MS-7206

Modular Ethernet Switch System

User's Guide

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Edition 1

ZyXEL

www.zyxel.com

About This User's Guide

Intended Audience

This manual is intended for people who want to configure the MM-7201. You should have at least a basic knowledge of TCP/IP and Ethernet networking concepts and topology.

It is recommended you use the web configurator to configure the MM-7201.

Related Documentation

- MS-7206 Hardware Installation Guide

  Hardware guide for the MS-7206 system, including the MS-7206S, MI-7248, MI-7248PWR, MI-7248TF, MF-7201, MP-7201, MPC-7202, MP-7202, and MP-7203.
- Command Line Interface (CLI) Reference Guide

  Line commands offer an alternative to the web configurator and in some cases are necessary to configure advanced features.
- Web Configurator Online Help

  Embedded web help for descriptions of individual screens and supplementary information.
- Supporting Disk

  Refer to the included CD for support documents.
- ZyXEL Web Site

  Please refer to www.zyxel.com for additional support documentation and product certifications.

User Guide Feedback

Help us help you. Send all User Guide-related comments, questions or suggestions for improvement to the following address, or use e-mail instead. Thank you!

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Document Conventions

Warnings and Notes

These are how warnings and notes are shown in this User’s Guide.

Warnings tell you about things that could harm you or your device.

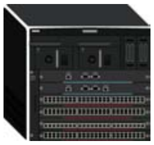
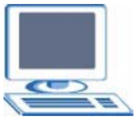
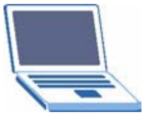
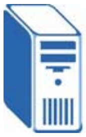
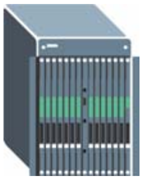
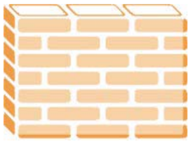
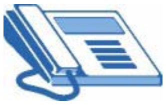
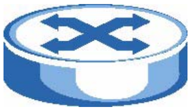
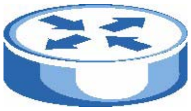
Notes tell you other important information (for example, other things you may need to configure or helpful tips) or recommendations.

Syntax Conventions

- The MM-7201 may be referred to as the “MM-7201”, the “management card” or the “product” in this User’s Guide.
- The “MS-7206 system” refers to the MS-7206 chassis and all the modules that are in the MS-7206 chassis. It is also referred to as the “system” or the “switch” in this User’s Guide.
- The “MS-7206 chassis” refers only to the main chassis of the MS-7206 system. It does not include any interface modules or management cards.
- Product labels, screen names, field labels and field choices are all in **bold** font.
- A key stroke is denoted by square brackets and uppercase text, for example, [ENTER] means the “enter” or “return” key on your keyboard.
- “Enter” means for you to type one or more characters and then press the [ENTER] key. “Select” or “choose” means for you to use one of the predefined choices.
- A right angle bracket (>) within a screen name denotes a mouse click. For example, **Maintenance** > **Log** > **Log Setting** means you first click **Maintenance** in the navigation panel, then the **Log** sub menu and finally the **Log Setting** tab to get to that screen.
- Units of measurement may denote the “metric” value or the “scientific” value. For example, “k” for kilo may denote “1000” or “1024”, “M” for mega may denote “1000000” or “1048576” and so on.
- “e.g.,” is a shorthand for “for instance”, and “i.e.,” means “that is” or “in other words”.

Icons Used in Figures

Figures in this User’s Guide may use the following generic icons. The MS-7206 icon is not an exact representation of your device.

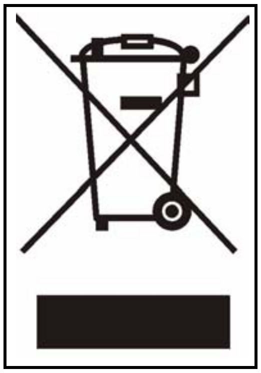
MS-7206 	Computer 	Notebook computer 
Server 	DSLAM 	Firewall 
Telephone 	Switch 	Router 

Safety Warnings

For your safety, be sure to read and follow all warning notices and instructions.

- Do NOT use this product near water, for example, in a wet basement or near a swimming pool.
- Do NOT expose your device to dampness, dust or corrosive liquids.
- Do NOT store things on the device.
- Do NOT install, use, or service this device during a thunderstorm. There is a remote risk of electric shock from lightning.
- Connect ONLY suitable accessories to the device.
- ONLY qualified service personnel should service or disassemble this device.
- Make sure to connect the cables to the correct ports.
- Place connecting cables carefully so that no one will step on them or stumble over them.
- Always disconnect all cables from this device before servicing or disassembling.
- Do not use the device outside, and make sure all the connections are indoors. There is a remote risk of electric shock from lightning.
- CAUTION: RISK OF EXPLOSION IF BATTERY (on the motherboard) IS REPLACED BY AN INCORRECT TYPE. DISPOSE OF USED BATTERIES ACCORDING TO THE INSTRUCTIONS. Dispose them at the applicable collection point for the recycling of electrical and electronic equipment. For detailed information about recycling of this product, please contact your local city office, your household waste disposal service or the store where you purchased the product.
- Do NOT obstruct the device ventilation slots, as insufficient airflow may harm your device.
- The PoE (Power over Ethernet) devices that supply or receive power and their connected Ethernet cables must all be completely indoors.
- Warning! To avoid risk of electric shock, remove only one card at a time and do not place fingers or objects inside the chassis. Cover empty slots with slot covers.

This product is recyclable. Dispose of it properly.



Contents Overview

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PART I
Introduction

Introducing the MM-7201

This chapter introduces the main applications and features of the MM-7201. It also introduces the ways you can manage the MM-7201.

1.1 Overview

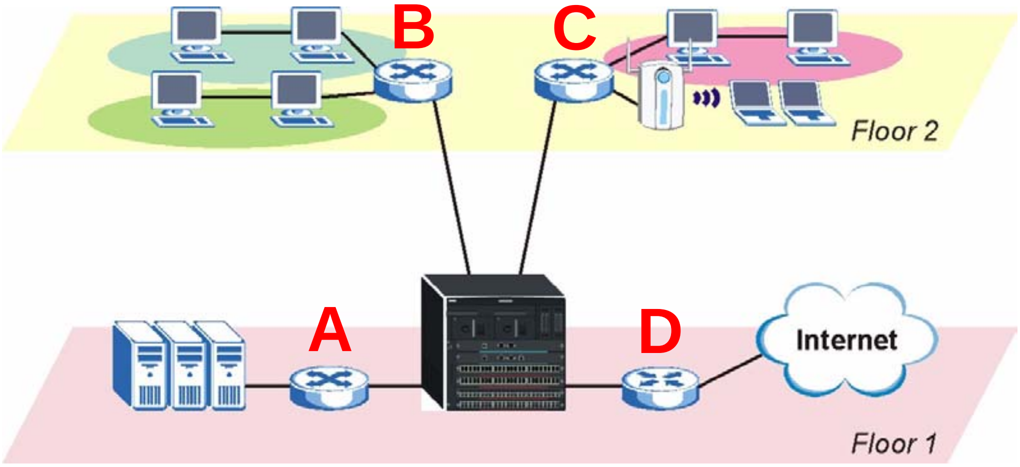
The MM-7201 is the management card for the MS-7206 Ethernet chassis system. The MM-7201 contains the configuration of the MS-7206 system and makes the interface modules work together as one switch.

Install one or two MM-7201 in each MS-7206 chassis.

- If you install one MM-7201, the MS-7206 system has a switching capability of 96 Gbps full duplex, the equivalent of two MI-7248 interface modules.
- If you install two MM-7201s, the MS-7206 system has a switching capability of 192 Gbps full duplex, the equivalent of four MI-7248 interface modules. In addition, the two MM-7201s provide switching and management redundancy. If one MM-7201 becomes unavailable, the other one takes over.

The MS-7206 system is designed to be used in enterprise applications, such as the one in the following example.

Figure 1 Applications: Enterprise



In this example, the MS-7206 system is connected to three Gigabit Ethernet switches **A**, **B**, and **C** and one router **D**.

- Switch **A** provides access to the servers in the data center. The MS-7206 system uses link aggregation (trunking) to create a high-speed connection with switch **A**.
- Switches **B** and **C** are connected to users in different departments via wired or wireless networks. The MS-7206 system is connected to these switches using fiber.
- Router **D** provides secure Internet access for the whole company. The MS-7206 system is connected to router **D** by a 10/100 Mbps copper connection.

In this configuration, the MS-7206 system provides high switching capacity, high port density, and centralized management for the enterprise network.

1.2 Ways to Manage the MM-7201

Use any of the following methods to manage the MM-7201.

- Web Configurator. This is recommended for everyday management of the MM-7201 using a (supported) web browser.
- Command Line Interface. Line commands are mostly used for troubleshooting by service engineers. See the CLI Reference Guide.
- FTP. FTP is used for firmware upgrades and configuration backup/restore. See Chapter 37 on page 215.
- SNMP. The device can be monitored by an SNMP manager. See Chapter 38 on page 223.

1.3 Good Habits for Managing the MM-7201

Do the following things regularly to make the MM-7201 more secure and to manage the MM-7201 more effectively.

- Change the password. Use a password that’s not easy to guess and that consists of different types of characters, such as numbers and letters.
- Write down the password and put it in a safe place.
- Back up the configuration (and make sure you know how to restore it). Restoring an earlier working configuration may be useful if the device becomes unstable or even crashes. If you forget your password, you will have to reset the MM-7201 to its factory default settings. If you backed up an earlier configuration file, you would not have to totally re-configure the MM-7201. You could simply restore your last configuration.

1.4 LEDs

Figure 2 LEDs

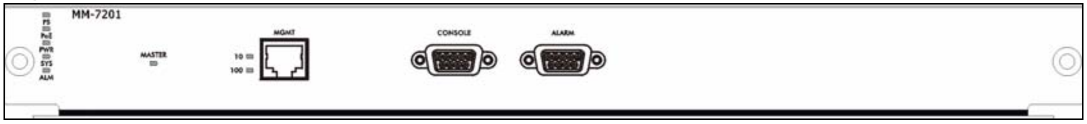


Table 1 LEDs

LED	COLOR	STATUS	DESCRIPTION
PS	Green	On	The MM-7201 is receiving power from one of the MS-7206 power modules.
		Off	The MM-7201 is not receiving power from any of the MS-7206 power modules.
PoE	Green	On	The MM-7201 is receiving power from a Power over Ethernet (PoE) injector.
		Off	The MM-7201 is not receiving power from a Power over Ethernet (PoE) injector.
PWR	Green	On	The MM-7201 is receiving power.
		Off	The MM-7201 is not receiving power.
SYS	Green	On	The MM-7201 is ready and running normally.
		Blinking	The MM-7201 is starting up.
		Off	The MM-7201 is not ready or failed to start up correctly.
ALM	Red	On	One or more fans are not working correctly, or the voltage is outside tolerance at one or more sensors.
		Off	The fans are working correctly, and the voltage is within tolerance at all sensors.
MASTER	Green	On	The MM-7201 is the active management card in the MS-7206 system.
		Off	The MM-7201 is the standby management card in the MS-7206 system.
10	Green	On	The MM-7201 has a 10 Mbps Ethernet connection on the **MGMT** port.
		Off	The MM-7201 does not have a 10 Mbps Ethernet connection on the **MGMT** port.
100	Green	On	The MM-7201 has a 100 Mbps Ethernet connection on the **MGMT** port.
		Off	The MM-7201 does not have a 100 Mbps Ethernet connection on the **MGMT** port.

PART II
Hardware

2

Front Panel

This chapter describes the front panel of and connections to the MM-7201.

2.1 Front Panel

This section introduces the ports on the front panel of the MM-7201. See Section 1.4 on page 33 for a description of LEDs.

Figure 3 Front Panel

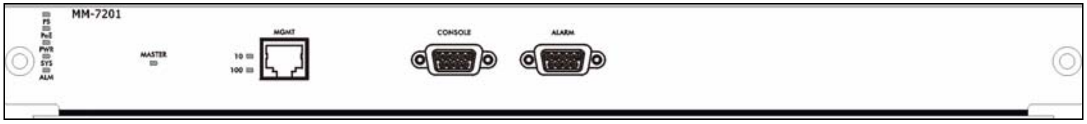


Table 2 Front Panel

PORT	DESCRIPTION
MGMT	Use this RJ-45 port for local (out-of-band) management of the MM-7201.
CONSOLE	Use this D-Sub 9-pin serial port for local (out-of-band) management of the MM-7201. You can only use the command line interface (CLI).
ALARM	Use this DB9 connector to connect to alarm output terminals on other pieces of equipment or to an alarm input terminal on another piece of equipment.

2.2 Connections

This section provides more information about the connections to each port on the MM-7201.

2.2.1 MGMT Port

This Ethernet connection has the following characteristics:

- 10/100 Mbps.
- Auto-negotiating. The port can detect and adjust to the optimum Ethernet speed and duplex mode (full duplex or half duplex) of the connected device.
- Auto-crossover or auto-MDI/MDI-X. The port automatically works with a straight-through or crossover Ethernet cable.

2.2.2 CONSOLE Port

For local management through the command line interface (CLI), use a computer with terminal emulation software configured to the following parameters:

- VT100 terminal emulation
- 9600 bps
- No parity, 8 data bits, 1 stop bit
- No flow control

Connect the male 9-pin end of the console cable to the **CONSOLE** port of the MM-7201. Connect the female end to a serial port (COM1, COM2 or other COM port) of your computer.

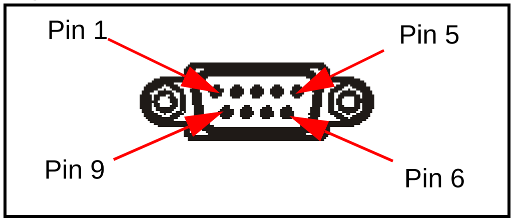
2.2.3 ALARM Port

The **ALARM** port has input pins and output pins.

A closed circuit on the **ALARM** input pins indicates an alarm. Pins 3 and 7 are alarm input one. Pins 4 and 8 are alarm input two. Pins 5 and 9 are alarm input 3.

The MM-7201 signals an alarm when it detects an alarm on the **ALARM** input pins or in the MS-7206 system (for example, the voltage or temperature is outside the normal range). To signal an alarm, the MM-7201 opens the circuit for pins 1 and 6 (the common pin) and closes the circuit for pins 2 and 6.

Figure 4 ALARM Pins Layout



3

Installing Cards

This chapter describes how to add, remove, and hot-swap management cards and interface modules in the system.

3.1 Management Cards

This section describes the steps required to add and remove management cards. If you want to hot-swap management cards, follow the steps below to remove the existing management card and add the new management card.

> Be careful when you remove a management card from one MS-7206 system and install it in a different MS-7206 system because it is possible that the two MS-7206 systems will have the same MAC address.

In the MS-7206 system, the MAC address comes from the management card, not the MS-7206 chassis. Each management card has a different MAC address. The MS-7206 system copies the MAC address from the active management card when the MS-7206 system starts up. The MS-7206 system keeps using this MAC address, even if the standby management card takes over, until the system starts up again. As a result, it is possible for two or more MS-7206 systems to have the same MAC address at the same time if the same management card was active when each of them last started up.

You can install management cards in slot 1 or slot 2.

3.1.1 Add a Management Card (System Is Off)

1 Insert the card in the MS-7206 chassis.
2 Turn on the system.

If you insert the management card in slot 1, it automatically becomes the active management card. If you insert the management card in slot 2, it becomes the standby management card if there is another management card in slot 1.

3.1.2 Add a Management Card (System Is On)

Insert the card in the MS-7206 chassis.

If there is another management card in the system, the new management card automatically becomes the standby management card. If the firmware version of the new management card is different than the firmware version of the existing management card, the new management card does not function in the system.

3.1.3 Remove a Management Card

Remove the card from the MS-7206 chassis. If you remove the active management card, the standby management card takes over.

3.2 Interface Modules

This section describes the steps required to add and remove interface modules. If you want to hot-swap interface modules, follow the steps below to remove the existing interface module and add the new interface module.

You can install interface modules in slot 3, slot 4, slot 5, or slot 6.

3.2.1 Add an Interface Module (System Is Off)

1. Insert the card in the MS-7206 chassis.
2. Turn on the system.

The system automatically detects what type of interface module is installed. You do not have to configure the Slot Setup screen.

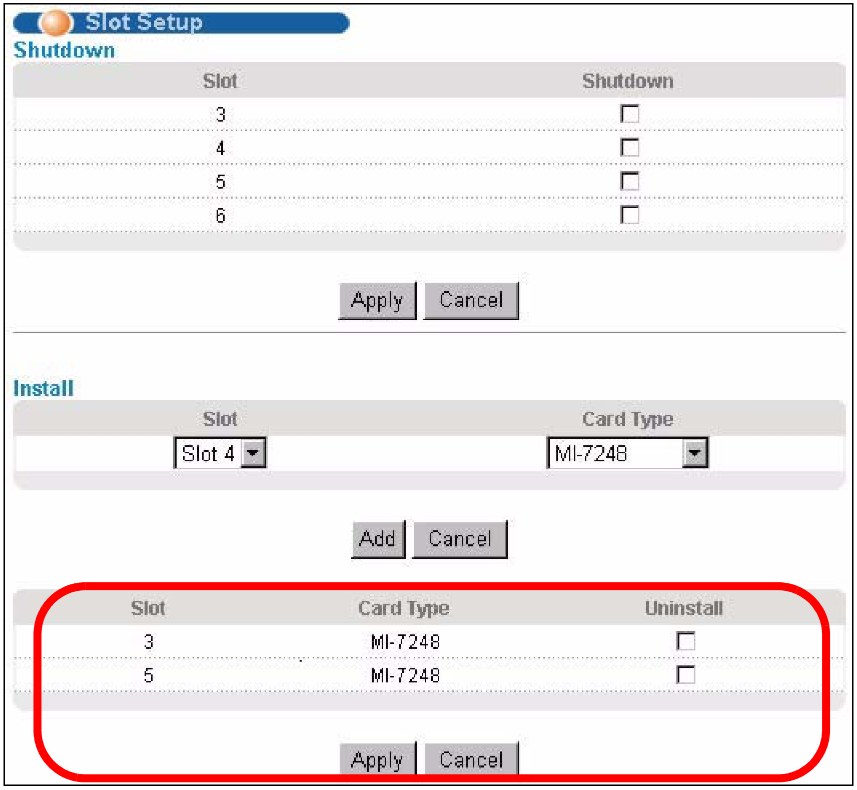
3.2.2 Add an Interface Module (System Is On)

If the same type of interface module was previously installed in the slot, insert the card in the MS-7206 chassis.

If a different type of interface module was previously installed in the slot or if no interface module was previously installed in the slot, follow these steps.

1. Open the Slot Setup screen, and uninstall the existing type of interface module in the slot (if necessary).

Figure 5 Slot Setup (Uninstall)



Slot Setup

Shutdown

Slot	Shutdown
3	□
4	□
5	□
6	□

Install

Slot	Card Type
Slot 4	MI-7248

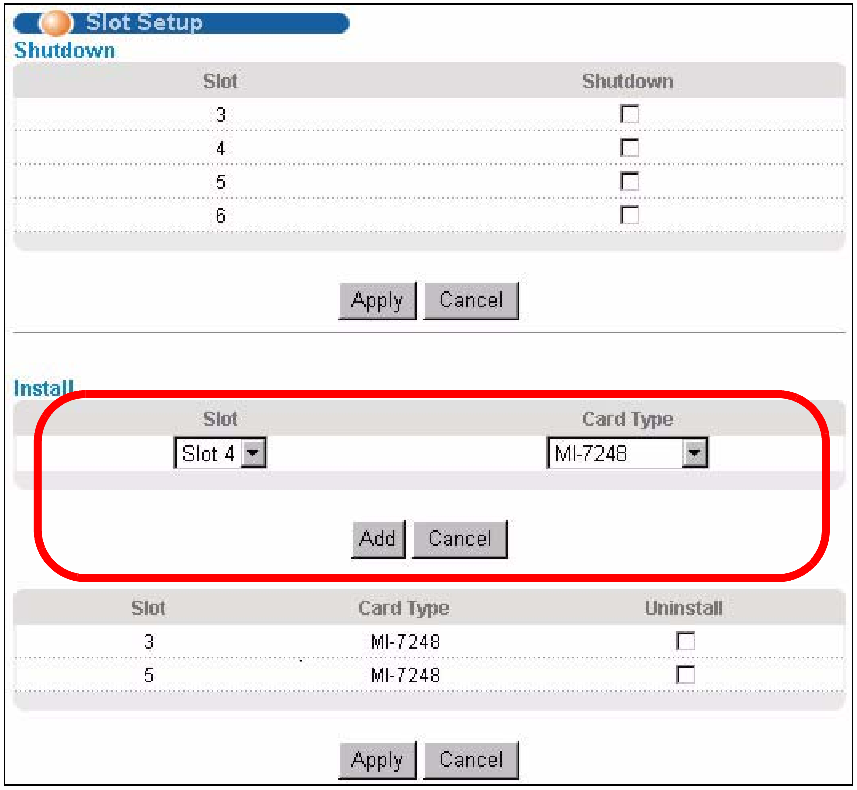
Slot	Card Type	Uninstall
3	MI-7248	□
5	MI-7248	□

2 Remove the interface module from the system (if necessary).

3 Insert the interface module in slot 3, slot 4, slot 5, or slot 6.

4 Open the Slot Setup screen, and install the new type of interface module in the slot.

Figure 6 Slot Setup (Install)



Shutdown

Slot	Shutdown
3	□
4	□
5	□
6	□

Install

Slot	Card Type
Slot 4	MI-7248

Slot	Card Type	Uninstall
3	MI-7248	□
5	MI-7248	□

3.2.3 Remove an Interface Module

Remove the interface module from the MS-7206 chassis.

