted ports are the uplink port and the un-trusted ports are connected to subscribers.

Configurations:
Users can enable / disable the ARP Inspection on the Switch. Users also can enable / disable the ARP Inspection on a specific VLAN. If the ARP Inspection on the Switch is disabled, the ARP Inspection is disabled on all VLANs even some of the VLAN ARP Inspection are enabled.

Default Settings
The ARP Inspection on the Switch is disabled.
The age time for the MAC filter is 5 minutes.
ARP Inspection is enabled in VLAN(s): None.

Port	Trusted	Port	Trusted
1	no	2	no
3	no	4	no
5	no	6	no
…	…	…	…

Notices: There are a global state and per VLAN states.
- ✓ When the global state is disabled, the ARP Inspection on the Switch is disabled even per VLAN states are enabled.
- ✓ When the global state is enabled, user must enable per VLAN states to enable the ARP Inspection on the specific VLAN.

6.1.3.1.2. CLI Configuration

Node	Command	Description
enable	show arp-inspection	This command displays the current ARP Inspection configurations.
configure	arp-inspection (disable | enable)	This command disables/enables the ARP Inspection function on the switch.
configure	arp-inspection vlan	This command enables the ARP Inspection function

	VLANID	on a VLAN or range of VLANs.
configure	no arp-inspection vlan VLANID	This command disables the ARP Inspection function on a VLAN or range of VLANs.
interface	arp-inspection trust	This command configures the trust port for the specific port.
interface	no arp-inspection trust	This command configures the un-trust port for the specific port.

Example:

L2SWITCH#*configure terminal*
L2SWITCH(config)#*arp-inspection enable*
L2SWITCH(config)#*arp-inspection vlan 1*
L2SWITCH(config)#*interface 1/0/1*
L2SWITCH(config-if)#*arp-inspection trust*

6.1.3.1.3. Web Configuration

Parameter	Description
State	Use this to **Enable** or **Disable** ARP inspection on the Switch.
VLAN State	Enter the VLAN IDs you want the Switch to enable ARP Inspection for. You can designate multiple VLANs individually by using a comma (,) and by range with a hyphen (-).
Trusted Ports	Select the ports which are trusted and deselect the ports which are untrusted. The Switch does not discard ARP packets on trusted ports for any reason. The Switch discards ARP packets on untrusted ports in the

	following situations: • The sender's information in the ARP packet does not match any of the current bindings. • The rate at which ARP packets arrive is too high. You can specify the maximum rate at which ARP packets can arrive on untrusted ports.
Select All	Click this to set all ports to trusted.
Deselect All	Click this to set all ports to untrusted.
Apply	Click **Apply** to add/modify the settings.
Refresh	Click **Refresh** to begin configuring this screen afresh.
ARP Inspection Status	
ARP Inspection State	This field displays the current status of the ARP Inspection feature, **Enabled** or **Disabled**.
Enabled on VLAN	This field displays the VLAN IDs that have ARP Inspection enabled on them. This will display **None** if no VLANs have been set.
Trusted Ports	This field displays the ports which are trusted. This will display **None** if no ports are trusted.

6.1.3.2. Filter Table
6.1.3.2.1. Introduction
Dynamic ARP inspections validates the packet by performing IP to MAC address binding inspection stored in a trusted database (the DHCP snooping database) before forwarding the packet. When the Switch identifies an unauthorized ARP packet, it automatically creates a MAC address filter to block traffic from the source MAC address and source VLAN ID of the unauthorized ARP packet. The switch also periodically deletes entries if the age-time for the entry is expired.

✓ If the ARP Inspection is enabled and the system detects invalid hosts, the system will create a filtered entry in the MAC address table.
✓ When Port link down and ARP Inspection was disabled, Switch will remove the MAC-filter entries learned by this port.
✓ When Port link down and ARP Inspection was enabled, Switch will remove the MAC-filter entries learned by this port.
✓ The maximum entry of the MAC address filter table is 256.
✓ When MAC address filter table of ARP Inspection is full, the Switch receives unauthorized ARP packet, and it automatically creates a SYSLOG and drop this ARP packet. The SYSLOG event happens on the first time.

Default Settings
✓ The mac-filter age time   : 5 minutes. (0 – No age)

✓ The maximum mac-filter entries : 256.

6.1.3.2.2. CLI Configuration

Node	Command	Description
enable	show arp-inspection mac-filter	This command displays the current ARP Inspection filtered MAC.
configure	arp-inspection mac-filter age VALUE	This command configures the age time for the ARP inspection MAC filter entry.
configure	clear arp-inspection mac-filter	This command clears all of entries in the filter table.
configure	no arp-inspection mac-filter mac MACADDR vlan VLANID	This command removes an entry from the ARP inspection MAC filter table.

6.1.3.2.3. Web Configuration

Parameter	Description
Filter Age Time	This setting has no effect on existing MAC address filters. Enter how long (1-10080 minutes) the MAC address filter remains in the Switch after the Switch identifies an unauthorized ARP packet. The Switch automatically deletes the MAC address filter afterwards.
Apply	Click Apply to add/modify the settings.
Refresh Filter Table	Click Refresh to begin configuring this screen afresh.
No.	This field displays a sequential number for each MAC address filter.
MAC Address	This field displays the source MAC address in the MAC address filter.
VLAN	This field displays the source VLAN ID in the MAC address filter.