PART III
Basic

4

The Web Configurator

This section introduces the configuration and functions of the web configurator.

4.1 Introduction

The web configurator is an HTML-based management interface that allows easy setup and management via Internet browser. Use Internet Explorer 6.0 and later or Netscape Navigator 7.0 and later versions. The recommended screen resolution is 1024 by 768 pixels.

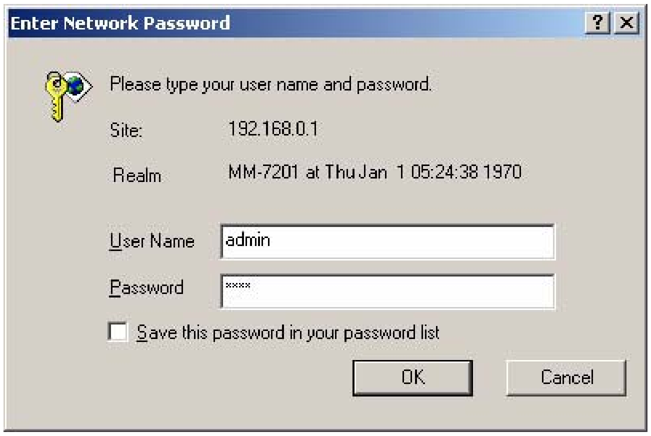
In order to use the web configurator you need to allow:

- Web browser pop-up windows from the system. Web pop-up blocking is enabled by default in Windows XP SP (Service Pack) 2.
- JavaScript (enabled by default).
- Java permissions (enabled by default).

4.2 System Login

1. Start your web browser.
2. Type “http://” and the IP address of the system (the default management IP address is 192.168.0.1 through the **MGMT** port) in the **Location** or **Address** field. Press [ENTER].
3. The login screen appears. The default username is **admin** and associated default password is **1234**.

Figure 7 Web Configurator: Login



Enter Network Password

Please type your user name and password.

Site: 192.168.0.1

Realm MM-7201 at Thu Jan 1 05:24:38 1970

User Name admin

Password ****

□ Save this password in your password list

You may configure the time in the **General Setup** screen. See Chapter 8 on page 67.

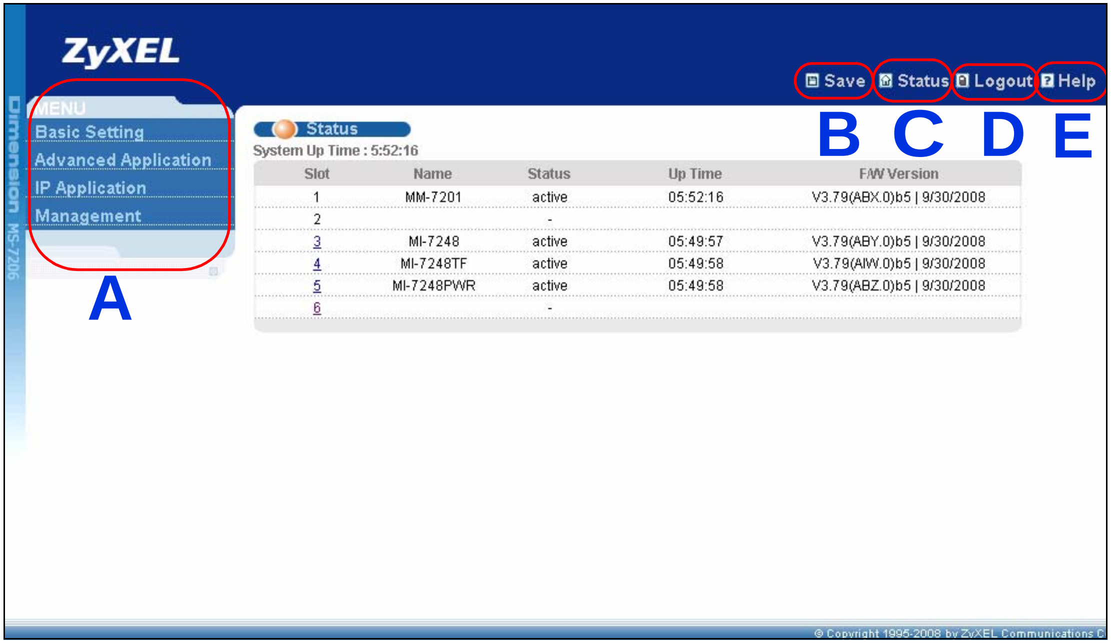
4 Click **OK** to view the first web configurator screen.

4.3 The Status Screen

The **Status** screen is the first screen that displays when you access the web configurator.

The following figure shows the navigating components of a web configurator screen.

Figure 8 Web Configurator Home Screen (Status)



Status

System Up Time : 5:52:16

Slot	Name	Status	Up Time	F/W Version
1	MM-7201	active	05:52:16	V3.79(ABX.0)b5 | 9/30/2008
2		-		
3	MI-7248	active	05:49:57	V3.79(ABY.0)b5 | 9/30/2008
4	MI-7248TF	active	05:49:58	V3.79(AIW.0)b5 | 9/30/2008
5	MI-7248PWR	active	05:49:58	V3.79(ABZ.0)b5 | 9/30/2008
6		-		

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A - Click the menu items to open submenu links, and then click on a submenu link to open the screen in the main window.

B, **C**, **D**, **E -** These are quick links which allow you to perform certain tasks no matter which screen you are currently working in.

B - Click this link to save your configuration into the MM-7201’s nonvolatile memory. Nonvolatile memory is the configuration of your MM-7201 that stays the same even if the MM-7201’s power is turned off.

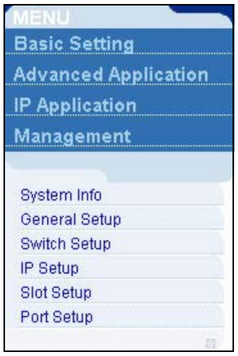
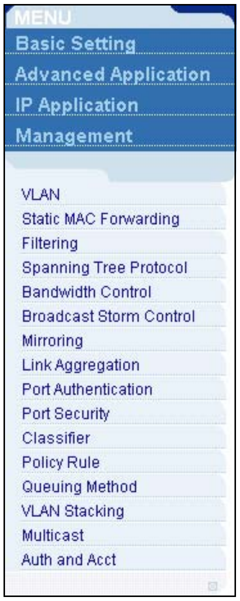
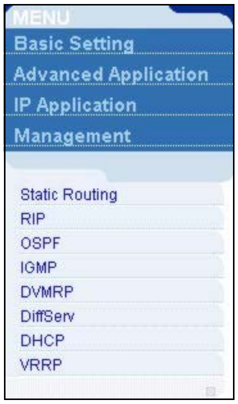
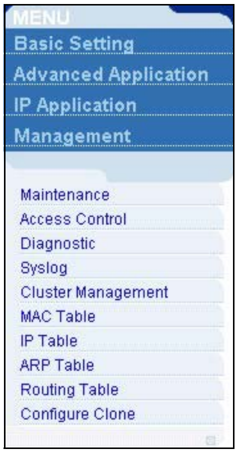
C - Click this link to go to the status page of the system.

D - Click this link to log out of the web configurator.

E - Click this link to display web help pages. The help pages provide descriptions for all of the configuration screens.

In the navigation panel, click a main link to reveal a list of submenu links.

Table 3 Navigation Panel Menu Overview

BASIC SETTING	ADVANCED APPLICATION	IP APPLICATION	MANAGEMENT
 MENU Basic Setting Advanced Application IP Application Management System Info General Setup Switch Setup IP Setup Slot Setup Port Setup	 MENU Basic Setting Advanced Application IP Application Management VLAN Static MAC Forwarding Filtering Spanning Tree Protocol Bandwidth Control Broadcast Storm Control Mirroring Link Aggregation Port Authentication Port Security Classifier Policy Rule Queuing Method VLAN Stacking Multicast Auth and Acct	 MENU Basic Setting Advanced Application IP Application Management Static Routing RIP OSPF IGMP DVMRP DiffServ DHCP VRRP	 MENU Basic Setting Advanced Application IP Application Management Maintenance Access Control Diagnostic Syslog Cluster Management MAC Table IP Table ARP Table Routing Table Configure Clone

The following table describes the links in the navigation panel.

Table 4 Navigation Panel Menu Description

LINK	DESCRIPTION
Basic Setting	
System Info	Look at basic information about the MM-7201 and to monitor the system hardware, including temperature, fan speed, voltage, and power.
General Setup	Configure the system name, login precedence, time, and other general settings for the system.
Switch Setup	Configure MAC address learning, declaration timeout values for GARP, and priority queues. You can also control whether or not the switch handles bridge control protocols, such as STP.
IP Setup	Configure the default gateway, DNS server, management IP address, and IP domains.
Slot Setup	Control the power to the each slot or to change what type of card is in the slot without restarting the system.
Port Setup	Configure basic port settings, such as speed, duplex, and flow control. You can also configure the default 802.1p priority and the way bridge protocol data units (BPDU) are handled.

Table 4 Navigation Panel Menu Description (continued)

LINK	DESCRIPTION
Advanced Application	
VLAN	Configure VLAN settings.
Static MAC Forwarding	Configure static MAC addresses for a port. These static MAC addresses do not age out.
Filtering	Set up filtering rules.
Spanning Tree Protocol	Configure RSTP/MRSTP to prevent network loops.
Bandwidth Control	Specify the guaranteed bandwidth and maximum bandwidth for incoming traffic on a port and to specify the maximum bandwidth for outgoing traffic on a port.
Broadcast Storm Control	Limit the number of broadcast, multicast and destination lookup failure (DLF) packets the switch receives per second on the ports.
Mirroring	Copy ("mirror") traffic from one or more ports to a specified monitor port. You can examine the traffic on the monitor port without interfering with regular traffic flow.
Link Aggregation	Logically aggregate physical links to form one logical, higher-bandwidth link.
Port Authentication	Activate 802.1x authentication and configure the RADIUS server.
Port Security	Activate MAC address learning and set the maximum number of MAC addresses to learn on a port.
Classifier	Configure classifiers for traffic. After you configure the classifier, you can specify actions ("policies") for traffic that matches the rules.
Policy Rule	Configure policy rules for classified traffic.
Queuing Method	Configure queuing methods to handle network congestion.
VLAN Stacking	Add an outer VLAN tag to the inner IEEE 802.1Q tagged frames that enter the network. If a service provider assigns an outer VLAN tag for each customer, the service provider's customers can assign their own inner VLAN tags without creating overlapping VLANs in the service provider's network.
Multicast	Configure various multicast features and create multicast VLANs.
Auth and Acct	Configure authentication and accounting services via external servers. The external servers can be either RADIUS (Remote Authentication Dial-In User Service) or TACACS+ (Terminal Access Controller Access-Control System Plus).
IP Application	
Static Routing	Tell the switch how to forward IP traffic when you configure the TCP/IP parameters manually.
RIP	RIP (Routing Information Protocol) allows a routing device to exchange routing information with other routers. Use this to configure RIP on the switch.
OSPF	OSPF (Open Shortest Path First) is a link-state protocol designed to distribute routing information within an autonomous system (AS). An autonomous system is a collection of networks using a common routing protocol to exchange routing information. Use this to configure OSPF on the switch.
IGMP	IGMP (Internet Group Multicast Protocol) is a session-layer protocol used to establish membership in a multicast group. It is not used to carry user data. Use this to configure IGMP on the switch.
DVMRP	DVMRP (Distance Vector Multicast Routing Protocol) is a protocol used for routing multicast data within an autonomous system (AS). Use this to configure DVMRP on the switch when you wish it to act as a multicast router ("mrouter").

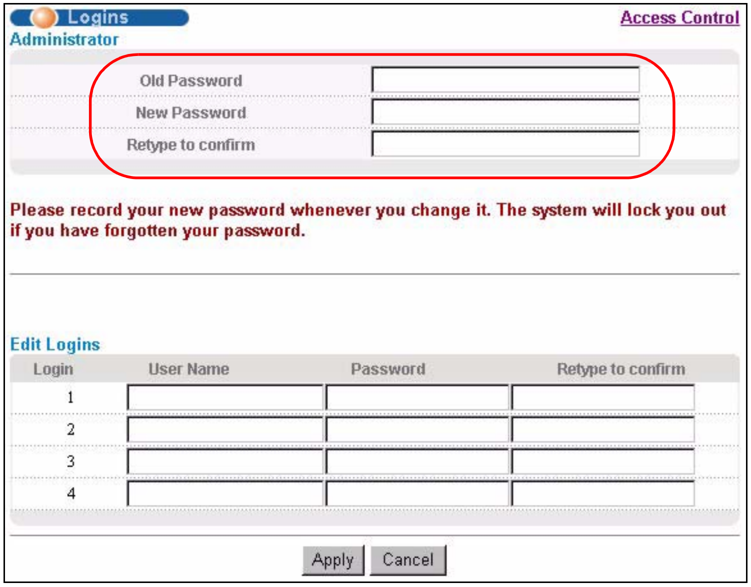
Table 4 Navigation Panel Menu Description (continued)

LINK	DESCRIPTION
DiffServ	Use this to enable DiffServ, configure marking rules and set DSCP-to-IEEE802.1p mappings.
DHCP	DHCP (Dynamic Host Configuration Protocol RFC 2131 and RFC 2132) allows individual computers to obtain TCP/IP configuration at start-up from a server. Use this screen to configure the switch as a DHCP server or a DHCP relay.
VRRP	Virtual Router Redundancy Protocol (VRRP), defined in RFC 2338, allows you to create redundant backup gateways to ensure that the default gateway of a host is always available. Use this to configure VRRP on the switch.
Management	
Maintenance	Use this to manage firmware and configuration files, to reset a slot, or to reboot the whole switch.
Access Control	Use this to configure SNMP, administrator accounts, and remote management.
Diagnostic	Use this to check system logs, ping IP addresses or perform port tests.
Syslog	Use this to configure the switch’s log settings and syslog server.
Cluster Management	Use this to manage switches through one switch, called the cluster manager. The switches must be directly connected and be in the same VLAN group so as to be able to communicate with one another.
MAC Table	Use this to look at the MAC addresses, VLAN IDs, and ports of devices connected to the switch.
IP Table	Use this to look at the IP addresses, VLAN IDs, and ports of devices connected to the switch.
ARP Table	Use this to look at the MAC addresses – IP address resolution table.
Routing Table	Use this to look at the routing table.
Configure Clone	Use this to copy attributes of one port or slot to other ports or slots.

4.3.1 Change Your Password

After you log in for the first time, it is recommended you change the default administrator password. Click **Management** > **Access Control** > **Logins** to display the next screen.

Figure 9 Change Administrator Login Password



Please record your new password whenever you change it. The system will lock you out if you have forgotten your password.

Edit Logins

Login	User Name	Password	Retype to confirm
1			
2			
3			
4			

4.4 Saving Your Configuration

When you are done modifying the settings in a screen, click **Apply** to save your changes back to the run-time memory. Settings in the run-time memory are lost when the MM-7201's power is turned off.

Click the **Save** link in the upper right hand corner of the web configurator to save your configuration to nonvolatile memory. Nonvolatile memory refers to the MM-7201's storage that remains even if the MM-7201's power is turned off.

Use the **Save** link when you are done with a configuration session.

4.5 Switch Lockout

You could block yourself (and all others) from using in-band-management (managing through the data ports on the interface modules) if you do one of the following:

1 Delete the management VLAN (default is VLAN 1).

2 Delete all port-based VLANs with the CPU port as a member. The "CPU port" is the management port of the switch.

3 Filter all traffic to the CPU port.

4 Disable all ports.

5 Misconfigure the text configuration file.

6 Forget the password and/or IP address.

7 Prevent all services from accessing the switch.

8 Change a service port number but forget it.

Be careful not to lock yourself and others out of the switch. If you do lock yourself out, try using out-of-band management (via the management port or console port) to configure the MM-7201.

4.6 Resetting the Switch

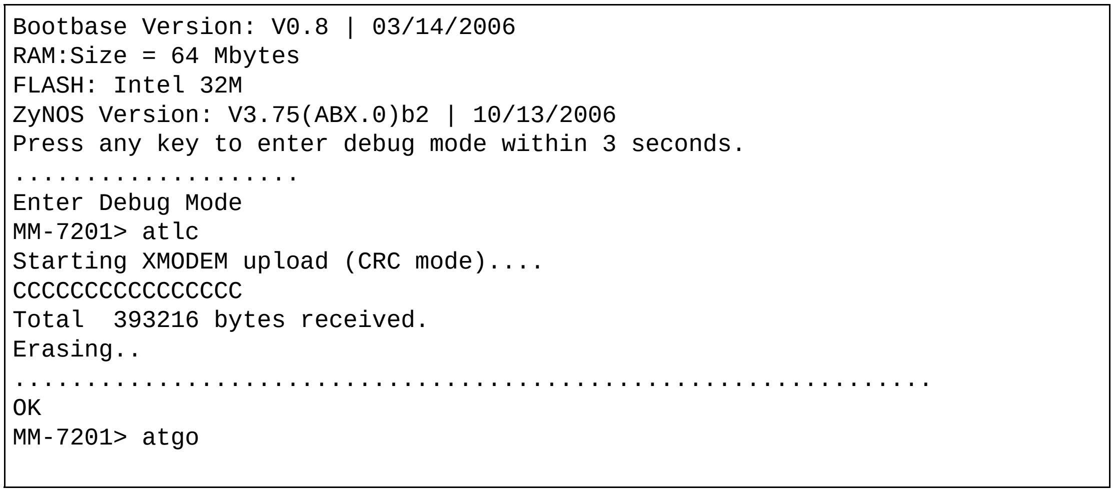
If you (and others) forget the administrator password or are no longer able to access the MM-7201 (using in-band or out-of-band management), you need to reload the factory-default configuration file.

Uploading the factory-default configuration file replaces the current configuration file with the factory-default configuration file. This means that you will lose all previous configurations and the speed of the console port will be reset to the default values in Section 2.2.2 on page 38. The password will also be reset to “1234” and the IP address to 192.168.0.1.

To upload the configuration file, do the following:

1. Connect to the console port using a computer with terminal emulation software. See Section 2.2.2 on page 38 for details.
2. Disconnect and reconnect the system’s power to begin a session. When you reconnect the power, you will see the initial screen.
3. When you see the message “`Press any key to enter Debug Mode within 3 seconds ...`” press any key to enter debug mode.
4. Type `atlc` after the “`Enter Debug Mode`” message.
5. Wait for the “`Starting XMODEM upload`” message before activating XMODEM upload on your terminal.
6. After a configuration file upload, type `atgo` to restart the MM-7201.

Figure 10 Resetting the MM-7201: Via the Console Port



```
Bootbase Version: V0.8 | 03/14/2006
RAM:Size = 64 Mbytes
FLASH: Intel 32M
ZyNOS Version: V3.75(ABX.0)b2 | 10/13/2006
Press any key to enter debug mode within 3 seconds.
....................
Enter Debug Mode
MM-7201> atlc
Starting XMODEM upload (CRC mode)....
CCCCCCCCCCCCCCCC
Total  393216 bytes received.
Erasing..
................................................................
OK
MM-7201> atgo
```

The switch is now reinitialized with a default configuration file including the default password of “1234”.

4.7 Logging Out of the Web Configurator

Click **Logout** in a screen to exit the web configurator. You have to log in with your password again after you log out. This is recommended after you finish a management session for security reasons.

Figure 11 Web Configurator: Logout Screen

Thank you for using the Web Configurator.
Please close the browser before next login.
Goodbye!

4.8 Help

The web configurator’s online help has descriptions of individual screens and some supplementary information.

Click the **Help** link from a web configurator screen to view an online help description of that screen.

5

Initial Setup Example

This chapter explains how to complete the following steps for an example network.

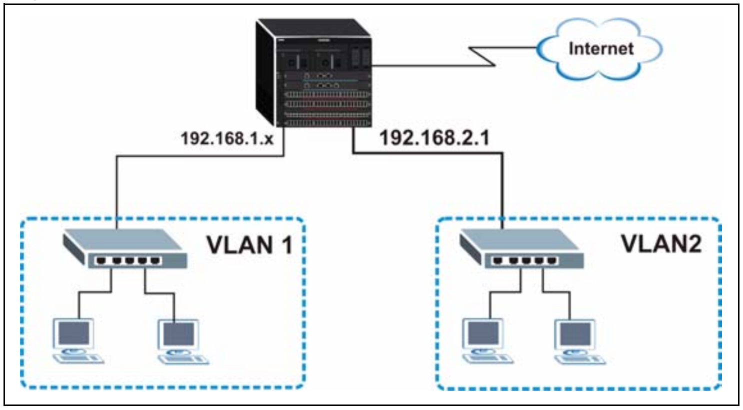
- Configure an IP interface
- Configure DHCP server settings
- Create a VLAN
- Set port VLAN ID
- Enable RIP

5.1 Configuring an IP Interface

On a layer-3 switch, an IP interface (also known as an IP routing domain) is not bound to a physical port. The default out-of-band IP address of the switch is 192.168.0.1 with a subnet mask of 255.255.255.0. The default in-band IP address of the switch is 192.168.1.1 with a subnet mask of 255.255.255.0.

In the example network, since the **RD** (VLAN 1) network is already in the same IP interface as the switch, you don't need to create an IP interface for it. However, if you want to have the **Sales** (VLAN 2) network on a different routing domain, you need to create a new IP interface. This allows the switch to route traffic between the **RD** and **Sales** networks.

Figure 12 Initial Setup Network Example: IP Interface



1 Connect your computer to the out-of-band **MGMT** port that is used only for management. Make sure your computer is in the same subnet as the **MGMT** port.

2 Open your web browser and enter http://192.168.0.1 (the default **MGMT** port IP address) in the address bar to access the web configurator. See Section 4.2 on page 45 for more information.

3 Click **Basic Setting** > **IP Setup**.

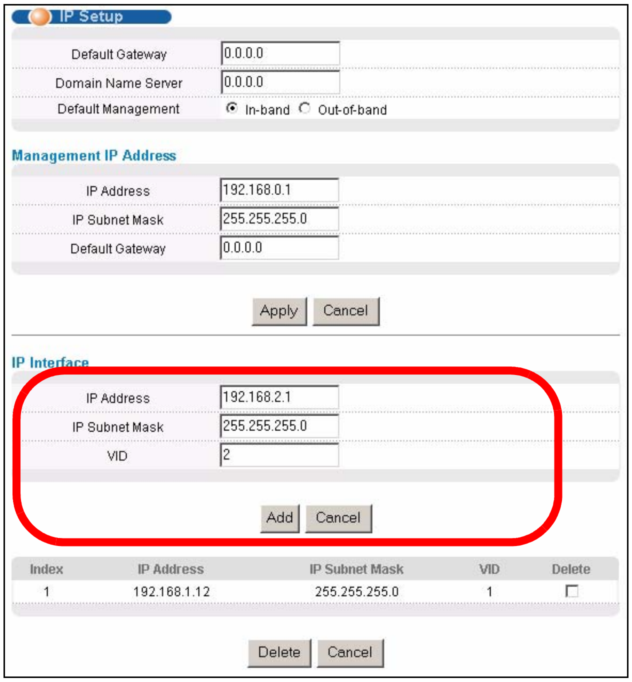
4 Configure the related fields in the **IP Setup** screen. For the **Sales** network,

Enter 192.168.2.1 in the **IP Address** field.

Enter 255.255.255.0 in the **IP Subnet Mask** field.

In the **VID** field, enter 2, the ID of the VLAN group to which you want this IP interface to belong. This is the same as the VLAN ID you configure in the **Static VLAN** screen later (Section 5.3 on page 55).

5 Click **Add** to save the settings to the run-time memory. Settings in the run-time memory are lost when the MM-7201's power is turned off.



Default Gateway	0.0.0.0
Domain Name Server	0.0.0.0
Default Management	● In-band ○ Out-of-band

Management IP Address

IP Address	192.168.0.1
IP Subnet Mask	255.255.255.0
Default Gateway	0.0.0.0

IP Interface

IP Address	192.168.2.1
IP Subnet Mask	255.255.255.0
VID	2

Index	IP Address	IP Subnet Mask	VID	Delete
1	192.168.1.12	255.255.255.0	1	□

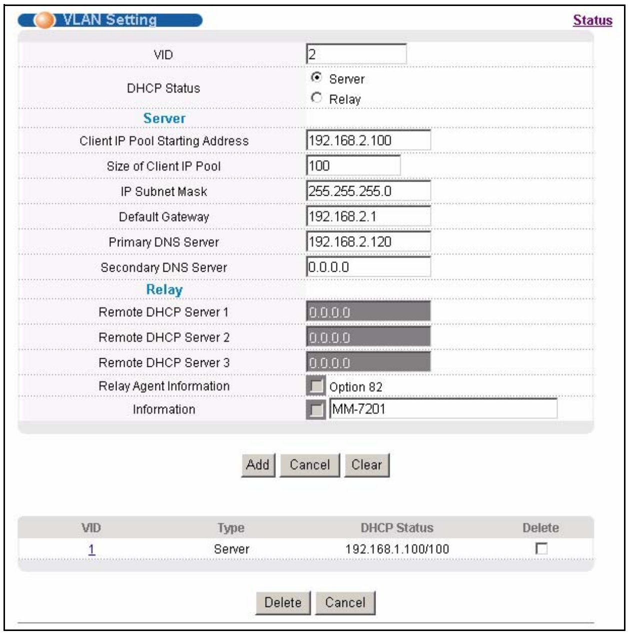
5.2 Configuring DHCP Server Settings

You can set the switch to assign network information (such as the IP address, DNS server, etc.) to DHCP clients on the network. For the example network, configure two DHCP client pools on the switch for the DHCP clients in the **RD** and **Sales** networks.

1 Click **IP Application** > **DHCP** > **VLAN**.

2 In the **DHCP VLAN Setting** screen, specify the ID of the VLAN to which the DHCP clients belong, set the DHCP status to **Server**, configure the starting IP address pool, subnet mask, default gateway address and the DNS server address(es).

3 Click **Add** to save the settings to the run-time memory. Settings in the run-time memory are lost when the MM-7201's power is turned off.



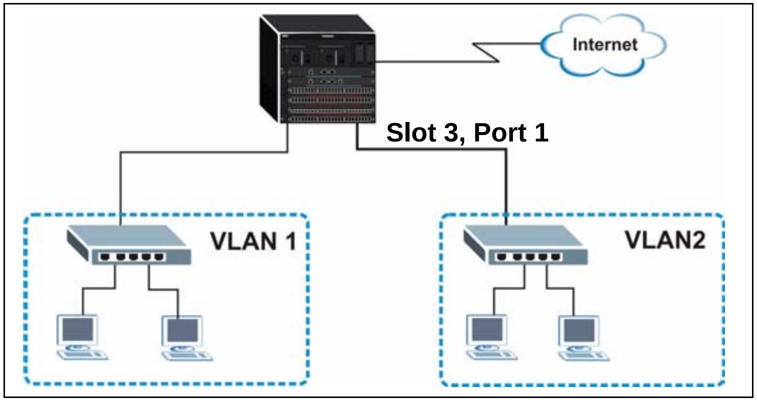
VID	2
DHCP Status	● Server ○ Relay
Server	
Client IP Pool Starting Address	192.168.2.100
Size of Client IP Pool	100
IP Subnet Mask	255.255.255.0
Default Gateway	192.168.2.1
Primary DNS Server	192.168.2.120
Secondary DNS Server	0.0.0.0
Relay	
Remote DHCP Server 1	0.0.0.0
Remote DHCP Server 2	0.0.0.0
Remote DHCP Server 3	0.0.0.0
Relay Agent Information	□ Option 82
Information	□ MM-7201

VID	Type	DHCP Status	Delete
1	Server	192.168.1.100/100	□

5.3 Creating a VLAN

VLANs confine broadcast frames to the VLAN group in which the port(s) belongs. You can do this with port-based VLAN or tagged static VLAN with fixed port members. In this example, you want to configure port 1 in slot 3 as a member of VLAN 2.

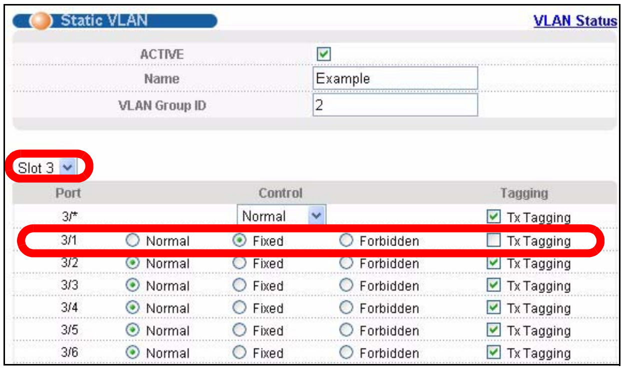
Figure 13 Initial Setup Network Example: VLAN



1 Click **Advanced Application** > **VLAN** > **Static VLAN**.

2 In the **Static VLAN** screen, select **ACTIVE**, enter a descriptive name in the **Name** field and enter 2 in the **VLAN Group ID** field for the **VLAN2** network.

3 Select **Slot 3** in the drop-down box above the port list.



ACTIVE	☑
Name	Example
VLAN Group ID	2

Slot 3

Port	Control			Tagging
3/*	Normal			☑ Tx Tagging
3/1	○ Normal	● Fixed	○ Forbidden	□ Tx Tagging
3/2	● Normal	○ Fixed	○ Forbidden	☑ Tx Tagging
3/3	● Normal	○ Fixed	○ Forbidden	☑ Tx Tagging
3/4	● Normal	○ Fixed	○ Forbidden	☑ Tx Tagging
3/5	● Normal	○ Fixed	○ Forbidden	☑ Tx Tagging
3/6	● Normal	○ Fixed	○ Forbidden	☑ Tx Tagging

The **VLAN Group ID** field in this screen and the **VID** field in the **IP Setup** screen (Section 5.1 on page 53) refer to the same VLAN ID.

4 Since the **VLAN2** network is connected to port 1 in slot 3, select **Fixed** to configure port 1 to be a permanent member of the VLAN only.

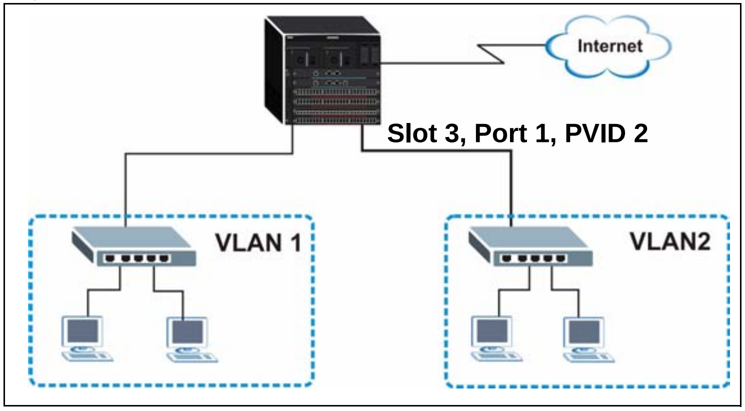
5 To ensure that VLAN-unaware devices (such as computers and hubs) can receive frames properly, clear the **TX Tagging** check box to set the switch to remove VLAN tags before sending.

6 Click **Add** to save the settings to the run-time memory. Settings in the run-time memory are lost when the MM-7201’s power is turned off.

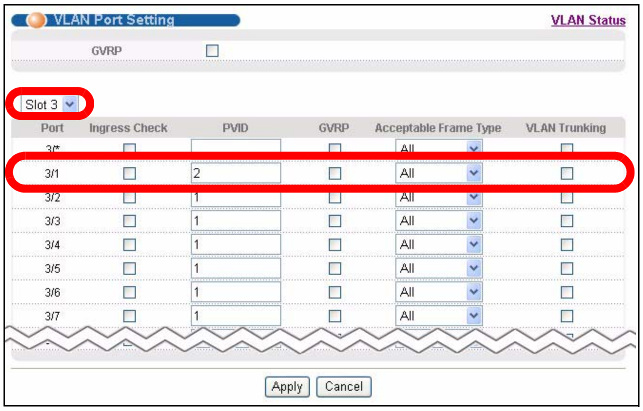
5.4 Setting Port VID

Use PVID to add a tag to incoming untagged frames received on that port so that the frames are forwarded to the VLAN group that the tag defines. In the example network, configure 2 as the port VID on port 1 in slot 3 so that any untagged frames received on that port get sent to VLAN 2.

Figure 14 Initial Setup Network Example: Port VID



1 Click **Advanced Application** > **VLAN** > **VLAN Port Setting**.
2 Select **Slot 3** in the drop-down box above the port list.
3 Enter 2 in the **PVID** field for port 1.
4 Click **Apply** to save your changes back to the run-time memory. Settings in the run-time memory are lost when the MM-7201's power is turned off.



GVRP □

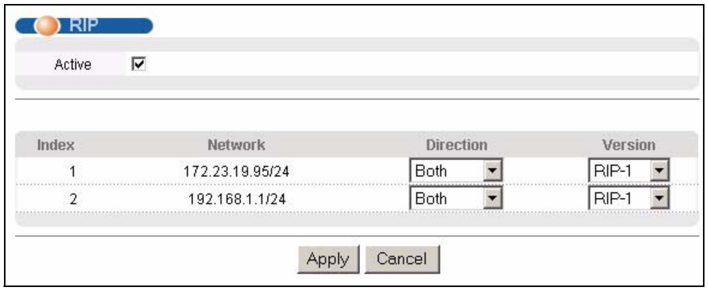
Slot 3

Port	Ingress Check	PVID	GVRP	Acceptable Frame Type	VLAN Trunking
3/*	□		□	All	□
3/1	□	2	□	All	□
3/2	□	1	□	All	□
3/3	□	1	□	All	□
3/4	□	1	□	All	□
3/5	□	1	□	All	□
3/6	□	1	□	All	□
3/7	□	1	□	All	□

5.5 Enabling RIP

To exchange routing information with other routing devices across different routing domains, enable RIP (Routing Information Protocol) in the **RIP** screen.

1 Click **IP Application** and **RIP** in the navigation panel.
2 Select **Both** in the **Direction** field to set the switch to broadcast and receive routing information.
3 In the **Version** field, select **RIP-1** for the RIP packet format that is universally supported.



Active ☑

Index	Network	Direction	Version
1	172.23.19.95/24	Both	RIP-1
2	192.168.1.1/24	Both	RIP-1

4 Click **Apply** to save your changes back to the run-time memory. Settings in the run-time memory are lost when the MM-7201's power is turned off.

6

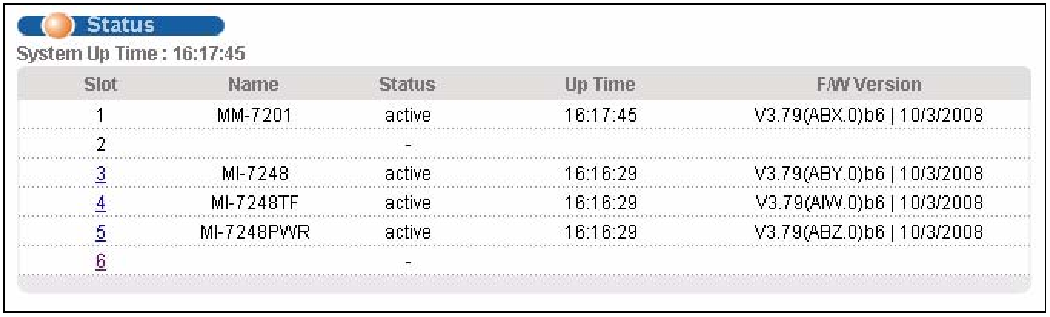
System Status and Port Statistics

This chapter describes the system status (web configurator home page), port status, and port details screens.

6.1 Status

Use this screen to look at a summary of each slot and whatever card may be in each slot. To view the summary, click **Status** in any web configurator screen.

Figure 15 Status



Status

System Up Time : 16:17:45

Slot	Name	Status	Up Time	F/W Version
1	MM-7201	active	16:17:45	V3.79(ABX.0)b6 | 10/3/2008
2		-		
3	MI-7248	active	16:16:29	V3.79(ABY.0)b6 | 10/3/2008
4	MI-7248TF	active	16:16:29	V3.79(AIW.0)b6 | 10/3/2008
5	MI-7248PWR	active	16:16:29	V3.79(ABZ.0)b6 | 10/3/2008
6		-		

The following table describes the labels in this screen.

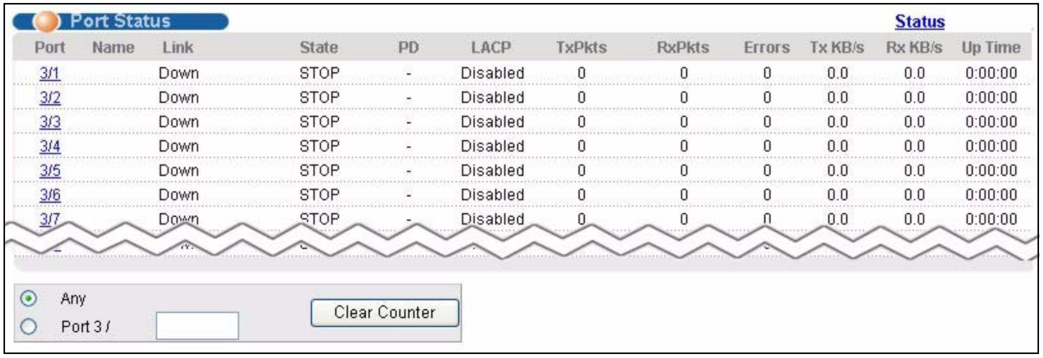
Table 5 Status

LABEL	DESCRIPTION
Slot	This identifies the slot. Click a slot number to look at the status of each port in the slot.
Name	This is the model name of the card in the slot. It is blank if there is no card in the slot.
Status	This field displays the status of the card in the slot. Possible values are: **active**: The card is ready. **standby**: The card is the backup management card.
Up Time	This field shows the total amount of time in hours, minutes and seconds the card has been up in the slot.
F/W Version	This field displays the version number of the card's current firmware including the date created.

6.1.1 Port Status

Use this screen to look at the status of each port in the selected slot. You can also clear the port counters for each port in the slot. To open this screen, click **Status** in any web configurator screen, and then click the number of the slot.

Figure 16 Port Status



Port Status

Status

Port	Name	Link	State	PD	LACP	TxPkts	RxPkts	Errors	Tx KB/s	Rx KB/s	Up Time
3/1		Down	STOP	-	Disabled	0	0	0	0.0	0.0	0:00:00
3/2		Down	STOP	-	Disabled	0	0	0	0.0	0.0	0:00:00
3/3		Down	STOP	-	Disabled	0	0	0	0.0	0.0	0:00:00
3/4		Down	STOP	-	Disabled	0	0	0	0.0	0.0	0:00:00
3/5		Down	STOP	-	Disabled	0	0	0	0.0	0.0	0:00:00
3/6		Down	STOP	-	Disabled	0	0	0	0.0	0.0	0:00:00
3/7		Down	STOP	-	Disabled	0	0	0	0.0	0.0	0:00:00

● Any

○ Port 3 / ▭

The following table describes the labels in this screen.