Port	This field displays the source port of the discarded ARP packet.
Expiry (min)	This field displays how long (in minutes) the MAC address filter remains in the Switch.
Action	Click **Delete** to remove the record manually.
Total	This field displays the current number of MAC address filters that were created because the Switch identified unauthorized ARP packets.

6.2. Access Control List (ACL)

6.2.1. Introduction

L2 Access control list (**ACL**) is a list of permissions attached to an object. The list specifies who or what is allowed to access the object and what operations are allowed to be performed on the object.

L2 ACL function allows user to configure a few rules to reject packets from the specific ingress ports or all ports. These rules will check the packets' source MAC address and destination MAC address. If packets match these rules, the system will do the actions "deny". "deny" means rejecting these packets.

The Action Resolution engine collects the information (action and metering results) from the hit entries: if more than one rule matches, the actions and meter/counters are taken from the policy associated with the matched rule with highest priority.

L2 ACL Support:
    1. Filter a specific source MAC address.
        Command: *source mac host MACADDR*
    2. Filter a specific destination MAC address.
        Command: *destination mac host MACADDR*
    3. Filter a range of source MAC address.
        Command: *source mac MACADDR MACADDR*
        The second MACADDR is a mask, for example: ffff.ffff.0000
    4. Filter a range of destination MAC address.
        Command: *destination mac MACADDR MACADDR*
        The second MACADDR is a mask, for example: ffff.ffff.0000

L3 ACL Support:
    1. Filter a specific source IP address.
        Command: *source ip host IPADDR*
    2. Filter a specific destination IP address.
        Command: *destination ip host IPADDR*
    3. Filter a range of source IP address.
        Command: *source ip IPADDR IPADDR*
        The second IPADDR is a mask, for example: 255.255.0.0
    4. Filter a range of destination IP address.

Command: *destination ip IPADDR IPADDR*

L4 ACL Support:
    1. Filter a UDP/TCP source port.
    2. Filter a UDP/TCP destination port.

Default Settings
   ✓   Maximum profile   : 64.
   ✓   Maximum profile name length : 16.

Notice: The ACL name should be the combination of the digit or the alphabet.

6.2.2. CLI Configuration

Node	Command	Description
enable	show access-list	This command displays all of the access control profiles.
configure	access-list STRING	This command creates a new access control profile. Where the STRING is the profile name.
configure	no access-list STRING	This command deletes an access control profile.
acl	show	This command displays the current access control profile.
acl	action (disable|drop|permit)	This command actives this profile. disable – disable the profile. drop – If packets match the profile, the packets will be dropped. permit – If packets match the profile, the packets will be forwarded.
acl	destination mac host MACADDR	This command configures the destination MAC and mask for the profile.
acl	destination mac MACADDR MACADDR	This command configures the destination MAC and mask for the profile.
acl	destination mac MACADDR MACADDR	This command configures the destination MAC and mask for the profile. The second MACADDR parameter is the mask for the profile.
acl	no destination mac	This command removes the destination MAC from the profile.
acl	ethertype STRING	This command configures the ether type for the profile. Where the STRING is a hex-decimal value. e.g.: 08AA.
acl	no ethertype	This command removes the limitation of the ether type from the profile.
acl	source mac host MACADDR	This command configures the source MAC and mask for the profile.
acl	source mac MACADDR	This command configures the source AMC and mask for the profile.

	MACADDR	
acl	no source mac	This command removes the source MAC and mask from the profile.
acl	source ip host IPADDR	This command configures the source IP address for the profile.
acl	source ip IPADDR IPMASK	This command configures the source IP address and mask for the profile.
acl	no source ip	This command removes the source IP address from the profile.
acl	destination ip host IPADDR	This command configures a specific destination IP address for the profile.
acl	destination ip IPADDR IPMASK	This command configures the destination IP address and mask for the profile.
acl	no destination ip	This command removes the destination IP address from the profile.
acl	l4-source-port IPADDR	This command configures UDP/TCP source port for the profile.
acl	no l4-source-port IPADDR	This command removes the UDP/TCP source port from the profile.
acl	L4-destination-port PORT	This command configures the UDP/TCP destination port for the profile.
acl	no l4-destination-port	This command removes the UDP/TCP destination port from the profile.
acl	vlan VLANID	This command configures the VLAN for the profile.
acl	no vlan	This command removes the limitation of the VLAN from the profile.
acl	source interface PORT_ID	This command configures the source interface for the profile.
acl	no source interface PORT_ID	This command removes the source interface from the profile.

Where the MAC mask allows users to filter a range of MAC in the packets' source MAC or destination MAC.