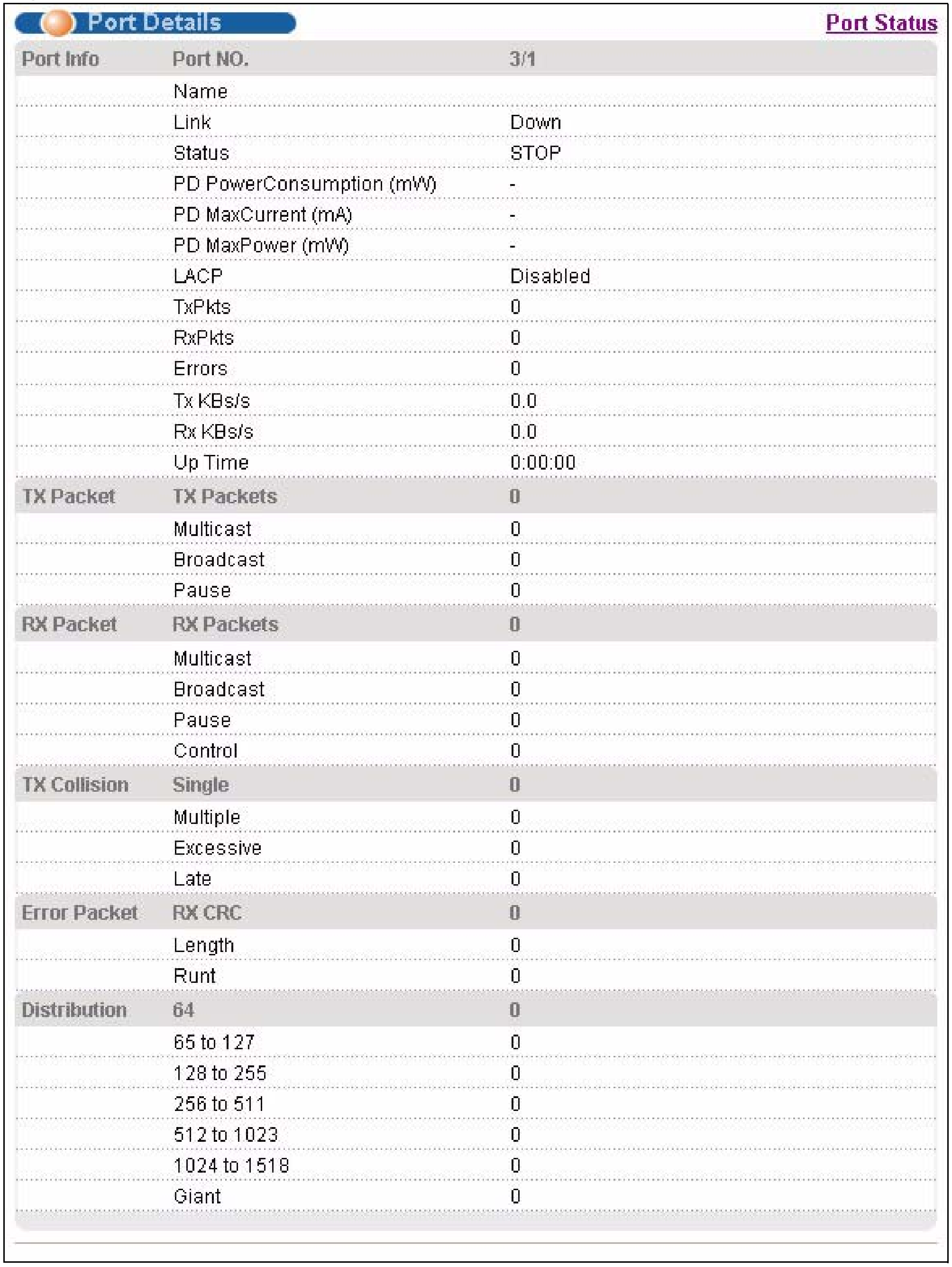
Table 6 Port Status

LABEL	DESCRIPTION
Port	This field displays the slot number and the port number. Click a port number to look at detailed statistics for a specific port. See Section 6.1.2 on page 59.
Name	This is the name assigned to this port. You can configure this in the **Port Setup** screen. See Chapter 12 on page 79.
Link	This field displays the speed (either **10M** for 10 Mbps, **100M** for 100 Mbps or **1000M** for 1000 Mbps) and the duplex (**F** for full duplex or **H** for half). It shows **Down** if there is no connection. You can configure some of these settings in the **Port Setup** screen. See Chapter 12 on page 79.
State	If STP (Spanning Tree Protocol) is enabled, this field displays the STP state of the port. If STP is disabled, this field displays **FORWARDING** if the link is up, otherwise, it displays **STOP**. See Chapter 16 on page 95 for more information about STP.
PD	This field displays the current amount of power consumed by devices (powered devices, or PD) that use Power over Ethernet (PoE) to get power from the switch on this port.
LACP	This fields displays whether LACP (Link Aggregation Control Protocol) is **Enabled** or **Disabled** on the port. See Chapter 20 on page 113 for more information about LACP.
TxPkts	This field shows the number of frames transmitted on this port.
RxPkts	This field shows the number of frames received on this port.
Errors	This field shows the number of errors received on this port.
Tx KB/s	This field shows the number of kilobytes per second transmitted on this port.
Rx KB/s	This field shows the number of kilobytes per second received on this port.
Up Time	This field shows the total amount of time in hours, minutes and seconds the port has been up.
Any	Select this, and click **Clear Counter** to reset all the port counters for this slot.
Port	Select this, enter a specific port number, and click **Clear Counter** to reset the port counters for the specified port.
Clear Counter	Click this to clear the port counters for the specified port(s).

6.1.2 Port Details

Use this screen to look at detailed statistics for a specific port. You can clear the statistics that are based on counters in the **Port Status** screen. See Section 6.1.1 on page 58. To open this screen, click **Status** in any web configurator screen, then click the number of the slot, and finally click the number of the port.

Figure 17 Port Details



Port Info	Port NO.	3/1
	Name	
	Link	Down
	Status	STOP
	PD PowerConsumption (mW)	-
	PD MaxCurrent (mA)	-
	PD MaxPower (mW)	-
	LACP	Disabled
	TxPkts	0
	RxPkts	0
	Errors	0
	Tx KBs/s	0.0
	Rx KBs/s	0.0
	Up Time	0:00:00
TX Packet	TX Packets	0
	Multicast	0
	Broadcast	0
	Pause	0
RX Packet	RX Packets	0
	Multicast	0
	Broadcast	0
	Pause	0
	Control	0
TX Collision	Single	0
	Multiple	0
	Excessive	0
	Late	0
Error Packet	RX CRC	0
	Length	0
	Runt	0
Distribution	64	0
	65 to 127	0
	128 to 255	0
	256 to 511	0
	512 to 1023	0
	1024 to 1518	0
	Giant	0

The following table describes the labels in this screen.

Table 7 Port Details

LABEL	DESCRIPTION
Port Info	
Port NO	This field displays the slot number and the port number.
Name	This is the name assigned to this port. You can configure this in the **Port Setup** screen. See Chapter 12 on page 79.
Link	This field displays the speed (either **10M** for 10 Mbps, **100M** for 100 Mbps or **1000M** for 1000 Mbps) and the duplex (**F** for full duplex or **H** for half). It shows **Down** if there is no connection. You can configure some of these settings in the **Port Setup** screen. See Chapter 12 on page 79.
Status	If STP (Spanning Tree Protocol) is enabled, this field displays the STP state of the port. If STP is disabled, this field displays **FORWARDING** if the link is up, otherwise, it displays **STOP**. See Chapter 16 on page 95 for more information about STP.
PD PowerConsumption	This field displays the current amount of power consumed by devices (powered devices, or PD) that use Power over Ethernet (PoE) to get power from the switch on this port.
PD MaxCurrent	This field displays the maximum amount of current drawn by devices (powered devices, or PD) that use Power over Ethernet (PoE) to get power from the switch on this port.
PD MaxPower	This field displays the maximum amount of power consumed by devices (powered devices, or PD) that use Power over Ethernet (PoE) to get power from the switch on this port.
LACP	This fields displays whether LACP (Link Aggregation Control Protocol) is **Enabled** or **Disabled** on the port. See Chapter 20 on page 113 for more information about LACP.
TxPkts	This field shows the number of frames transmitted on this port.
RxPkts	This field shows the number of frames received on this port.
Errors	This field shows the number of errors received on this port.
Tx KBs/s	This field shows the number of kilobytes per second transmitted on this port.
Rx KBs/s	This field shows the number of kilobytes per second received on this port.
Up Time	This field shows the total amount of time in hours, minutes and seconds the port has been up.
TX Packet	
TX Packets	This field shows the number of frames transmitted on this port.
Multicast	This field shows the number of multicast frames transmitted on this port.
Broadcast	This field shows the number of broadcast frames transmitted on this port.
Pause	This field shows the number of pause frames transmitted on this port.
RX Packet	
RX Packets	This field shows the number of frames received on this port.
Multicast	This field shows the number of multicast frames received on this port.
Broadcast	This field shows the number of broadcast frames received on this port.
Pause	This field shows the number of pause frames received on this port.
Control	This field shows the number of control frames received on this port.
TX Collision	
Single	This field shows the number of times one collision occurred before a frame could be transmitted successfully on this port.

Table 7 Port Details (continued)

LABEL	DESCRIPTION
Multiple	This field shows the number of times 2-15 collisions occurred before a frame could be transmitted successfully on this port.
Excessive	This field shows the number of times 16 collisions occurred while the switch tried to transmit a frame on this port. In this case, the switch gave up, and the frame was not transmitted.
Late	This field shows the number of times a collision occurred after the switch had already transmitted the 512th bit of the frame.
Error Packet	
RX CRC	This field displays the number of frames received on this port that had a Cyclic Redundancy Check (CRC) error.
Length	This field displays the number of frames received on this port that were too long.
Runt	This field displays the number of frames received on this port that were too short.
Distribution	
64	This field shows the number of frames received and transmitted (including bad frames) that were 64 octets in length (this includes FCS octets but excludes framing bits).
65 to 127	This field shows the number of frames received and transmitted (including bad frames) that were 65 to 127 octets in length (this includes FCS octets but excludes framing bits).
128 to 255	This field shows the number of frames received and transmitted (including bad frames) that were 128 to 255 octets in length (this includes FCS octets but excludes framing bits).
256 to 511	This field shows the number of frames received and transmitted (including bad frames) that were 256 to 511 octets in length (this includes FCS octets but excludes framing bits).
512 to 1023	This field shows the number of frames received and transmitted (including bad frames) that were 512 to 1023 octets in length (this includes FCS octets but excludes framing bits).
1024 to 1518	This field shows the number of frames received and transmitted (including bad frames) that were 1024 to 1518 octets in length (this includes FCS octets but excludes framing bits).
Giant	This field shows the number of frames received and transmitted (including bad frames) that were 1519 or more octets in length (this includes FCS octets but excludes framing bits).

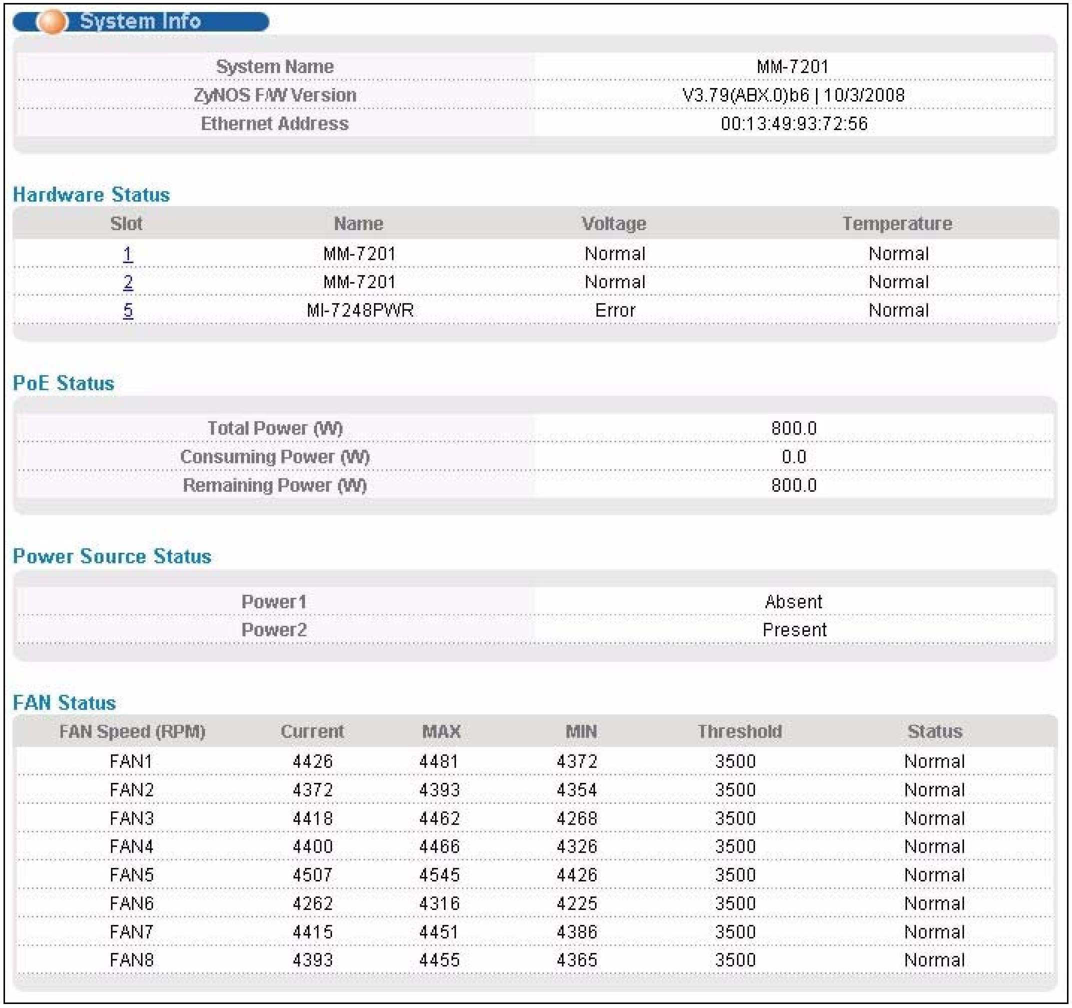
7

System Info

7.1 System Info

Use this screen to look at basic information about the MM-7201 and to monitor the system hardware, including temperature, fan speed, voltage, and power. To open this screen, click **Basic Setting** > **System Info**.

Figure 18 System Info



System Info

System Name	MM-7201
ZyNOS F/W Version	V3.79(ABX.0)b6 | 10/3/2008
Ethernet Address	00:13:49:93:72:56

Hardware Status

Slot	Name	Voltage	Temperature
1	MM-7201	Normal	Normal
2	MM-7201	Normal	Normal
5	MI-7248PWR	Error	Normal

PoE Status

Total Power (W)	800.0
Consuming Power (W)	0.0
Remaining Power (W)	800.0

Power Source Status

Power1	Absent
Power2	Present

FAN Status

FAN Speed (RPM)	Current	MAX	MIN	Threshold	Status
FAN1	4426	4481	4372	3500	Normal
FAN2	4372	4393	4354	3500	Normal
FAN3	4418	4462	4268	3500	Normal
FAN4	4400	4466	4326	3500	Normal
FAN5	4507	4545	4426	3500	Normal
FAN6	4262	4316	4225	3500	Normal
FAN7	4415	4451	4386	3500	Normal
FAN8	4393	4455	4365	3500	Normal

The following table describes the labels in this screen.

Table 8 System Info

LABEL	DESCRIPTION
System Name	This field displays the descriptive name of the MM-7201 for identification purposes. Click **Basic Setting > General Setup** to change this. See Chapter 8 on page 67.
ZyNOS F/W Version	This field displays the version number of the MM-7201's current firmware including the date created. Click **Management > Maintenance > Firmware Upgrade** to change this. See Chapter 37 on page 215.
Ethernet Address	This field displays the Ethernet MAC (Media Access Control) address of the MS-7206 system. The MS-7206 system copies the MAC address from the active management card when the MS-7206 system starts up. The MS-7206 system keeps using this MAC address, even if the standby management card takes over, until the system starts up again.
Hardware Status	
Slot	This field displays the slots that have a card installed in them. Click a slot number to look at more detail about the card's hardware. See Section 7.1.1 on page 65.
Name	This field displays the type of card in the slot.
Voltage	This field displays the voltage status in the card. **Normal**: The voltage is within allowable range. **Error**: The voltage is outside the allowable range at one or more sensors.
Temperature	This field displays the temperature status in the card. **Normal**: The temperature is below the threshold. **Error**: The temperature is above the threshold at one or more sensors.
PoE Status	
Total Power (W)	This field displays the total amount of power available from a Power over Ethernet (PoE) injector.
Consuming Power (W)	This field displays the amount of power from a PoE injector the system is using.
Remaining Power (W)	This field displays the amount of power from a PoE injector the system is not using.
Power Source Status	
Power1 Power2	This field displays the status of each power module in the system. **Present**: There is a power module in this slot, and it is working properly. **Absent**: There is no power module in this slot, or the power module is not working properly.
FAN Status	
Fan Speed (RPM)	A properly functioning fan is an essential component (along with a sufficiently ventilated, cool operating environment) in order for the system to stay within the temperature threshold. Each fan has a sensor that is capable of detecting and reporting if the fan speed falls below the threshold shown.
Current	This field displays this fan's current speed in Revolutions Per Minute (RPM).
MAX	This field displays this fan's maximum speed measured in Revolutions Per Minute (RPM).
MIN	This field displays this fan's minimum speed measured in Revolutions Per Minute (RPM).

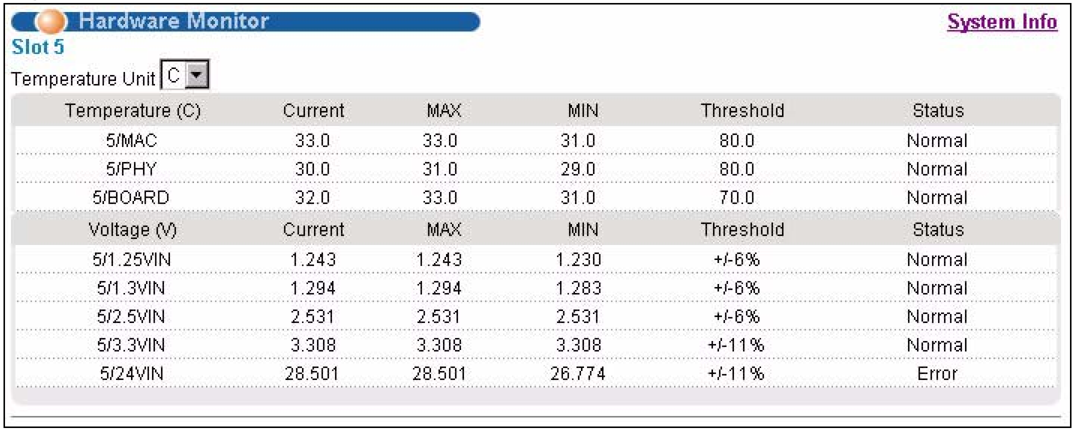
Table 8 System Info (continued)

LABEL	DESCRIPTION
Threshold	This field displays the minimum speed at which a normal fan should work.
Status	This field displays the overall status of the fan. **Normal**: This fan is functioning above the minimum speed. **Error**: This fan is functioning below the minimum speed.

7.1.1 Hardware Monitor

Use this screen to look at more detail about a card's hardware. To open this screen, click **Basic Setting** > **System Info**, and then click the slot number in which the card is installed.

Figure 19 Hardware Monitor



Slot 5

Temperature Unit C

Temperature (C)	Current	MAX	MIN	Threshold	Status
5/MAC	33.0	33.0	31.0	80.0	Normal
5/PHY	30.0	31.0	29.0	80.0	Normal
5/BOARD	32.0	33.0	31.0	70.0	Normal
Voltage (V)	Current	MAX	MIN	Threshold	Status
5/1.25VIN	1.243	1.243	1.230	+/-6%	Normal
5/1.3VIN	1.294	1.294	1.283	+/-6%	Normal
5/2.5VIN	2.531	2.531	2.531	+/-6%	Normal
5/3.3VIN	3.308	3.308	3.308	+/-11%	Normal
5/24VIN	28.501	28.501	26.774	+/-11%	Error

The following table describes the labels in this screen.

Table 9 Hardware Monitor

LABEL	DESCRIPTION
System Info	Click this to return to the **System Info** screen. See Figure 18 on page 63.
Slot	This field displays the slot number in which the card is located.
Temperature Unit	The card has temperature sensors that are capable of detecting and reporting if the temperature rises above the threshold. You may choose the temperature unit (Centigrade or Fahrenheit) in this field.
Temperature	The number is the slot number in which the card is located. **MAC**, **PHY** and **BOARD** refer to the location of the temperature sensors on the card's printed circuit board.
Current	This shows the current temperature in degrees at this sensor.
MAX	This field displays the maximum temperature measured at this sensor.
MIN	This field displays the minimum temperature measured at this sensor.
Threshold	This field displays the upper temperature limit at this sensor.
Status	This field displays the status of each sensor. **Normal**: The temperature is below the threshold. **Error**: The temperature is above the threshold.
Voltage(V)	The number is the slot number in which the card is located. The power supply for each voltage has a sensor that is capable of detecting and reporting if the voltage falls out of the tolerance range.
Current	This is the current voltage reading.

Table 9 Hardware Monitor (continued)

LABEL	DESCRIPTION
MAX	This field displays the maximum voltage measured at this point.
MIN	This field displays the minimum voltage measured at this point.
Threshold	This field displays the percentage tolerance of the voltage with which the card still works.
Status	This field displays the status of each sensor. **Normal**: The voltage is within allowable range. **Error**: The voltage is outside the allowable range at one or more sensors.

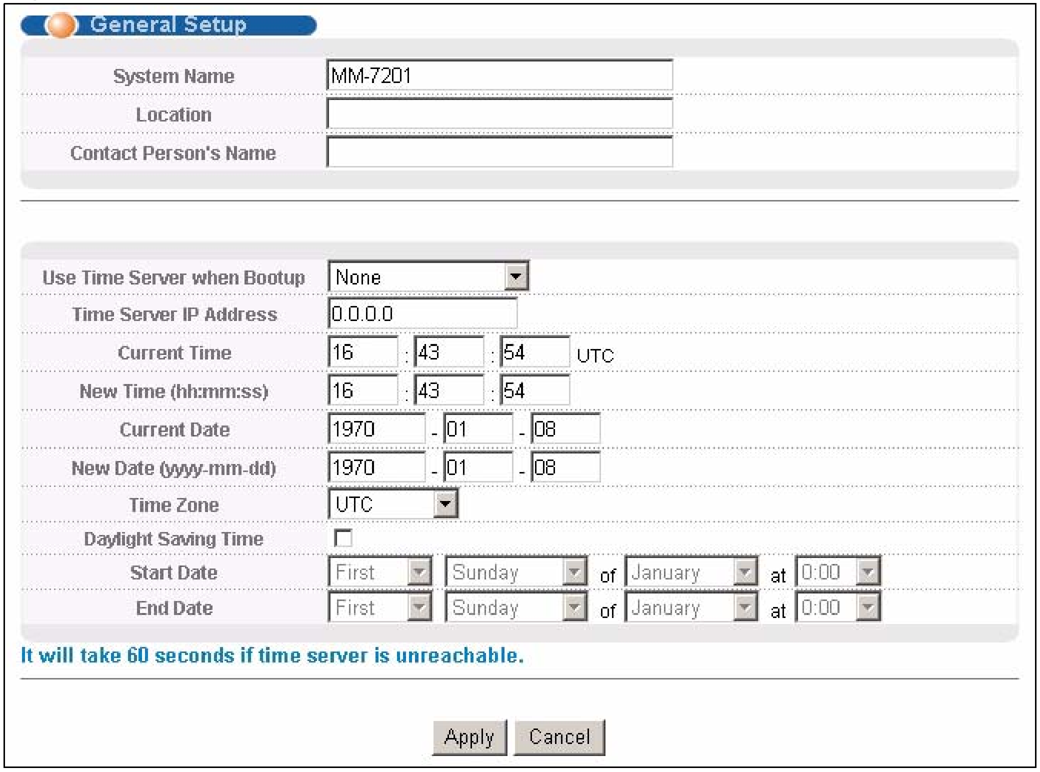
8

General Setup

8.1 General Setup

Use this screen to configure the system name, login precedence, time, and other general settings for the system. To open this screen, click **Basic Setting** > **General Setup**.

Figure 20 General Setup



General Setup

System Name	MM-7201
Location	
Contact Person's Name	

Use Time Server when Bootup	None
Time Server IP Address	0.0.0.0
Current Time	16 : 43 : 54 UTC
New Time (hh:mm:ss)	16 : 43 : 54
Current Date	1970 - 01 - 08
New Date (yyyy-mm-dd)	1970 - 01 - 08
Time Zone	UTC
Daylight Saving Time	□
Start Date	First Sunday of January at 0:00
End Date	First Sunday of January at 0:00

It will take 60 seconds if time server is unreachable.

The following table describes the labels in this screen.

Table 10 General Setup

LABEL	DESCRIPTION
System Name	Choose a descriptive name for identification purposes. This name consists of up to 64 printable characters; spaces are allowed.
Location	Enter the geographic location of your switch. You can use up to 32 printable English keyboard characters; spaces are allowed.
Contact Person's Name	Enter the name of the person in charge of this switch. You can use up to 32 printable English keyboard characters; spaces are allowed.

Table 10 General Setup (continued)

LABEL	DESCRIPTION
Use Time Server when Bootup	Enter the time service protocol that your timeserver uses. Not all time servers support all protocols, so you may have to use trial and error to find a protocol that works. The main differences between them are the time format. The MM-7201 requests time and date settings from the time server in the following circumstances: • When the MM-7201 starts up. • In 24-hour intervals after starting. • When you click **Apply** in this screen. When you select the **Daytime (RFC 867)** format, the switch displays the day, month, year and time with no time zone adjustment. When you use this format it is recommended that you use a Daytime timeserver within your geographical time zone. **Time (RFC-868)** format displays a 4-byte integer giving the total number of seconds since 1970/1/1 at 0:0:0. **NTP (RFC-1305)** is similar to Time (RFC-868). **None** is the default value. Enter the time manually. When you enter the time settings manually, the MM-7201 uses the new setting when you click **Apply**. Each time you turn on the switch, the time and date will be reset to 1970-1-1 0:0.
Time Server IP Address	Enter the IP address of your timeserver. The switch searches for the timeserver for up to 60 seconds. If you select a timeserver that is unreachable, then this screen will appear locked for 60 seconds. Please wait.
Current Time	This field displays the time you open this menu (or refresh the menu).
New Time (hh:mm:ss)	Enter the new time in hour, minute and second format. The new time then appears in the **Current Time** field after you click **Apply**.
Current Date	This field displays the date you open this menu.
New Date (yyyy-mm-dd)	Enter the new date in year, month and day format. The new date then appears in the **Current Date** field after you click **Apply**.
Time Zone	Select the time difference between UTC (Universal Time Coordinated, formerly known as GMT, Greenwich Mean Time) and your time zone from the drop-down list box.
Daylight Saving Time	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. Select this option if you use Daylight Saving Time.
Start Date	Configure the day and time when Daylight Saving Time starts if you selected **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**, **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**, **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).

Table 10 General Setup (continued)

LABEL	DESCRIPTION
End Date	Configure the day and time when Daylight Saving Time ends if you selected **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 first Sunday of November. 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**, **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**, **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 save your changes to the switch’s run-time memory. The switch loses these changes if it is turned off or loses power, so use the **Save** link on the top navigation panel to save your changes to the non-volatile memory when you are done configuring.
Cancel	Click **Cancel** to reset the fields.

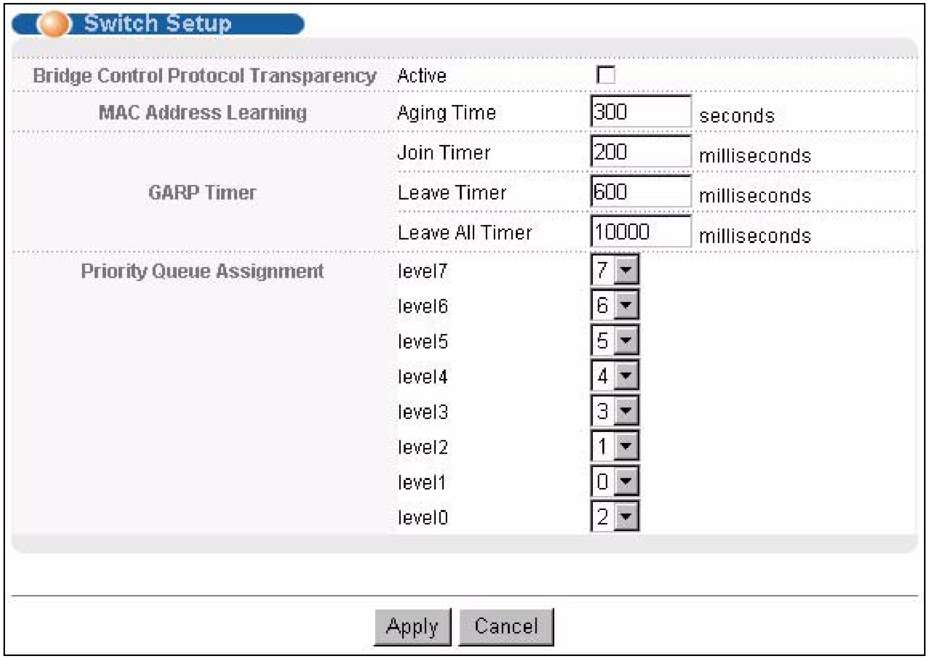
9

Switch Setup

9.1 Switch Setup

Use this screen to configure MAC address learning, declaration timeout values for GARP, and priority queues. You can also control whether or not the switch handles bridge control protocols, such as STP. To open this screen, click **Basic Setting** > **Switch Setup**.

Figure 21 Switch Setup



Switch Setup

Bridge Control Protocol Transparency	Active	□	
MAC Address Learning	Aging Time	300	seconds
GARP Timer	Join Timer	200	milliseconds
	Leave Timer	600	milliseconds
	Leave All Timer	10000	milliseconds
Priority Queue Assignment	level7	7	
	level6	6	
	level5	5	
	level4	4	
	level3	3	
	level2	1	
	level1	0	
	level0	2	

The following table describes the labels in this screen.

Table 11 Switch Setup

LABEL	DESCRIPTION
Bridge Control Protocol Transparency	Select **Active** to allow the switch to handle bridging control protocols (STP for example). You also need to define how to treat a BPDU in the **Port Setup** screen.
MAC Address Learning	MAC address learning reduces outgoing traffic broadcasts. For MAC address learning to occur on a port, the port must be active.
Aging Time	Enter a time from 10 to 3000 seconds. This is how long all dynamically learned MAC addresses remain in the MAC address table before they age out (and must be relearned).

Table 11 Switch Setup (continued)

LABEL	DESCRIPTION
GARP Timer:	Switches join VLANs by making a declaration. A declaration is made by issuing a **Join** message using GARP. Declarations are withdrawn by issuing a **Leave** message. A **Leave All** message terminates all registrations. GARP timers set declaration timeout values. See Chapter 13 on page 83 for more information.
Join Timer	Join Timer sets the duration of the Join Period timer for GVRP in milliseconds. Each port has a **Join Period** timer. The allowed **Join Time** range is between 100 and 65535 milliseconds; the default is 200 milliseconds. See the chapter on VLAN setup for more background information.
Leave Timer	Leave Time sets the duration of the **Leave Period** timer for GVRP in milliseconds. Each port has a single **Leave Period** timer. Leave Time must be two times larger than **Join Timer**; the default is 600 milliseconds.
Leave All Timer	Leave All Timer sets the duration of the Leave All Period timer for GVRP in milliseconds. Each port has a single Leave All Period timer. Leave All Timer must be larger than Leave Timer.
Priority Queue Assignment	Use this section to configure the priority level-to-physical queue mapping. IEEE 802.1p defines up to eight separate traffic types by inserting a tag into a MAC-layer frame that contains bits to define class of service. Frames without an explicit priority tag are given the default priority of the ingress port. See Chapter 12 on page 79 to configure the default priority. The switch has eight physical queues that you can map to the 8 priority levels. On the switch, traffic assigned to higher index queues gets through faster while traffic in lower index queues is dropped if the network is congested.
Priority Level	The following descriptions are based on the traffic types defined in the IEEE 802.1d standard (which incorporates the 802.1p).
level7	Typically used for network control traffic such as router configuration messages.
level6	Typically used for voice traffic that is especially sensitive to jitter (jitter is the variations in delay).
level5	Typically used for video that consumes high bandwidth and is sensitive to jitter.
level4	Typically used for controlled load, latency-sensitive traffic such as SNA (Systems Network Architecture) transactions.
level3	Typically used for “excellent effort” or better than best effort and would include important business traffic that can tolerate some delay.
level2	This is for “spare bandwidth”.
level1	This is typically used for non-critical “background” traffic such as bulk transfers that are allowed but that should not affect other applications and users.
level0	Typically used for best-effort traffic.
Apply	Click **Apply** to save your changes to the switch’s run-time memory. The switch loses these changes if it is turned off or loses power, so use the **Save** link on the top navigation panel to save your changes to the non-volatile memory when you are done configuring.
Cancel	Click **Cancel** to reset the fields.

10

IP Setup

This chapter introduces IP interfaces and then describes the **IP Setup** screen.

10.1 IP Interfaces

The switch needs an IP address for it to be managed over the network. The factory default IP address is 192.168.0.1. The subnet mask specifies the network number portion of an IP address. The factory default subnet mask is 255.255.255.0.

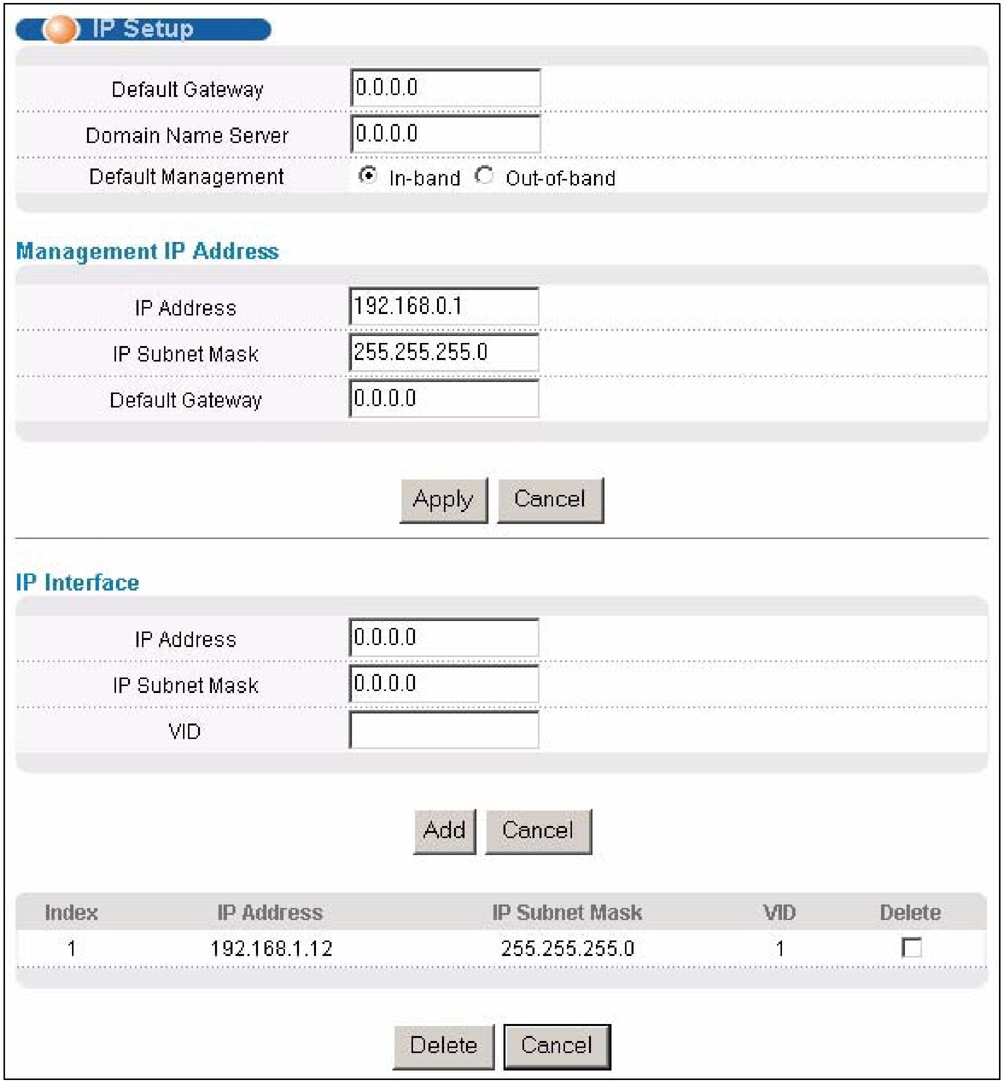
On the switch, as a layer-3 device, an IP address is not bound to any physical ports. Since each IP address on the switch must be in a separate subnet, the configured IP address is also known as IP interface (or routing domain). In addition, this allows routing between subnets based on the IP address without additional routers.

You can configure multiple routing domains on the same VLAN as long as the IP address ranges for the domains do not overlap. To change the IP address of the switch in a routing domain, simply add a new routing domain entry with a different IP address in the same subnet.

10.2 IP Setup

Use this screen to configure the default gateway, DNS server, management IP address, and IP domains. To open this screen, click **Basic Setting** > **IP Setup**.

Figure 22 IP Setup



IP Setup

Default Gateway	0.0.0.0
Domain Name Server	0.0.0.0
Default Management	● In-band ○ Out-of-band

Management IP Address

IP Address	192.168.0.1
IP Subnet Mask	255.255.255.0
Default Gateway	0.0.0.0

IP Interface

IP Address	0.0.0.0
IP Subnet Mask	0.0.0.0
VID	

Index	IP Address	IP Subnet Mask	VID	Delete
1	192.168.1.12	255.255.255.0	1	□

The following table describes the labels in this screen.

Table 12 IP Setup

LABEL	DESCRIPTION
Default Gateway	Enter the IP address of the default outgoing gateway in dotted decimal notation, for example 192.168.0.254.
Domain Name Server	DNS (Domain Name System) is for mapping a domain name to its corresponding IP address and vice versa. Enter a domain name server IP address in order to be able to use a domain name instead of an IP address.
Default Management	Specify which traffic flow (**In-Band** or **Out-of-band**) the switch is to send packets originating from itself (such as SNMP traps) or packets with unknown source. Select **Out-of-band** to have the switch send the packets to the management port labelled **MGMT**. This means that device(s) connected to the other port(s) do not receive these packets. Select **In-Band** to have the switch send the packets to all ports except the management port (labelled **MGMT**) to which connected device(s) do not receive these packets.
Management IP Address	Use these fields to set the settings for the out-of-band management port.

Table 12 IP Setup (continued)

LABEL	DESCRIPTION
IP Address	Enter the out-of-band management IP address of your switch in dotted decimal notation. For example, 192.168.0.1.
IP 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 192.168.0.254
Apply	Click **Apply** to save your changes to the switch's run-time memory. The switch loses these changes if it is turned off or loses power, so use the **Save** link on the top navigation panel to save your changes to the non-volatile memory when you are done configuring.
Cancel	Click **Cancel** to reset the fields to your previous configuration.
IP Interface	Use these fields to create or edit IP routing domains on the switch.
IP Address	Enter the IP address of your switch in dotted decimal notation for example 192.168.1.1. This is the IP address of the switch in an IP routing domain.
IP Subnet Mask	Enter the IP subnet mask of an IP routing domain in dotted decimal notation. For example, 255.255.255.0.
VID	Enter the VLAN identification number to which an IP routing domain belongs.
Add	Click **Add** to save your changes to the switch's run-time memory. The switch loses these changes if it is turned off or loses power, so use the **Save** link on the top navigation panel to save your changes to the non-volatile memory when you are done configuring.
Cancel	Click **Cancel** to reset the fields to your previous configuration.
Index	This field displays the index number of an entry.
IP Address	This field displays IP address of the switch in the IP domain.
Subnet Mask	This field displays the subnet mask of the switch in the IP domain.
VID	This field displays the VLAN identification number of the IP domain on the switch.
Delete	Click **Delete** to remove the selected entry from the summary table. Note: Deleting all IP subnets locks you out from the switch.
Cancel	Click **Cancel** to clear the **Delete** check boxes.

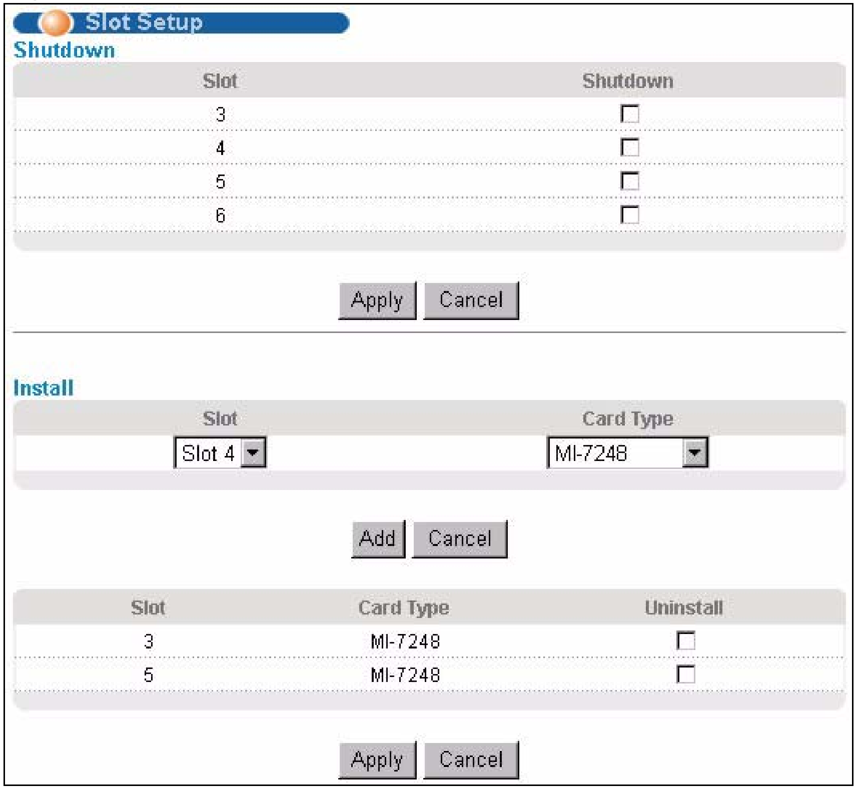
11

Slot Setup

11.1 Slot Setup

Use this screen to control the power to the each slot or to change what type of card is in the slot without restarting the system. To open this screen, click **Basic Setting** > **Slot Setup**.