For example: source mac 00:01:02:03:04:05 ff:ff:ff:ff:00

➔ The command will filter source MAC range from 00:01:02:03:00:00 to 00:01:02:03:ff:ff

Where the IPMASK mask allows users to filter a range of IP in the packets' source IP or destination IP.
For example: source ip 172.20.1.1 255.255.0.0

➔ The command will filter source IP range from 172.20.0.0 to 172.20.255.255

Example:

L2SWITCH#*configure terminal*
L2SWITCH(config)#*access-list 111*
L2SWITCH(config-acl)#*vlan 2*
L2SWITCH(config-acl)#source interface 1
L2SWITCH(config-acl)#show
  Profile Name: 111
  Activate: disabled
  VLAN: 2
  Source Interface: 1
  Destination MAC Address: any
  Source MAC Address: any
  Ethernet Type: any
  Source IP Address: any
  Destination IP Address: any
  Source Application: any
  Destination Application: any

6.2.3.　Web Configuration

Access Control List Status

Profile Name	Test	State	Dorp
Ethernet Type	0x8888	VLAN	Any
Source MAC	Any	Mask of Source MAC	None
Destination MAC	Any	Mask of Destination MAC	None
Source IP	Any	Mask of Source IP	None
Destination IP	Any	Mask of Destination IP	None
Source Application	Any	Destination Application	Any
Source Interface	27		

Delete

Parameter	Description
Profile Name	The access control profile name.
State	Disables / Drop / Permits the access control on the Switch.
Ethernet Type	Configures the Ethernet type of the packets that you want to filter.
VLAN	Configures the VLAN of the packets that you want to filter.
Source MAC	Configures the source MAC of the packets that you want to filter.
Mask of Source MAC	Configures the bitmap mask of the source MAC of the packets that you want to filter. If the Source MAC field has been configured and this field is empty, it means the profile will filter the one MAC configured in Source MAC field.
Destination MAC	Configures the destination MAC of the packets that you want to filter.
Mask of Destination MAC	Configures the bitmap mask of the destination MAC of the packets that you want to filter. If the Destination MAC field has been configured and this field is empty, it means the profile will filter the one MAC configured in Destination MAC field.
Source IP	Configures the source IP of the packets that you want to filter.
Mask of Source IP	Configures the bitmap mask of the source IP of the packets that you want to filter. If the Source IP field has been configured and this field is empty, it means the profile will filter the one IP configured in Source IP field.
Destination IP	Configures the destination IP of the packets that you want to filter.
Mask of Destination IP	Configures the bitmap mask of the destination IP of the packets that you want to filter. If the Destination IP field has been configured and this field is empty,

	it means the profile will filter the one IP configured in Destination IP field.
Source Application	Configures the source UDP/TCP ports of the packets that you want to filter.
Destination Application	Configures the destination UDP/TCP ports of the packets that you want to filter.
Source Interface(s)	Configures one or a rage of the source interfaces of the packets that you want to filter.
Apply	Click Apply to add/modify the settings.
Refresh	Click Refresh to begin configuring this screen afresh.

7. Monitor

7.1. Port Statistics

7.1.1. Introduction

This feature helps users to monitor the ports' statistics, to display the link up ports' traffic utilization only.

7.1.2. CLI Configuration

Node	Command	Description
enable	show port-statistics	This command displays the link up ports' statistics.

Example:

L2SWITCH#show port-statistics

	Packets		Bytes		Errors		Drops	
Port	Rx	Tx	Rx	Tx	Rx	Tx	Rx	Tx
----	--------	--------	--------	--------	--------	--------	--------	--------
7	1154	2	108519	1188	0	0	0	0

7.1.3. Web Configuration

Parameter	Description
Port	Select a port or a range of ports to display their statistics.
Rx Packets	The field displays the received packet count.
Tx Packets	The field displays the transmitted packet count.
Rx Bytes	The field displays the received byte count.
Tx Bytes	The field displays the transmitted byte count.
Rx Errors	The field displays the received error count.
Tx Errors	The field displays the transmitted error count.
Rx Drops	The field displays the received drop count.
Tx Drops	The field displays the transmitted drop count.

Refresh	Click this button to refresh the screen quickly.

7.2. Port Utilization

7.2.1. Introduction

This feature helps users to monitor the ports' traffic utilization, to display the link up ports' traffic utilization only.

7.2.2. CLI Configuration

Node	Command	Description
enable	show port-utilization	This command displays the link up ports' traffic utilization.

7.2.3. Web Configuration

Parameter	Description
Port	Select a port or a range of ports to display their RMON statistics.
Speed	The current port speed.
Utilization	The port traffic utilization.
Refresh	Click this button to refresh the screen quickly.

7.3. RMON Statistics

7.3.1. Introduction

This feature helps users to monitor or clear the port's RMON statistics.

7.3.2. CLI Configuration

Node	Command	Description
enable	show rmon statistics	This command displays the RMON statistics.
configure	clear rmon statistics [IFNAME]	This command clears one port's or all ports' RMON statistics.

7.3.3. Web Configuration

Parameter	Description
Port	Select a port or a range of ports to display their RMON statistics.
Show	Show them.
Clear	Clear the RMON statistics for the port or a range of ports.

7.4. Traffic Monitor

7.4.1. Introduction

The function can be enabled / disabled on a specific port or globally be enabled disabled on the Switch. The function will monitor the broadcast / multicast / broadcast and multicast packets rate. If the packet rate is over the user's specification, the port will be blocked. And if the recovery function is enabled, the port will be enabled after recovery time.