Figure 23 Slot Setup



Slot Setup

Shutdown

Slot	Shutdown
3	□
4	□
5	□
6	□

Install

Slot	Card Type
Slot 4	MI-7248

Slot	Card Type	Uninstall
3	MI-7248	□
5	MI-7248	□

The following table describes the labels in this screen.

Table 13 Slot Setup

LABEL	DESCRIPTION
Shutdown	Use this section to control the power to each slot.
Slot	This field displays the number of each slot in the system.
Shutdown	Select this to turn off the power to the slot. Clear this to turn on the power to the slot.
Apply	Click **Apply** to save your changes to the switch’s run-time memory. The switch loses these changes if it is turned off or loses power, so use the **Save** link on the top navigation panel to save your changes to the non-volatile memory when you are done configuring.

Table 13 Slot Setup (continued)

LABEL	DESCRIPTION
Cancel	Click **Cancel** to reset the fields.
Install	Use this section to change what type of card is in the slot without restarting the system. Follow this procedure. • In this section, uninstall the old type of card. • Remove the old card from the slot, if necessary. • Insert the new card into the slot, if necessary. • In this section, install the new type of card.
Slot	Select the slot number into which you have installed a new card.
Card Type	Select the type of card you have installed in the slot. If you select the wrong type of card, the MM-7201 automatically stops the interface card, and the slot is out of service.
Add	Click **Add** to save your changes to the switch's run-time memory. The switch loses these changes if it is turned off or loses power, so use the **Save** link on the top navigation panel to save your changes to the non-volatile memory when you are done configuring.
Cancel	Click **Cancel** to reset the fields to your previous configuration.
Slot	This field displays the number of each slot into which you have installed a card. The system automatically installs any cards that are in the system when the system boots up.
Card Type	This field displays the type of card you have installed in the slot.
Uninstall	Select this and click **Apply** to uninstall the card in the slot.
Apply	Click **Apply** to save your changes to the switch's run-time memory. The switch loses these changes if it is turned off or loses power, so use the **Save** link on the top navigation panel to save your changes to the non-volatile memory when you are done configuring.
Cancel	Click **Cancel** to reset the fields.

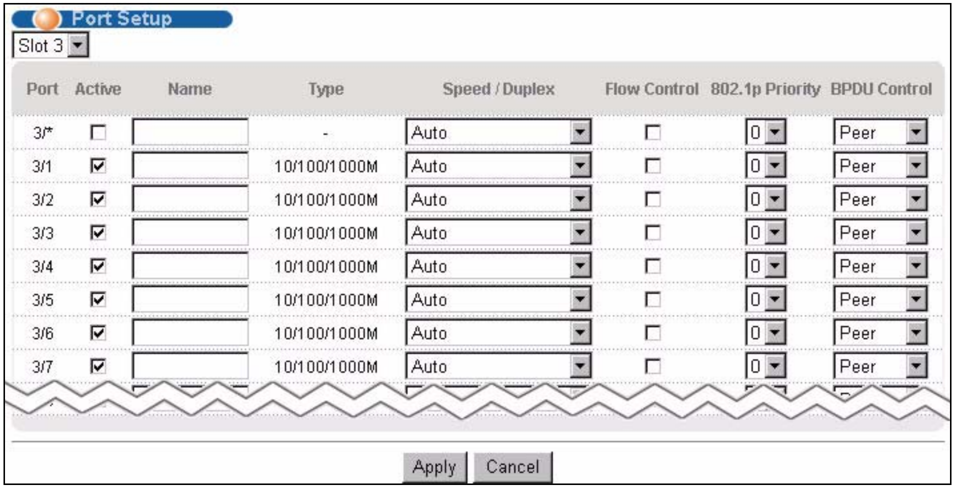
12

Port Setup

12.1 Port Setup

Use this screen to configure basic port settings, such as speed, duplex, and flow control. You can also configure the default 802.1p priority and the way bridge protocol data units (BPDU) are handled. To open this screen, click **Basic Setting** > **Port Setup**.

Figure 24 Port Setup



Port Setup

Slot 3

Port	Active	Name	Type	Speed / Duplex	Flow Control	802.1p Priority	BPDU Control
3/*	□		-	Auto	□	0	Peer
3/1	☑		10/100/1000M	Auto	□	0	Peer
3/2	☑		10/100/1000M	Auto	□	0	Peer
3/3	☑		10/100/1000M	Auto	□	0	Peer
3/4	☑		10/100/1000M	Auto	□	0	Peer
3/5	☑		10/100/1000M	Auto	□	0	Peer
3/6	☑		10/100/1000M	Auto	□	0	Peer
3/7	☑		10/100/1000M	Auto	□	0	Peer

The following table describes the labels in this screen.

Table 14 Port Setup

LABEL	DESCRIPTION
Slot	Select the slot at whose settings you want to look.
Port	This field displays the slot number and port number.
*	Settings in this row apply to all ports. Use this row only if you want to make some settings the same for all ports. Use this row first to set the common settings and then make adjustments on a port-by-port basis. Note: Changes in this row are copied to all the ports as soon as you make them.
Active	Select this check box to enable a port. The factory default for all ports is enabled. A port must be enabled for data transmission to occur.

Table 14 Port Setup (continued)

LABEL	DESCRIPTION
Name	Enter a descriptive name that identifies this port. You can enter up to 64 alpha-numerical characters. Note: Due to space limitation, the port name may be truncated in some web configurator screens.
Type	This field displays **10/100/1000M** for Gigabit connections.
Speed/Duplex	Select the speed and the duplex mode of the Ethernet connection on this port. Choices are **Auto**, **10M/Half Duplex**, **10M/Full Duplex**, **100M/Half Duplex**, **100M/Full Duplex** and **1000M/Full Duplex**. Selecting **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. Select **Flow Control** to enable it.
802.1p Priority	This priority value is added to incoming frames without a (802.1p) priority tag.
BPDU Control	Configure the way to treat BPDUs received on this port. You must activate bridging control protocol transparency in the **Switch Setup** screen first. Select **Peer** to process any BPDU (Bridge Protocol Data Units) received on this port. Select **Tunnel** to forward BPDUs received on this port. Select **Discard** to drop any BPDU received on this port. Select **Network** to process a BPDU with no VLAN tag and forward a tagged BPDU.
Apply	Click **Apply** to save your changes to the switch's run-time memory. The switch loses these changes if it is turned off or loses power, so use the **Save** link on the top navigation panel to save your changes to the non-volatile memory when you are done configuring.
Cancel	Click **Cancel** to reset the fields.

PART IV
Advanced

13

VLAN

This chapter introduces VLANs and then describes the screens you use to configure VLAN settings.

13.1 Introduction to VLANs

A VLAN (Virtual Local Area Network) allows a physical network to be partitioned into multiple logical networks. Devices on a logical network belong to one group. A device can belong to more than one group. With VLAN, a device cannot directly talk to or hear from devices that are not in the same group(s); the traffic must first go through a router.

In MTU (Multi-Tenant Unit) applications, VLAN is vital in providing isolation and security among the subscribers. When properly configured, VLAN prevents one subscriber from accessing the network resources of another on the same LAN, thus a user will not see the printers and hard disks of another user in the same building.

VLAN also increases network performance by limiting broadcasts to a smaller and more manageable logical broadcast domain. In traditional switched environments, all broadcast packets go to each and every individual port. With VLAN, all broadcasts are confined to a specific broadcast domain.

VLAN is unidirectional; it only governs outgoing traffic.

13.2 Introduction to IEEE 802.1Q Tagged VLANs

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 2 Bytes	User Priority 3 Bits	CFI 1 Bit	VLAN ID 12 bits

13.2.1 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.

13.3 Automatic VLAN Registration

GARP and GVRP are the protocols used to automatically register VLAN membership across switches.

13.3.1 GARP

GARP (Generic Attribute Registration Protocol) allows network switches to register and de-register attribute values with other GARP participants within a bridged LAN. GARP is a protocol that provides a generic mechanism for protocols that serve a more specific application, for example, GVRP.

Switches join VLANs by making a declaration. A declaration is made by issuing a Join message using GARP. Declarations are withdrawn by issuing a Leave message. A Leave All message terminates all registrations. GARP timers set declaration timeout values.

13.3.2 GVRP

GVRP (GARP VLAN Registration Protocol) is a registration protocol that defines a way for switches to register necessary VLAN members on ports across the network. Enable this function to permit VLANs groups beyond the local switch.

Please refer to the following table for common IEEE 802.1Q VLAN terminology.

Table 15 IEEE 802.1Q VLAN Terminology

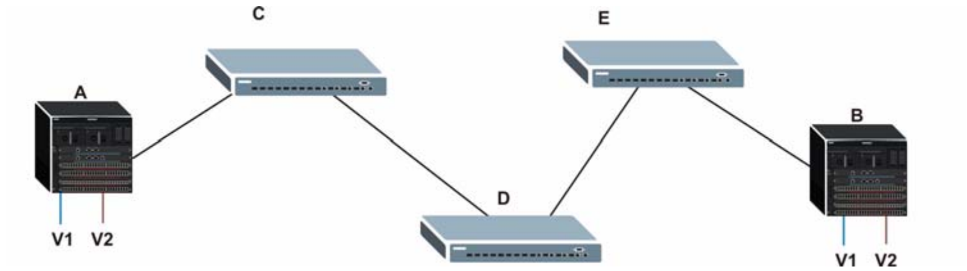
VLAN PARAMETER	TERM	DESCRIPTION
VLAN Type	Permanent VLAN	This is a static VLAN created manually.
	Dynamic VLAN	This is a VLAN configured by a GVRP registration/ deregistration process.
VLAN Administrative Control	Registration Fixed	Fixed registration ports are permanent VLAN members.
	Registration Forbidden	Ports with registration forbidden are forbidden to join the specified VLAN.
	Normal Registration	Ports dynamically join a VLAN using GVRP.
VLAN Tag Control	Tagged	Ports belonging to the specified VLAN tag all outgoing frames transmitted.
	Untagged	Ports belonging to the specified VLAN don't tag all outgoing frames transmitted.
VLAN Port	Port VID	This is the VLAN ID assigned to untagged frames that this port received.
	Acceptable Frame Type	You may choose to accept both tagged and untagged incoming frames, just tagged incoming frames or just untagged incoming frames on a port.
	Ingress filtering	If set, the switch discards incoming frames for VLANs that do not have this port as a member

13.4 Port VLAN Trunking

Enable **VLAN Trunking** on a port to allow frames belonging to unknown VLAN groups to pass through that port. This is useful if you want to set up VLAN groups on end devices without having to configure the same VLAN groups on intermediary devices.

Refer to the following figure. Suppose you want to create VLAN groups 1 and 2 (V1 and V2) on devices A and B. Without **VLAN Trunking,** you must configure VLAN groups 1 and 2 on all intermediary switches C, D and E; otherwise they will drop frames with unknown VLAN group tags. However, with **VLAN Trunking** enabled on a port(s) in each intermediary switch you only need to create VLAN groups in the end devices (A and B). C, D and E automatically allow frames with VLAN group tags 1 and 2 (VLAN groups that are unknown to those switches) to pass through their VLAN trunking port(s).

Figure 25 Port VLAN Trunking



13.5 Static VLAN

Use a static VLAN to decide whether an incoming frame on a port should be

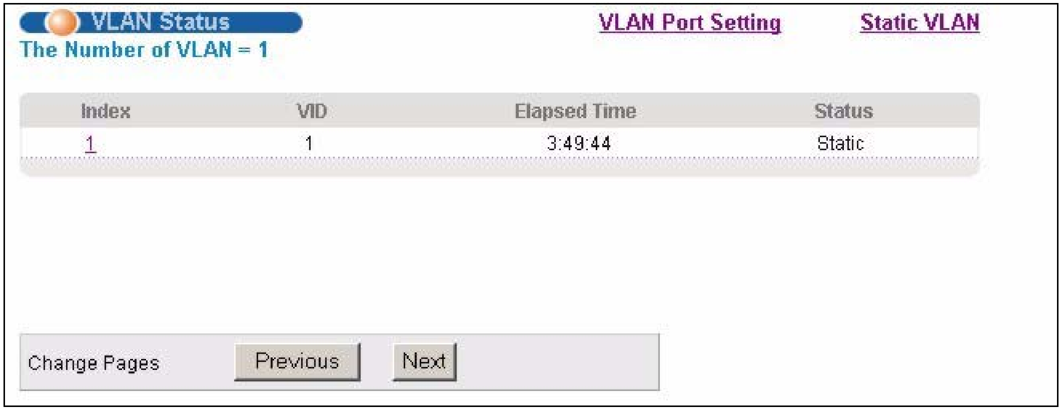
- sent to a VLAN group as normal depending on its VLAN tag.
- sent to a group whether it has a VLAN tag or not.
- blocked from a VLAN group regardless of its VLAN tag.

You can also tag all outgoing frames (that were previously untagged) from a port with the specified VID.

13.6 VLAN Status

Use this screen to look at the current status of VLANs in the system. See Section 13.2 on page 83 for background information about VLAN. To open this screen, click **Advanced Application** > **VLAN**.

Figure 26 VLAN Status



The Number of VLAN = 1

Index	VID	Elapsed Time	Status
1	1	3:49:44	Static

The following table describes the labels in this screen.

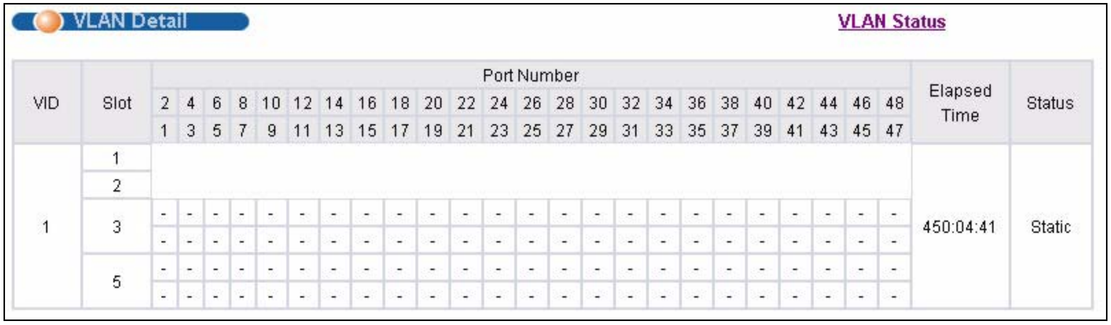
Table 16 VLAN Status

LABEL	DESCRIPTION
The Number of VLAN	This is the number of VLANs configured on the switch.
Index	This is the VLAN index number. Click on an index number to look at detailed port settings for the VLAN.
VID	This is the VLAN identification number that was configured in the **Static VLAN** screen.
Elapsed Time	This field shows how long it has been since a normal VLAN was registered or a static VLAN was set up.
Status	This field shows how this VLAN was added to the switch. **Dynamic**: The VLAN was added using GVRP. **Static**: The VLAN was added as a permanent entry. **Other**: The VLAN was added another way, such as Multicast VLAN Registration (MVR).
Change Pages	Click **Previous** or **Next** to show the previous/next screen if all status information cannot be seen in one screen.

13.6.1 VLAN Detail

Use this screen to look at detailed port settings for a VLAN. See Section 13.2 on page 83 for background information about VLAN. To open this screen, click **Advanced Application** > **VLAN**, and then click on the index number of the VLAN.

Figure 27 VLAN Detail



VLAN Detail

VLAN Status

VID	Slot	Port Number																								Elapsed Time	Status
		2	4	6	8	10	12	14	16	18	20	22	24	26	28	30	32	34	36	38	40	42	44	46	48		
		1	3	5	7	9	11	13	15	17	19	21	23	25	27	29	31	33	35	37	39	41	43	45	47		
1	1																									450:04:41	Static
	2																										
	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		
		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		
	5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		
		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		

The following table describes the labels in this screen.

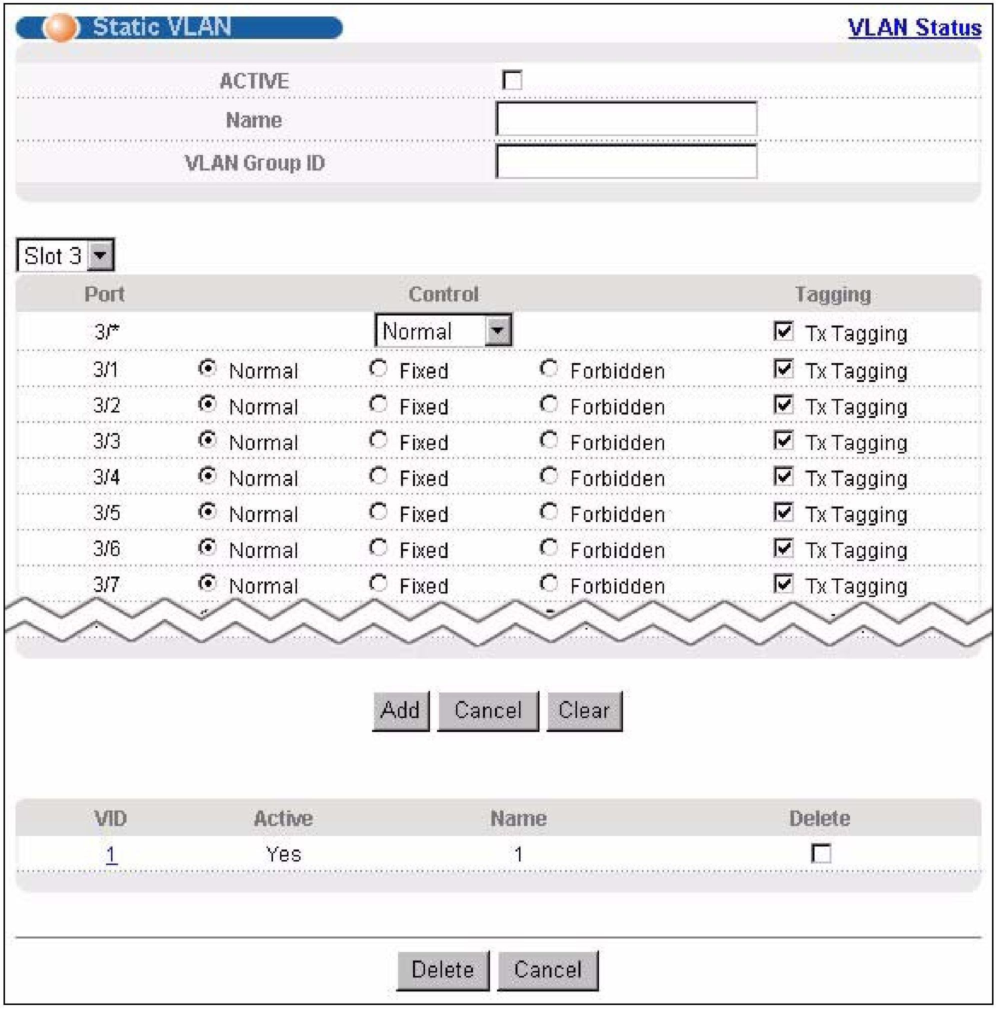
Table 17 VLAN Detail

LABEL	DESCRIPTION
VLAN Status	Click this to go to the **VLAN Status** screen.
VID	This is the VLAN identification number that was configured in the **Static VLAN** screen.
Slot	This is the number of each slot with a card in it.
Port Number	This column displays the ports that may participate in a VLAN. A tagged port is marked as **T**, an untagged port is marked as **U** and ports not participating in a VLAN are marked as "**–**".
Elapsed Time	This field shows how long it has been since a normal VLAN was registered or a static VLAN was set up.
Status	This field shows how this VLAN was added to the switch. **Dynamic**: The VLAN was added using GVRP. **Static**: The VLAN was added as a permanent entry. **Other**: The VLAN was added another way, such as Multicast VLAN Registration (MVR).