7.4.2. CLI Configuration

Node	Command	Description
enable	show traffic-monitor	This command displays the traffic monitor configurations and current status.
configure	traffic-monitor (disable|enable)	This command enables / disables the traffic monitor on the Switch.
interface	traffic-monitor (disable|enable)	This command enables / disables the traffic monitor on the port.
interface	traffic-monitor rate RATE_LIMIT type (bcast|mcast|bcast+mcast)	This command configures the packet rate and packet type for the traffic monitor on the port. bcast – Broadcast packet. mcast – Multicast packet.
interface	traffic-monitor recovery (disable|enable)	This command enables / disables the recovery function for the traffic monitor on the port.
interface	traffic-monitor recovery time VALUE	This command configures the recovery time for the traffic monitor on the port.
configure	interface range (gigabitethernet1/0/) PORTLISTS	This command enters the interface configure node.
if-range	traffic-monitor (disable|enable)	This command enables / disables the traffic monitor on the port.
if-range	traffic-monitor rate RATE_LIMIT type (bcast|mcast|bcast+mcast)	This command configures the packet rate and packet type for the traffic monitor on the port. bcast – Broadcast packet. mcast – Multicast packet.
if-range	traffic-monitor recovery (disable|enable)	This command enables / disables the recovery function for the traffic monitor on the port.
if-range	traffic-monitor recovery time VALUE	This command configures the recovery time for the traffic monitor on the port.

7.4.3.   Web Configuration

Traffic Monitor

Traffic Monitor Settings

State	Disable

Port		State	Action	Packet Type	Packet Rate(pps)	Recovery State	Recovery Time (min)
From: 1 To: 1		Disable	None	Broadcast	100	Enable	1

Apply Refresh

Traffic Monitor Status

Port	State	Status	Packet Type	Packet Rate(pps)	Recovery State	Recovery Time (min)
1	Disabled	Normal	Broadcast	100	Enabled	1
2	Disabled	Normal	Broadcast	100	Enabled	1
3	Disabled	Normal	Broadcast	100	Enabled	1
4	Disabled	Normal	Broadcast	100	Enabled	1
5	Disabled	Normal	Broadcast	100	Enabled	1
6	Disabled	Normal	Broadcast	100	Enabled	1
7	Disabled	Normal	Broadcast	100	Enabled	1
8	Disabled	Normal	Broadcast	100	Enabled	1
9	Disabled	Normal	Broadcast	100	Enabled	1
10	Disabled	Normal	Broadcast	100	Enabled	1
11	Disabled	Normal	Broadcast	100	Enabled	1
12	Disabled	Normal	Broadcast	100	Enabled	1
13	Disabled	Normal	Broadcast	100	Enabled	1
14	Disabled	Normal	Broadcast	100	Enabled	1
15	Disabled	Normal	Broadcast	100	Enabled	1
16	Disabled	Normal	Broadcast	100	Enabled	1
17	Disabled	Normal	Broadcast	100	Enabled	1
18	Disabled	Normal	Broadcast	100	Enabled	1
19	Disabled	Normal	Broadcast	100	Enabled	1
20	Disabled	Normal	Broadcast	100	Enabled	1
21	Disabled	Normal	Broadcast	100	Enabled	1
22	Disabled	Normal	Broadcast	100	Enabled	1
23	Disabled	Normal	Broadcast	100	Enabled	1
24	Disabled	Normal	Broadcast	100	Enabled	1

Parameter	Description
State	Globally enables / disables the traffic monitor function.
Port	The port range which you want to configure.
State	Enables / disables the traffic monitor function on these ports.
Action	Unblock these ports.
Packet Type	Specify the packet type which you want to monitor.

Packet Rate	Specify the packet rate which you want to monitor.
Recover State	Enables / disables the recovery function for the traffic monitor function on these ports.
Recovery Time	Configures the recovery time for the traffic monitor function on these ports.(Range: 1 – 60 minutes)

8. Management

8.1. SNMP

8.1.1. Introduction

Simple Network Management Protocol (SNMP) is used in network management systems to monitor network-attached devices for conditions that warrant administrative attention. SNMP is a component of the Internet Protocol Suite as defined by the Internet Engineering Task Force (IETF). It consists of a set of standards for network management, including an application layer protocol, a database schema, and a set of data objects.

SNMP exposes management data in the form of variables on the managed systems, which describe the system configuration. These variables can then be queried (and sometimes set) by managing applications.

Support below MIBs:
- ✓ RFC 1157 A Simple Network Management Protocol
- ✓ RFC 1213 MIB-II
- ✓ RFC 1493 Bridge MIB
- ✓ RFC 1643 Ethernet Interface MIB
- ✓ RFC 1757 RMON Group 1,2,3,9

SNMP community act like passwords and are used to define the security parameters of SNMP clients in an SNMP v1 and SNMP v2c environments. The default SNMP community is "public" for both SNMP v1 and SNMP v2c before SNMP v3 is enabled. Once SNMP v3 is enabled, the communities of SNMP v1 and v2c have to be unique and cannot be shared.

Network ID of Trusted Host:
> The IP address is a combination of the Network ID and the Host ID.
> > Network ID = (Host IP & Mask).
> > User need only input the network ID and leave the host ID to 0. If user has input the host ID, such as 192.168.1.102, the system will reset the host ID, such as 192.168.1.0

Note: Allow user to configure the community string and rights only.
User configures the Community String and the Rights and the Network ID of Trusted Host=0.0.0.0, Subnet Mask=0.0.0.0. It means that all hosts with the community string can access the Switch.

Default Settings
- ✓ SNMP   : disabled.
- ✓ System Location   : L2SWITCH. (Maximum length 64 characters)
- ✓ System Contact   : None. (Maximum length 64 characters)
- ✓ System Name   : None. (Maximum length 64characters)
- ✓ Trap Receiver   : None.
- ✓ Community Name : None.
- ✓ The maximum entry for community   : 3.
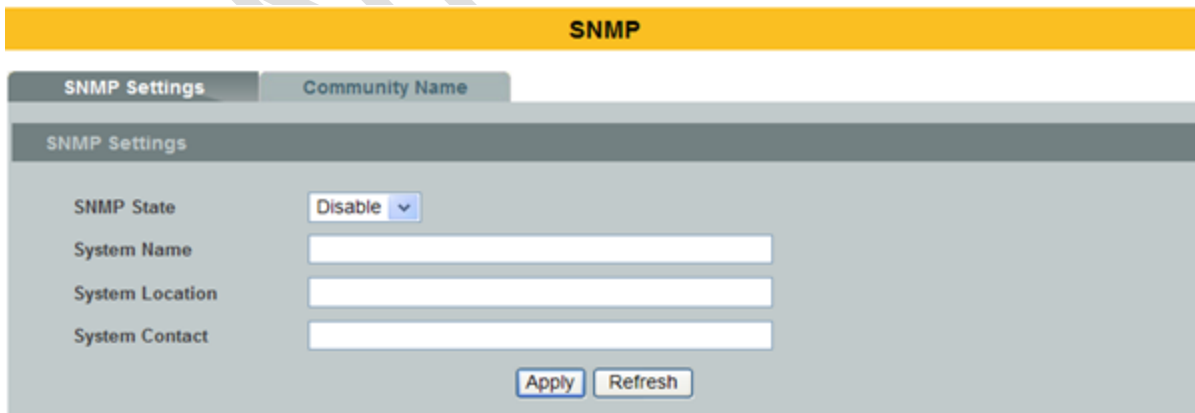- ✓ The maximum entry for trap receiver   : 5.

8.1.2. CLI Configuration

Node	Command	Description
enable	show snmp	This command displays the SNMP configurations.
configure	snmp community STRING (ro|rw) trusted-host IPADDR	This command configures the SNMP community name.
configure	snmp (disable|enable)	This command disables/enables the SNMP on the switch.
configure	snmp system-contact STRING	This command configures contact information for the system.
configure	snmp system-location STRING	This command configures the location information for the system.
configure	snmp system-name STRING	This command configures a name for the system. (The System Name is same as the host name)
configure	snmp trap-receiver IPADDR VERSION COMMUNITY	This command configures the trap receiver's configurations, including the IP address, version (v1 or v2c) and community.

Example:
L2SWITCH#configure terminal
L2SWITCH(config)#snmp enable
L2SWITCH(config)#snmp community public rw trusted-host 192.168.200.106/24
L2SWITCH(config)#snmp trap-receiver 192.168.200.106 v2c public
L2SWITCH(config)#snmp system-contact IT engineer
L2SWITCH(config)#snmp system-location Branch-Office

8.1.3. Web Configuration

SNMP Setting

Parameter	Description
SNMP State	Select **Enable** to activate SNMP on the Switch. Select **Disable** to not use SNMP on the Switch.
System Name	Type a System Name for the Switch.

	(The System Name is same as the host name)
System Location	Type a System Location for the Switch.
System Contact	Type a System Contact for the Switch.
Apply	Click Apply to configure the settings.
Refresh	Click this button to reset the fields to the last setting.

Community Name

Parameter	Description
Community String	Enter a Community string, this will act as a password for requests from the management station. An SNMP community string is a text string that acts as a password. It is used to authenticate messages that are sent between the management station (the SNMP manager) and the device (the SNMP agent). The community string is included in every packet that is transmitted between the SNMP manager and the SNMP agent.
Rights	Select Read-Only to allow the SNMP manager using this string to collect information from the Switch. Select Read-Write to allow the SNMP manager using this string to create or edit MIBs (configure settings on the Switch).
Network ID of Trusted Host	Type the IP address of the remote SNMP management station in dotted decimal notation, for example 192.168.1.0.
Mask	Type the subnet mask for the IP address of the remote SNMP management station in dotted decimal notation, for example 255.255.255.0.

Apply	Click **Apply** to configure the settings.
Refresh	Click **Refresh** to begin configuring this screen afresh.
Community Name List	
No.	This field indicates the community number. It is used for identification only. Click on the individual community number to edit the community settings.
Community String	This field displays the SNMP community string. An SNMP community string is a text string that acts as a password.
Right	This field displays the community string's rights. This will be **Read Only** or **Read Write**.
Network ID of Trusted Host	This field displays the IP address of the remote SNMP management station after it has been modified by the subnet mask.
Subnet Mask	This field displays the subnet mask for the IP address of the remote SNMP management station.
Action	Click **Delete** to remove a specific Community String.