13.6.2 Static VLAN

Use this screen to look at and configure 802.1Q VLAN parameters for the switch. See Section 13.2 on page 83 for background information about VLAN. To open this screen, click **Advanced Application** > **VLAN** > **Static VLAN**.

Figure 28 Static VLAN



ACTIVE	□
Name	
VLAN Group ID	

Slot 3

Port	Control			Tagging
3/*	Normal			☑ Tx Tagging
3/1	● Normal	○ Fixed	○ Forbidden	☑ Tx Tagging
3/2	● Normal	○ Fixed	○ Forbidden	☑ Tx Tagging
3/3	● Normal	○ Fixed	○ Forbidden	☑ Tx Tagging
3/4	● Normal	○ Fixed	○ Forbidden	☑ Tx Tagging
3/5	● Normal	○ Fixed	○ Forbidden	☑ Tx Tagging
3/6	● Normal	○ Fixed	○ Forbidden	☑ Tx Tagging
3/7	● Normal	○ Fixed	○ Forbidden	☑ Tx Tagging

VID	Active	Name	Delete
1	Yes	1	□

The following table describes the related labels in this screen.

Table 18 Static VLAN

LABEL	DESCRIPTION
ACTIVE	Select this check box to activate the VLAN settings.
Name	Enter a descriptive name for the VLAN group for identification purposes.
VLAN Group ID	Enter the VLAN ID for this static entry; the valid range is between 1 and 4094.
Slot	Select the slot at whose settings you want to look.
Port	This field displays the slot number and port number.
*	Settings in this row apply to all ports. Use this row only if you want to make some settings the same for all ports. Use this row first to set the common settings and then make adjustments on a port-by-port basis. Note: Changes in this row are copied to all the ports as soon as you make them.

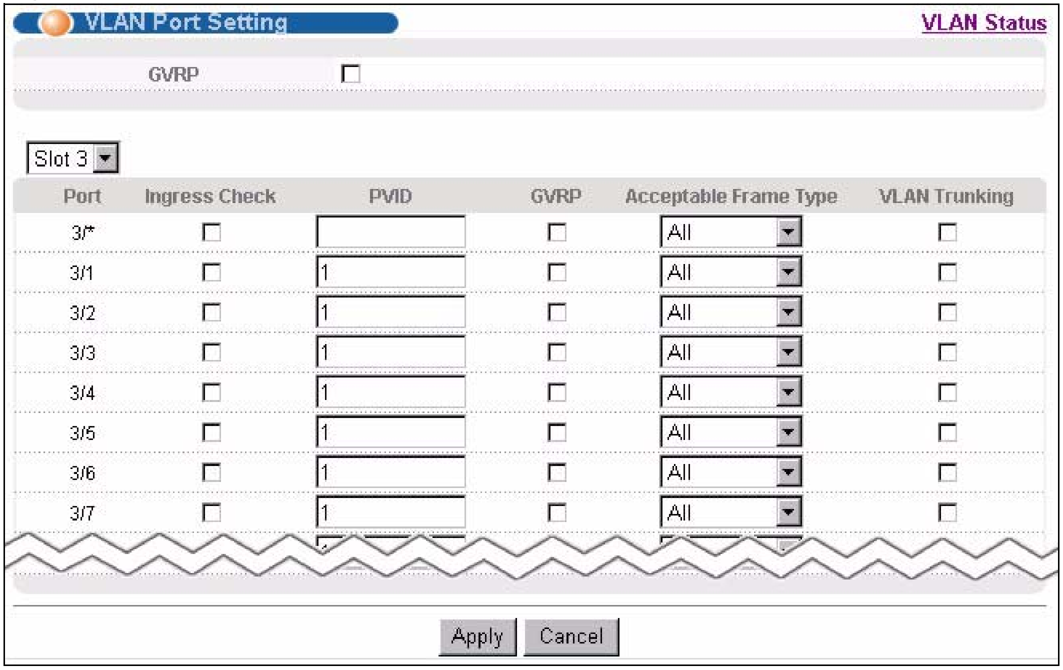
Table 18 Static VLAN (continued)

LABEL	DESCRIPTION
Control	Select **Normal** for the port to dynamically join this VLAN group using GVRP. This is the default selection. Select **Fixed** for the port to be a permanent member of this VLAN group. Select **Forbidden** if you want to prohibit the port from joining this VLAN group.
Tagging	Select **TX Tagging** if you want the port to tag all outgoing frames transmitted with this VLAN Group ID.
Add	Click **Add** to save your changes to the switch's run-time memory. The switch loses these changes if it is turned off or loses power, so use the **Save** link on the top navigation panel to save your changes to the non-volatile memory when you are done configuring.
Cancel	Click **Cancel** to reset the fields.
Clear	Click **Clear** to start configuring the screen again.
VID	This field displays the ID number of the VLAN group. Click the number to edit the VLAN settings.
Active	This field indicates whether the VLAN settings are enabled (**Yes**) or disabled (**No**).
Name	This field displays the descriptive name for this VLAN group.
Delete	Click **Delete** to remove the selected entry from the summary table.
Cancel	Click **Cancel** to clear the **Delete** check boxes.

13.6.3 VLAN Port Setting

Use this screen to configure the static VLAN (IEEE 802.1Q) settings on a port. See Section 13.2 on page 83 for background information about VLAN. To open this screen, click **Advanced Application** > **VLAN** > **VLAN Port Setting**.

Figure 29 VLAN Port Setting



VLAN Port Setting

VLAN Status

GVRP □

Slot 3 ▼

Port	Ingress Check	PVID	GVRP	Acceptable Frame Type	VLAN Trunking
3/*	□		□	All ▼	□
3/1	□	1	□	All ▼	□
3/2	□	1	□	All ▼	□
3/3	□	1	□	All ▼	□
3/4	□	1	□	All ▼	□
3/5	□	1	□	All ▼	□
3/6	□	1	□	All ▼	□
3/7	□	1	□	All ▼	□

The following table describes the labels in this screen.

Table 19 VLAN Port Setting

LABEL	DESCRIPTION
GVRP	GVRP (GARP VLAN Registration Protocol) is a registration protocol that defines a way for switches to register necessary VLAN members on ports across the network. Select this check box to permit VLAN groups beyond the local switch.
Slot	Select the slot at whose settings you want to look.
Port	This field displays the slot number and port number.
*	Settings in this row apply to all ports. Use this row only if you want to make some settings the same for all ports. Use this row first to set the common settings and then make adjustments on a port-by-port basis. Note: Changes in this row are copied to all the ports as soon as you make them.
Ingress Check	If this check box is selected for a port, the MM-7201 discards incoming frames for VLANs that do not include this port in its member set. Clear this check box to disable ingress filtering.
PVID	Enter a number between 1 and 4094 as the port VLAN ID.
GVRP	Select this check box to allow GVRP on this port.
Acceptable Frame Type	Specify the type of frames allowed on a port. Choices are **All**, **Tag Only** and **Untag 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 **Tag Only** to accept only tagged frames on this port. All untagged frames will be dropped. Select **Untag Only** to accept only untagged frames on this port. All tagged frames will be dropped.
VLAN Trunking	Enable **VLAN Trunking** on ports connected to other switches or routers (but not ports directly connected to end users) to allow frames belonging to unknown VLAN groups to pass through the switch.
Apply	Click **Apply** to save your changes to the switch's run-time memory. The switch loses these changes if it is turned off or loses power, so use the **Save** link on the top navigation panel to save your changes to the non-volatile memory when you are done configuring.
Cancel	Click **Cancel** to reset the fields.

14

Static MAC Forward Setup

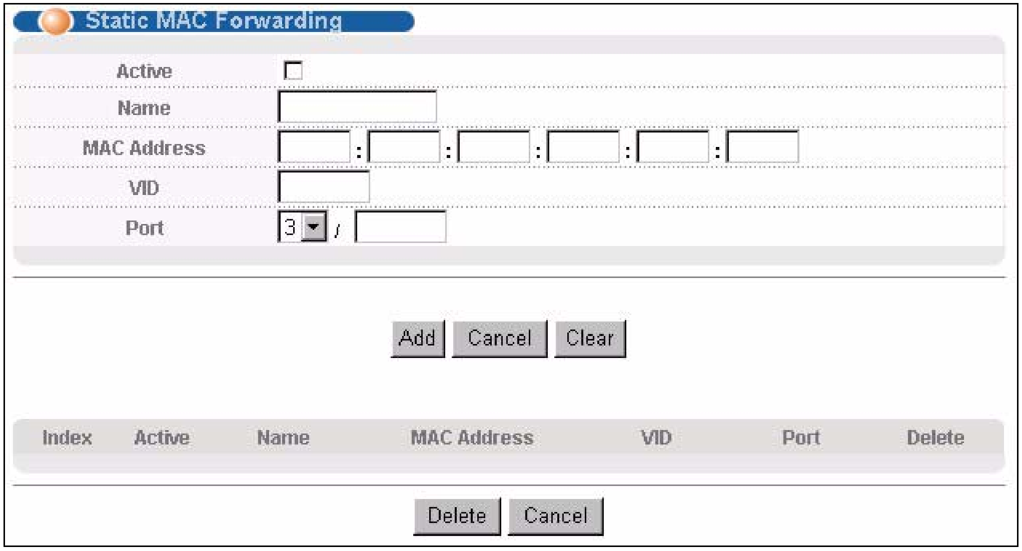
14.1 Static MAC Forwarding

A static 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.

Static MAC address forwarding together with port security allow only computers in the MAC address table on a port to access the switch. See Chapter 22 on page 121 for more information on port security.

Use this screen to configure static MAC address forwarding. To open this screen, click **Advanced Application** > **Static MAC Forwarding**.

Figure 30 Static MAC Forwarding



The following table describes the labels in this screen.

Table 20 Static MAC Forwarding

LABEL	DESCRIPTION
Active	Select this check box to activate your rule. You may temporarily deactivate a rule without deleting it by clearing this check box.
Name	Enter a descriptive name for identification purposes for this static MAC address forwarding rule.

Table 20 Static MAC Forwarding (continued)

LABEL	DESCRIPTION
MAC Address	Enter the MAC address in valid MAC address format, that is, six hexadecimal character pairs. Note: Static MAC addresses do not age out.
VID	Enter the VLAN identification number.
Port	Select the slot and enter the port where the MAC address entered in the previous field will be automatically forwarded.
Add	Click **Add** to save your rule to the switch's run-time memory. The switch loses this rule if it is turned off or loses power, so use the **Save** link on the top navigation panel to save your changes to the non-volatile memory when you are done configuring.
Cancel	Click **Cancel** to reset the fields.
Clear	Click **Clear** to begin configuring this screen afresh.
Index	Click an index number to modify a static MAC address rule for a port.
Active	This field displays whether this static MAC address forwarding rule is active (**Yes**) or not (**No**). You may temporarily deactivate a rule without deleting it.
Name	This field displays the descriptive name for identification purposes for this static MAC address-forwarding rule.
MAC Address	This field displays the MAC address that will be forwarded and the VLAN identification number to which the MAC address belongs.
VID	This field displays the ID number of the VLAN group.
Port	This field displays the port where the MAC address shown in the next field will be forwarded.
Delete	Click **Delete** to remove the selected entry from the summary table.
Cancel	Click **Cancel** to clear the **Delete** check boxes.

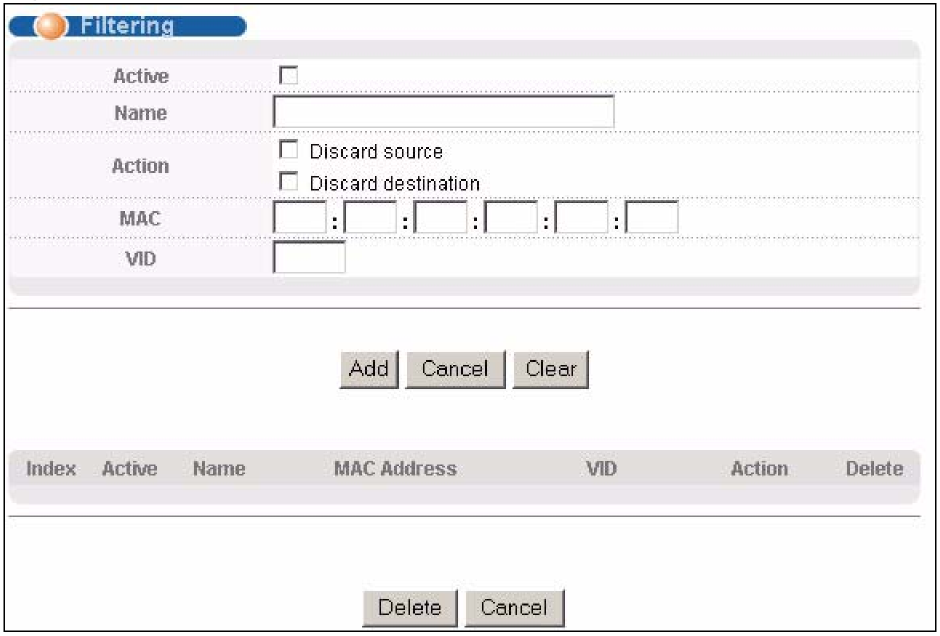
15

Filtering

15.1 Filtering

Use this screen to drop frames based on the source MAC address, destination MAC address, and/or VLAN ID. To open this screen, click **Advanced Application** > **Filtering**.

Figure 31 Filtering



The following table describes the related labels in this screen.

Table 21 Filtering

LABEL	DESCRIPTION
Active	Make sure to select this check box to activate your rule. You may temporarily deactivate a rule without deleting it by deselecting this check box.
Name	Type a descriptive name (up to 32 printable English keyboard characters) for this rule. This is for identification only.
Action	Select **Discard source** to drop frame from the source MAC address (specified in the **MAC** field). The switch can still send frames to the MAC address. Select **Discard destination** to drop frames to the destination MAC address (specified in the **MAC** address). The switch can still receive frames originating from the MAC address. Select **Discard source** and **Discard destination** to block traffic to/from the MAC address specified in the **MAC** field.

Table 21 Filtering (continued)

LABEL	DESCRIPTION
MAC	Type a MAC address in valid MAC address format, that is, six hexadecimal character pairs.
VID	Type the VLAN group identification number.
Add	Click **Add** to save your changes to the switch's run-time memory. The switch loses these changes if it is turned off or loses power, so use the **Save** link on the top navigation panel to save your changes to the non-volatile memory when you are done configuring.
Cancel	Click **Cancel** to reset the fields to your previous configuration.
Clear	Click **Clear** to clear the fields to the factory defaults.
Index	This field displays the index number of the rule. Click an index number to change the settings.
Active	This field displays **Yes** when the rule is activated and **No** when is it deactivated.
Name	This field displays the descriptive name for this rule. This is for identification purpose only.
MAC Address	This field displays the source/destination MAC address with the VLAN identification number to which the MAC address belongs.
VID	This field displays the VLAN group identification number.
Delete	Check the rule(s) that you want to remove in the **Delete** column and then click the **Delete** button.
Cancel	Click **Cancel** to clear the selected checkbox(es) in the **Delete** column.

16

Spanning Tree Protocol

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 also allows you to set up multiple STP configurations (or trees). Ports can then be assigned to the trees.

16.1 STP/RSTP Overview

(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 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 that then notifies the network. Both RSTP and STP flush unwanted learned addresses from the filtering database. In RSTP, the port states are Discarding, Learning, and Forwarding.

In this user’s guide, “STP” refers to both STP and RSTP.

16.1.1 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. It is assigned according to the speed of the link to which a port is attached. The slower the media, the higher the cost.

Table 22 STP Path Costs

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

On each bridge, the root port is the port through which this bridge communicates with the root. It 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.

16.1.2 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.

16.1.3 STP Port States

STP assigns five port states to eliminate packet looping. A bridge port is not allowed to go directly from blocking state to forwarding state so as to eliminate transient loops.

Table 23 STP Port States

PORT STATE	DESCRIPTION
Disabled	STP is disabled (default).
Blocking	Only configuration and management BPDUs are received and processed.
Listening	All BPDUs are received and processed.
Learning	All BPDUs are received and processed. Information frames are submitted to the learning process but not forwarded.
Forwarding	All BPDUs are received and processed. All information frames are received and forwarded.

16.1.4 Multiple RSTP

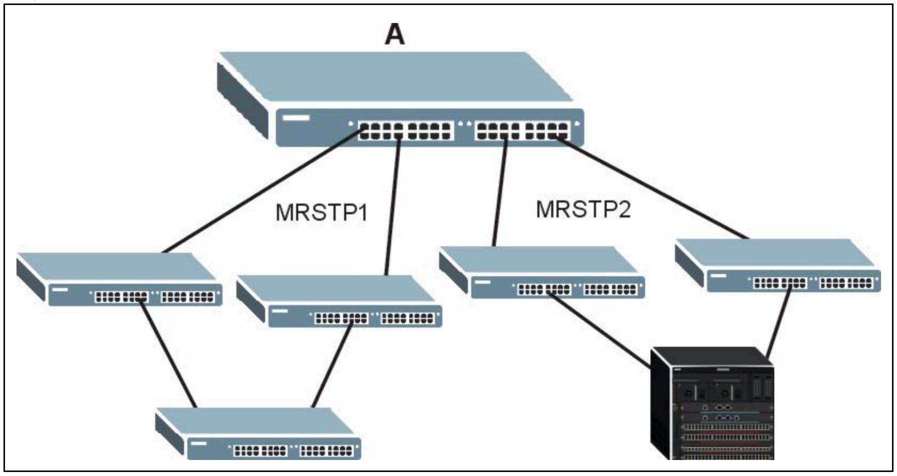
MRSTP (Multiple RSTP) is ZyXEL’s proprietary feature that is compatible with RSTP and STP. With MRSTP, you can have more than one spanning tree on your switch and assign port(s) to each tree. Each spanning tree operates independently with its own bridge information.

In the following example, there are two RSTP instances (**MRSTP 1** and **MRSTP2**) on switch **A**.

To set up MRSTP, activate MRSTP on the switch and specify which port(s) belong to which spanning tree.

Each port can belong to one STP tree only.

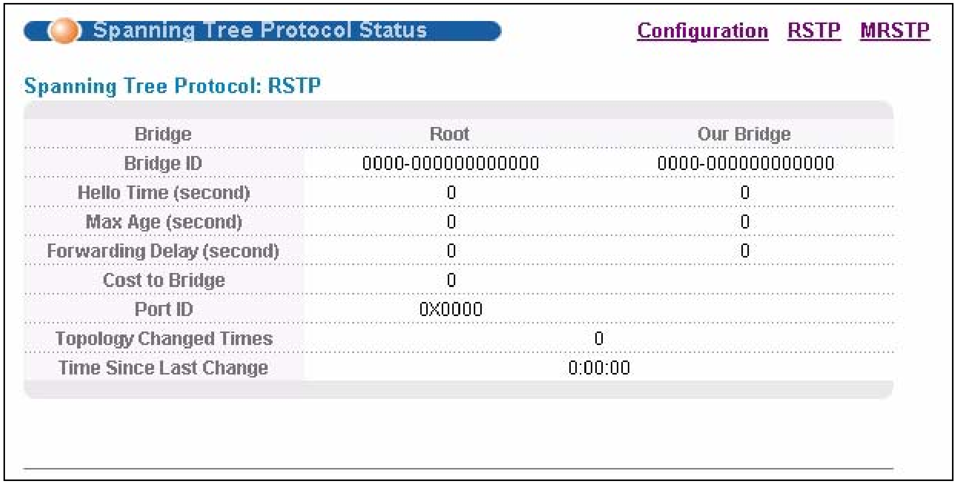
Figure 32 MRSTP Network Example



16.2 Spanning Tree Protocol Status Screen

The Spanning Tree Protocol status screen changes depending on what standard you choose to implement on your network. Click **Advanced Application** > **Spanning Tree Protocol** to see the screen as shown.