SNMP Trap

Parameter	Description
IP Address	Enter the IP address of the remote trap station in dotted decimal notation.
Version	Select the version of the Simple Network Management Protocol to use. **v1** or **v2c**.
Community String	Specify the community string used with this remote trap station.
Apply	Click **Apply** to configure the settings.
Refresh	Click **Refresh** to begin configuring this screen afresh.
Trap Receiver List	

No.	This field displays the index number of the trap receiver entry. Click the number to modify the entry.
IP Address	This field displays the IP address of the remote trap station.
Version	This field displays the version of Simple Network Management Protocol in use. **v1** or **v2c**.
Community String	This field displays the community string used with this remote trap station.
Action	Click **Delete** to remove a configured trap receiver station.

8.2. Mail Alarm

8.2.1. Introduction

The feature sends an e-mail trap to a predefined administrator when some events occur. The events are listed below:

◆ System Reboot : The system warn start or cold start.
◆ Port Link Change : A port link up or down.
◆ Configuration Change : The system configurations in the NV-RAM have been updated.
◆ Firmware Upgrade : The system firmware image has been updated.
◆ User Login : A user login the system.
◆ Port Blocked : A port is blocked by looping detection or BPDU Guard.

Default Settings

Mail-Alarm Configuration:

```
----------------------------------------------
State           : Disabled.
Server IP       : 0.0.0.0
Server Port     : 25
Mail From       :
Mail To         :

Trap Event Status:
----------------------------------------------
System Reboot         : Disabled.
Port Link Change      : Disabled.
Configuration Change  : Disabled.
Firmware Upgrade      : Disabled.
User Login            : Disabled.
Port Blocked          : Disabled.
Alarm                 : Disabled.
```

8.2.2. Reference

Default Ports	Server	Authentication	Port
SMTP Server (Outgoing Messages)	Non-Encrypted	AUTH	25 (or 587)
	Secure (TLS)	StartTLS	587
	Secure (SSL)	SSL	465
POP3 Server (Incoming Messages)	Non-Encrypted	AUTH	110
	Secure (SSL)	SSL	995
Googlemail - Gmail	Server:	Authentication:	Port:
SMTP Server (Outgoing Messages)	smtp.gmail.com	SSL	465
	smtp.gmail.com	StartTLS	587
POP3 Server (Incoming Messages)	pop.gmail.com	SSL	995
Outlook.com	Server:	Authentication:	Port:
SMTP Server (Outgoing Messages)	smtp.live.com	StartTLS	587
POP3 Server (Incoming Messages)	pop3.live.com	SSL	995
Yahoo Mail	Server:	Authentication:	Port:
SMTP Server (Outgoing Messages)	smtp.mail.yahoo.com	SSL	465
POP3 Server (Incoming Messages)	pop.mail.yahoo.com	SSL	995
Yahoo Mail Plus	Server:	Authentication:	Port:
SMTP Server (Outgoing Messages)	plus.smtp.mail.yahoo.com	SSL	465
POP3 Server (Incoming Messages)	plus.pop.mail.yahoo.com	SSL	995

8.2.3. CLI Configuration

Node	Command	Description
enable	show mail-alarm	This command displays the Mail Alarm configurations.
configure	mail-alarm (disable|enable)	This command disables / enables the Mail Alarm function.
configure	mail-alarm auth-account	This command configures the Mail server authentication account.
configure	mail-alarm mail-from	This command configures the mail sender.
configure	mail-alarm mail-to	This command configures the mail receiver.
configure	mail-alarm server-ip IPADDR server-port VALUE	This command configures the mail server IP address and the TCP port.
configure	mail-alarm server-ip IPADDR server-port Default	This command configures the mail server IP address and configures 25 as the server's TCP port.
configure	mail-alarm trap-event	This command disables / enables mail trap

	(reboot|link-change|config.| firmware|login|port-blocked| alarm) (disable|enable)	events.

8.2.4. Web Configuration

Parameter	Description
State	Enable / disable the Mail Alarm function.
Server IP	Specifies the mail server's IP address.
Server Port	Specifies the TCP port for the SMTP.
Account Name	Specifies the mail account name.
Account Password	Specifies the mail account password.
Mail From	Specifies the mail sender.
Mail To	Specifies the mail receiver.
Trap State	Enables / disables the mail trap event states.

8.3.   Maintenance

8.3.1.   Configuration

8.3.1.1. CLI Configuration

Node	Command	Description
configure	reboot	This command reboots the system.
configure	reload default-config	This command copies a default-config file to replace the current one. **Note:** The system will reboot automatically to take effect the configurations.
configure	write memory	This command writes current operating configurations to the configuration file.
configure	archive download-config <URL PATH>	This command downloads a new copy of configuration file from TFTP server. Where <URL PATH> can be: ftp://user:pass@192.168.1.1/file http://192.168.1.1/file tftp://192.168.1.1/file
configure	archive upload-config <URL PATH>	This command uploads the current configurations file to a TFTP server.
configure	archive download-fw <URL PATH>	This command downloads a new copy of firmware file from TFTP / FTP / HTTP server. Where <URL PATH> can be: ftp://user:pass@192.168.1.1/file http://192.168.1.1/file tftp://192.168.1.1/file

Example:

L2SWITCH#*configure terminal*
L2SWITCH(config)#*interface eth0*
L2SWITCH(config-if)#*ip address 172.20.1.101/24*
L2SWITCH(config-if)#*ip address default-gateway 172.20.1.1*
L2SWITCH(config-if)#*management vlan 1*

Enable the DHCP client function for the switch.
- ✓ L2SWITCH#*configure terminal*
- ✓ L2SWITCH(config)#*interface eth0*
- ✓ L2SWITCH(config-if)#*ip dhcp client enable*

8.3.1.2. Web Configuration

Configuration

Save Configurations

Press the Save button to save the current settings to the NV-RAM (flash).

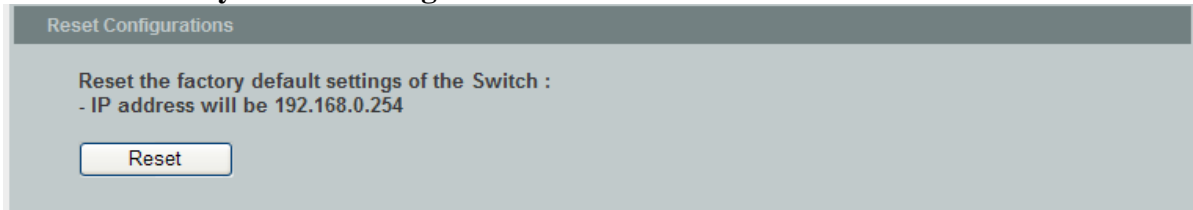**Upload / Download Configurations to /from a your server**

Follow the steps below to save the configuration file to a your PC.
- ✓ Select the "Press "Download" to save configurations file to your PC".
- ✓ Click the "Download" button to start the process.

Follow the steps below to load the configuration file from your PC to the Switch.

- ✓ Select the "Upload configurations file to your Switch".
- ✓ Select the full path to your configuration file.
- ✓ Click the Upload button to start the process.

Reset the factory default settings of the Switch

Press the Reset button to set the settings to factory default configurations.

The configuration status

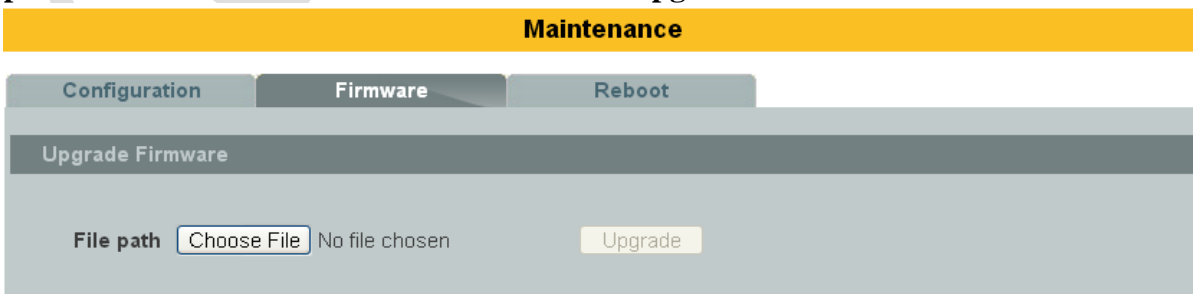Display the configuration status of recorded in the NV-RAM.

Notice:
If the user has changed any configurations, the message display "The configurations have been modified!"; otherwise, The message "The configurations are default values."

There are two conditions will change message from "The configurations have been modified!" to "The configurations are default values.":
1. *Click "Reset configuration" in web management or do cli command, reload default-config.*
2. *Click "Upload configuration" in web management or do cli command, "archive download-config xxx".*
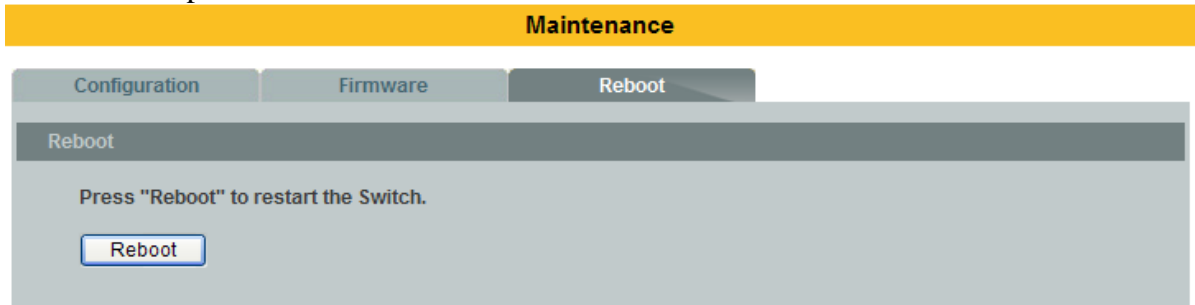
8.3.2. Firmware

Type the path and file name of the firmware file you wish to upload to the Switch in the **File path** text box or click **Browse** to locate it. Click **Upgrade** to load the new firmware.
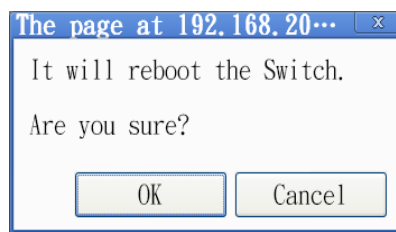
8.3.3.   Reboot

Reboot allows you to restart the Switch without physically turning the power off.
Follow the steps below to reboot the Switch.

In the **Reboot** screen, click the **Reboot** button. The following screen displays.

Click **OK** again and then wait for the Switch to restart. This takes up to two minutes. This does not affect the Switch's configuration.

8.4.   System log

8.4.1. Introduction

The syslog function records some of system information for debugging purpose. Each log message recorded with one of these levels, **Alert / Critical / Error / Warning / Notice / Information.** The syslog function can be enabled or disabled. The default setting is disabled. The log message is recorded in the Switch file system. If the syslog server's IP address has been configured, the Switch will send a copy to the syslog server.
The log message file is limited in 4KB size. If the file is full, the oldest one will be replaced.

8.4.2.   CLI Configuration

Node	Command	Description
enable	show syslog	The command displays the entire log message recorded in the Switch.
enable	show syslog level LEVEL	The command displays the log message with the LEVEL recorded in the Switch.
enable	show syslog server	The command displays the syslog server configurations.
configure	clear syslog	The command clears the syslog message.
configure	syslog-server (disable|enable)	The command disables / enables the syslog server function.
configure	syslog-server ipv4-ip IPADDR	The command configures the syslog server's IP address in IPv4 format.

Example:
  L2SWITCH#configure terminal
  L2SWITCH(config)#syslog-server ip 192.168.200.106
  L2SWITCH(config)#syslog-server enable

8.4.3. Web Configuration

Parameter	Description
Server IP	Select IP type for the server's IP. Enter the Syslog server IP address. Select **Enable** to activate switch sent log message to Syslog server when any new log message occurred.
Facility	Selects the facility level..
Apply	Click Apply to add/modify the settings.
Refresh	Click Refresh to begin configuring this screen afresh.
Log Level	Select **Alert/Critical/Error/Warning/Notice/Information** to choose which log message to want to see.
Clear	Click Clear to clear all of log message.
Save	Click Save to save all of log message into NV-RAM.

8.5. User Account

8.5.1. Introduction

The Switch allows users to create up to 6 user account. The user name and the password should be the combination of the digit or the alphabet. The last admin user account cannot be deleted. Users should input a valid user account to login the CLI or web management.

User Authority:
The Switch supports two types of the user account, admin and normal. The **default** users account is **username(admin) / password(admin)**.

- ✓ admin   -   read / write.

- ✓ normal   -   read only.
                  ; Cannot enter the privileged mode in CLI.
                  ; Cannot apply any configurations in web.

The Switch also supports backdoor user account. In case of that user forgot their user name or password, the Switch can generate a backdoor account with the system's MAC. Users can use the new user account to enter the Switch and then create a new user account.

Default Settings
- ✓ Maximum user account   : 6.
- ✓ Maximum user name length   : 32.
- ✓ Maximum password length   : 32.
- ✓ Default user account for privileged mode   : admin / admin.

Notices
- ✓ *The Switch allows users to create up to 6 user account.*
- ✓ *The user name and the password should be the combination of the digit or the alphabet.*
- ✓ *The last admin user account cannot be deleted.*
- ✓ *The maximum length of the username and password is 32 characters.*

8.5.2. CLI Configuration

Node	Command	Description
enable	show user account	This command displays the current user accounts.
configure	add user USER_ACCOUNT PASSWORD (normal|admin)	This command adds a new user account.
configure	delete user USER_ACCOUNT	This command deletes a present user account.

Example: The procedures to configure a user account.
- ➢ To enter the configure node.
    L2SWITCH#configure terminal
    L2SWITCH(config)#

➤ To configure a user account.
L2SWITCH(config)#add user w w admin

➤ To remove a management host.
L2SWITCH(config-if)#no management host 192.168.200.106

8.5.3. Web Configuration

Parameter	Description
User Name	Type a new username or modify an existing one.
User Password	Type a new password or modify an existing one. Enter up to 32 alphanumeric or digit characters.
User Authority Apply	Select with which group the user associates: **admin** (read and write) or **normal** (read only) for this user account. Click **Apply** to add/modify the user account.
Refresh	Click **Refresh** to begin configuring this screen afresh.
User Account List	
No.	This field displays the index number of an entry.
User Name	This field displays the name of a user account.
User Authority	This field displays the associated group.
Action	Click the **Delete** button to remove the user account. Note: You cannot delete the last admin accounts.

Customer support

For all questions relate to the NSH-3424 or any other Volktek product, please contact Volktek customer support:

Address	Volktek Customer Support
	4F, 192 Liancheng Road,
	Zhonghe District,
	New Taipei City 23553,
	Taiwan
Phone	+886-2-8242-1000
Fax	+886-2-8242-3333
E-mail	*support@volktek.com.tw*
Website	www.volktek.com

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