Figure 33 Advanced Application > Spanning Tree Protocol



Spanning Tree Protocol: RSTP

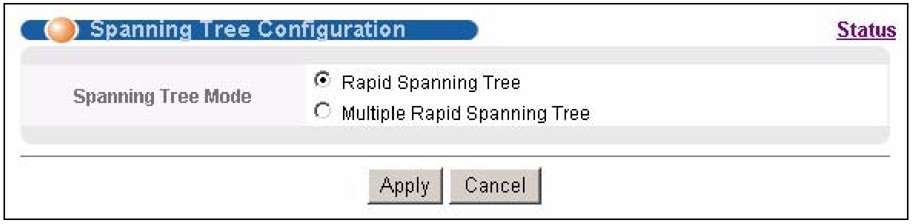
Bridge	Root	Our Bridge
Bridge ID	0000-000000000000	0000-000000000000
Hello Time (second)	0	0
Max Age (second)	0	0
Forwarding Delay (second)	0	0
Cost to Bridge	0	
Port ID	0X0000	
Topology Changed Times	0	
Time Since Last Change	0:00:00	

This screen differs depending on which STP mode (RSTP or MRSTP) you configure on the MM-7201. This screen is described in detail in the section that follows the configuration section for each STP mode. Click **Configuration** to activate one of the STP standards on the MM-7201.

16.3 Spanning Tree Configuration

Use the **Spanning Tree Configuration** screen to activate one of the STP modes on the MM-7201. Click **Configuration** in the **Advanced Application** > **Spanning Tree Protocol**.

Figure 34 Advanced Application > Spanning Tree Protocol > Configuration



Spanning Tree Mode
● Rapid Spanning Tree
○ Multiple Rapid Spanning Tree

The following table describes the labels in this screen.

Table 24 Advanced Application > Spanning Tree Protocol > Configuration

LABEL	DESCRIPTION
Spanning Tree Mode	You can activate one of the STP modes on the switch. Select **Rapid Spanning Tree** or **Multiple Rapid Spanning Tree**. See Section 16.1 on page 95 for background information on STP.

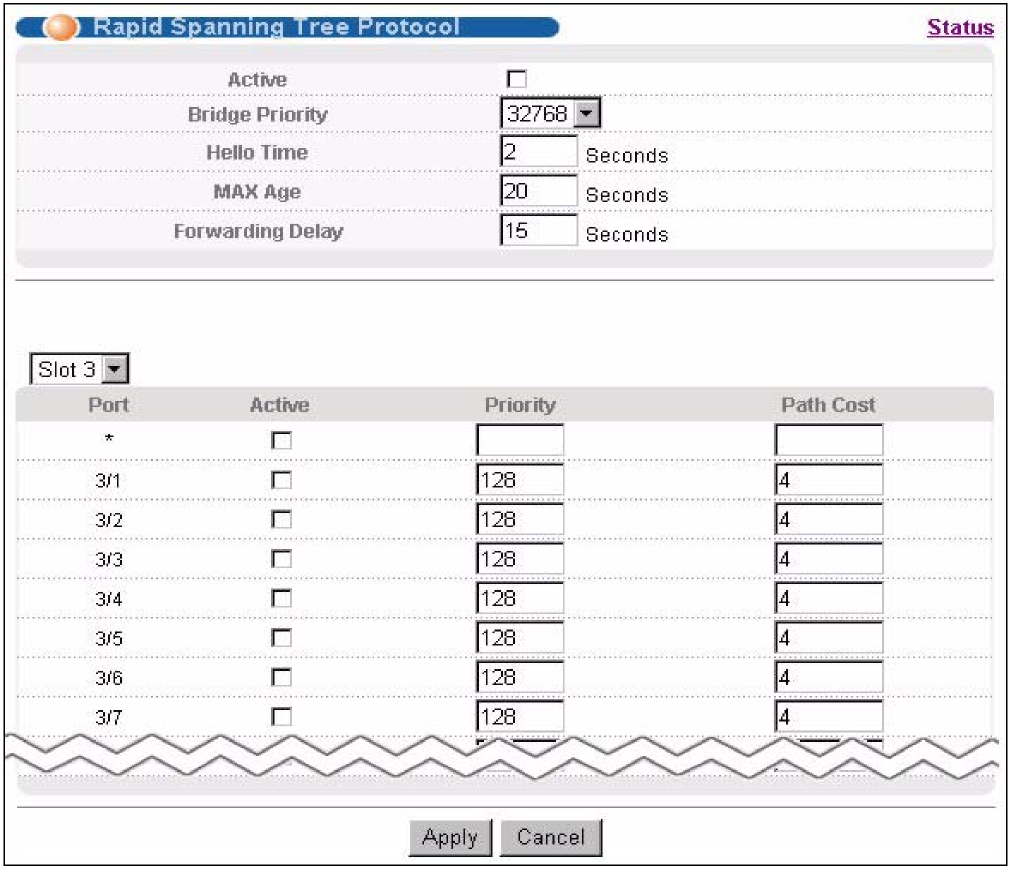
Table 24 Advanced Application > Spanning Tree Protocol > Configuration (continued)

LABEL	DESCRIPTION
Apply	Click **Apply** to save your changes to the switch's run-time memory. The switch loses these changes if it is turned off or loses power, so use the **Save** link on the top navigation panel to save your changes to the non-volatile memory when you are done configuring.
Cancel	Click **Cancel** to begin configuring this screen afresh.

16.4 Rapid Spanning Tree Protocol

Use this screen to configure RSTP on the switch. See Section 16.1 on page 95 for background information about RSTP. To open this screen, click **Advanced Application** > **Spanning Tree Protocol** > **RSTP**.

Figure 35 Rapid Spanning Tree Protocol



Rapid Spanning Tree Protocol

Status

Active	□
Bridge Priority	32768 ▾
Hello Time	2 Seconds
MAX Age	20 Seconds
Forwarding Delay	15 Seconds

Slot 3 ▾

Port	Active	Priority	Path Cost
*	□		
3/1	□	128	4
3/2	□	128	4
3/3	□	128	4
3/4	□	128	4
3/5	□	128	4
3/6	□	128	4
3/7	□	128	4

The following table describes the labels in this screen.

Table 25 Rapid Spanning Tree Protocol

LABEL	DESCRIPTION
Status	Click **Status** to display the **RSTP Status** screen. See Figure 36 on page 101.
Active	Select this to activate RSTP. Clear this to disable RSTP.

Table 25 Rapid Spanning Tree Protocol (continued)

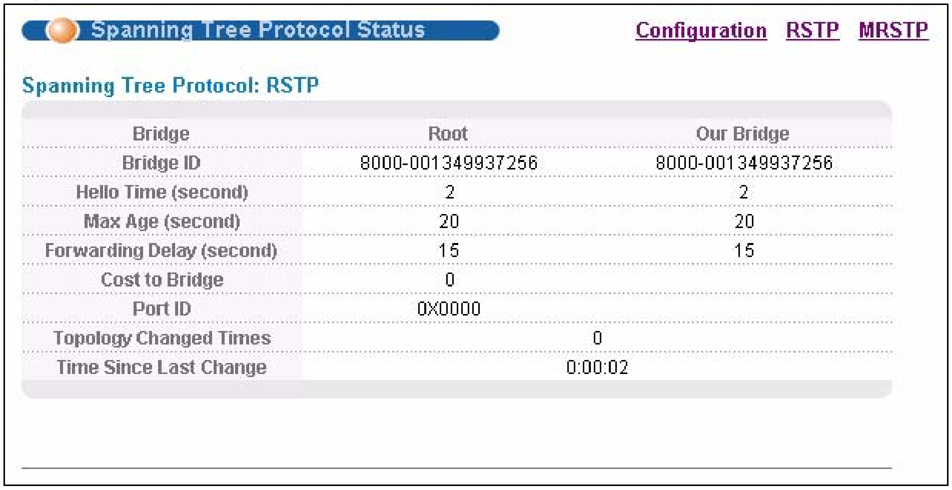
LABEL	DESCRIPTION
Bridge Priority	Bridge priority is used in determining the root switch, root port and designated port. The switch with the highest priority (lowest numeric value) becomes the STP root switch. If all switches have the same priority, the switch with the lowest MAC address will then become the root switch. Select a value from the drop-down list box. The lower the numeric value you assign, the higher the priority for this bridge. Bridge Priority determines the root bridge, which in turn determines Hello Time, Max Age and Forwarding Delay.
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.
Max Age	This is the maximum time (in seconds) a 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.
Forwarding Delay	This is the maximum time (in seconds) a 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. As a general rule: Note: 2 * (Forward Delay - 1) >= Max Age >= 2 * (Hello Time + 1)
Slot	Select the slot at whose settings you want to look.
Port	This field displays the slot number and port number.
*	Settings in this row apply to all ports. Use this row only if you want to make some settings the same for all ports. Use this row first to set the common settings and then make adjustments on a port-by-port basis. Note: Changes in this row are copied to all the ports as soon as you make them.
Active	Select this check box to activate RSTP on this port.
Priority	Configure the priority for each port here. Priority decides which port should be disabled when more than one port forms a loop in a switch. Ports with a higher priority numeric value are disabled first. The allowed range is between 0 and 255.
Path Cost	Path cost is the cost of transmitting a frame on to a LAN through that port. It is assigned according to the speed of the bridge. The slower the media, the higher the cost. See Table 22 on page 96 for more information.
Apply	Click **Apply** to save your changes to the switch's run-time memory. The switch loses these changes if it is turned off or loses power, so use the **Save** link on the top navigation panel to save your changes to the non-volatile memory when you are done configuring.
Cancel	Click **Cancel** to reset the fields.

16.5 Rapid Spanning Tree Protocol Status

Use this screen to look at the status of RSTP on the switch. See Section 16.1 on page 95 for background information about RSTP. To open this screen, click **Advanced Application** > **Spanning Tree Protocol**.

This screen is only available after you activate RSTP on the switch.

Figure 36 Rapid Spanning Tree Protocol Status



Spanning Tree Protocol: RSTP

Bridge	Root	Our Bridge
Bridge ID	8000-001349937256	8000-001349937256
Hello Time (second)	2	2
Max Age (second)	20	20
Forwarding Delay (second)	15	15
Cost to Bridge	0	
Port ID	0X0000	
Topology Changed Times	0	
Time Since Last Change	0:00:02	

The following table describes the labels in this screen.

Table 26 Rapid Spanning Tree Protocol Status

LABEL	DESCRIPTION
Configuration	Click **Configuration** to specify which STP mode you want to activate. Click **RSTP** to edit RSTP settings on the switch.
Bridge	**Root** refers to the base of the spanning tree (the root bridge). **Our Bridge** is this switch. This switch may also be the root bridge.
Bridge ID	This is the unique identifier for this bridge, consisting of bridge priority plus MAC address. This ID is the same for **Root** and **Our Bridge** if the switch is the root switch.
Hello Time (second)	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**
Max Age (second)	This is the maximum time (in seconds) a switch can wait without receiving a configuration message before attempting to reconfigure.
Forwarding Delay (second)	This is the time (in seconds) the root switch will wait before changing states (that is, listening to learning to forwarding).
Cost to Bridge	This is the path cost from the root port on this switch to the root switch.
Port ID	This is the priority and number of the port on the switch through which this switch must communicate with the root of the Spanning Tree.

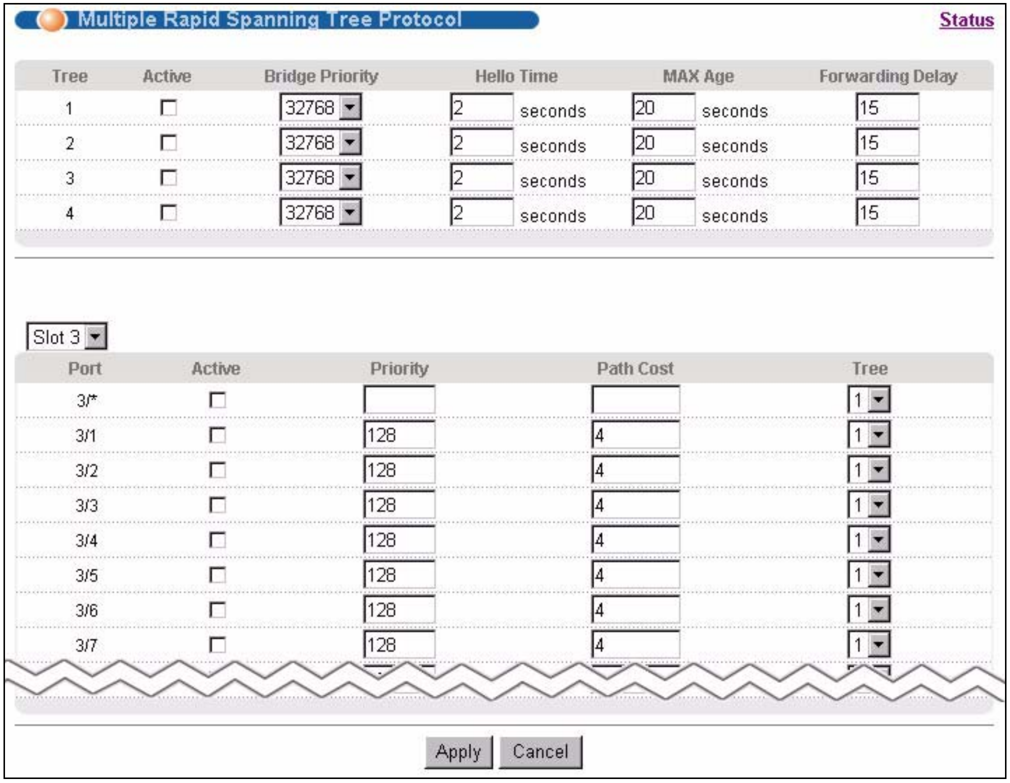
Table 26 Rapid Spanning Tree Protocol Status (continued)

LABEL	DESCRIPTION
Topology Changed Times	This is the number of times the spanning tree has been reconfigured.
Time Since Last Change	This is the time since the spanning tree was last reconfigured.

16.6 Multiple Rapid Spanning Tree Protocol

Use this screen to configure MRSTP on the switch. See Section 16.1 on page 95 for background information about MRSTP. To open this screen, click **Advanced Application** > **Spanning Tree Protocol** > **MRSTP**.

Figure 37 Multiple Rapid Spanning Tree Protocol



Tree	Active	Bridge Priority	Hello Time	MAX Age	Forwarding Delay
1	□	32768	2 seconds	20 seconds	15
2	□	32768	2 seconds	20 seconds	15
3	□	32768	2 seconds	20 seconds	15
4	□	32768	2 seconds	20 seconds	15

Slot 3

Port	Active	Priority	Path Cost	Tree
3/*	□			1
3/1	□	128	4	1
3/2	□	128	4	1
3/3	□	128	4	1
3/4	□	128	4	1
3/5	□	128	4	1
3/6	□	128	4	1
3/7	□	128	4	1

The following table describes the labels in this screen.

Table 27 Multiple Rapid Spanning Tree Protocol

LABEL	DESCRIPTION
Status	Click **Status** to display the **MRSTP Status** screen. See Figure 38 on page 104.
Tree	This is a read only index number of the STP trees.
Active	Select this to activate an STP tree. Clear this to disable an STP tree. Note: You must also activate **Multiple Rapid Spanning Tree** in the **Advanced Application** > **Spanning Tree Protocol** > **Configuration** screen to enable MRSTP on the switch.

Table 27 Multiple Rapid Spanning Tree Protocol (continued)

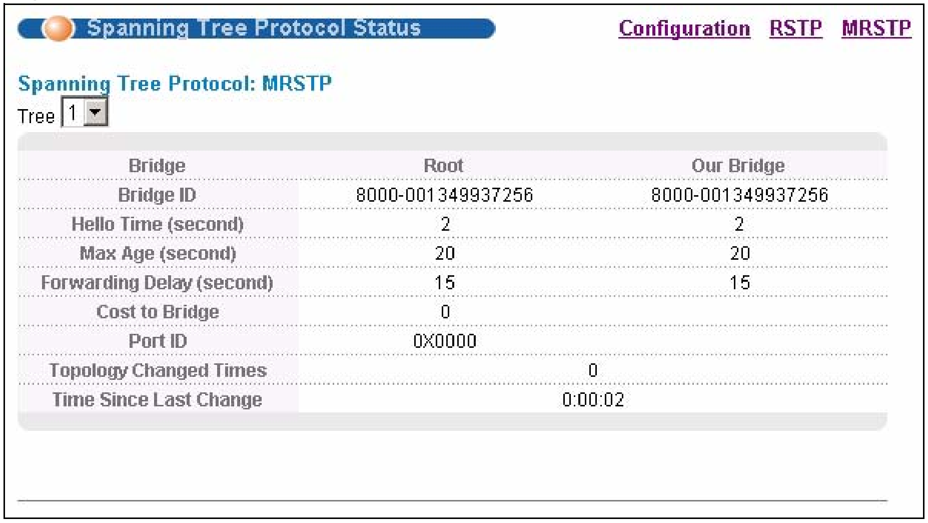
LABEL	DESCRIPTION
Bridge Priority	Bridge priority is used in determining the root switch, root port and designated port. The switch with the highest priority (lowest numeric value) becomes the STP root switch. If all switches have the same priority, the switch with the lowest MAC address will then become the root switch. Select a value from the drop-down list box. The lower the numeric value you assign, the higher the priority for this bridge. Bridge Priority determines the root bridge, which in turn determines Hello Time, Max Age and Forwarding Delay.
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.
Max Age	This is the maximum time (in seconds) a 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.
Forwarding Delay	This is the maximum time (in seconds) a 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. As a general rule: Note: 2 * (Forward Delay - 1) >= Max Age >= 2 * (Hello Time + 1)
Slot	Select the slot at whose settings you want to look.
Port	This field displays the slot number and port number.
*	Settings in this row apply to all ports. Use this row only if you want to make some settings the same for all ports. Use this row first to set the common settings and then make adjustments on a port-by-port basis. Note: Changes in this row are copied to all the ports as soon as you make them.
Active	Select this check box to activate STP on this port.
Priority	Configure the priority for each port here. Priority decides which port should be disabled when more than one port forms a loop in a switch. Ports with a higher priority numeric value are disabled first. The allowed range is between 0 and 255.
Path Cost	Path cost is the cost of transmitting a frame on to a LAN through that port. It is assigned according to the speed of the bridge. The slower the media, the higher the cost. See Table 22 on page 96 for more information.
Tree	Select which STP tree configuration this port should participate in.
Apply	Click **Apply** to save your changes to the switch’s run-time memory. The switch loses these changes if it is turned off or loses power, so use the **Save** link on the top navigation panel to save your changes to the non-volatile memory when you are done configuring.
Cancel	Click **Cancel** to reset the fields.

16.7 Multiple Rapid Spanning Tree Protocol Status

Use this screen to look at the status of MRSTP on the switch. See Section 16.1 on page 95 for background information about MRSTP. To open this screen, click **Advanced Application** > **Spanning Tree Protocol**.

This screen is only available after you activate MRSTP on the switch.

Figure 38 Multiple Rapid Spanning Tree Protocol Status



Spanning Tree Protocol: MRSTP

Tree 1

Bridge	Root	Our Bridge
Bridge ID	8000-001349937256	8000-001349937256
Hello Time (second)	2	2
Max Age (second)	20	20
Forwarding Delay (second)	15	15
Cost to Bridge	0	
Port ID	0X0000	
Topology Changed Times	0	
Time Since Last Change	0:00:02	

The following table describes the labels in this screen.

Table 28 Multiple Rapid Spanning Tree Protocol Status

LABEL	DESCRIPTION
Configuration	Click **Configuration** to specify which STP mode you want to activate. Click **MRSTP** to edit MRSTP settings on the switch.
Tree	Select which STP tree configuration you want to view.
Bridge	**Root** refers to the base of the spanning tree (the root bridge). **Our Bridge** is this switch. This switch may also be the root bridge.
Bridge ID	This is the unique identifier for this bridge, consisting of bridge priority plus MAC address. This ID is the same for **Root** and **Our Bridge** if the switch is the root switch.
Hello Time (second)	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**
Max Age (second)	This is the maximum time (in seconds) a switch can wait without receiving a configuration message before attempting to reconfigure.
Forwarding Delay (second)	This is the time (in seconds) the root switch will wait before changing states (that is, listening to learning to forwarding).
Cost to Bridge	This is the path cost from the root port on this switch to the root switch.
Port ID	This is the priority and number of the port on the switch through which this switch must communicate with the root of the Spanning Tree.

Table 28 Multiple Rapid Spanning Tree Protocol Status (continued)

LABEL	DESCRIPTION
Topology Changed Times	This is the number of times the spanning tree has been reconfigured.
Time Since Last Change	This is the time since the spanning tree was last reconfigured.

17

Bandwidth Control

This chapter introduces Committed Information Rate (CIR) and Peak Information Rate (PIR) and then shows you how to configure the maximum allowable bandwidth for incoming (ingress) and outgoing (egress) traffic flows on a port.

17.1 CIR and PIR

The Committed Information Rate (CIR) is the guaranteed bandwidth for the incoming traffic flow on a port. The Peak Information Rate (PIR) is the maximum bandwidth allowed for the incoming traffic flow on a port when there is no network congestion.

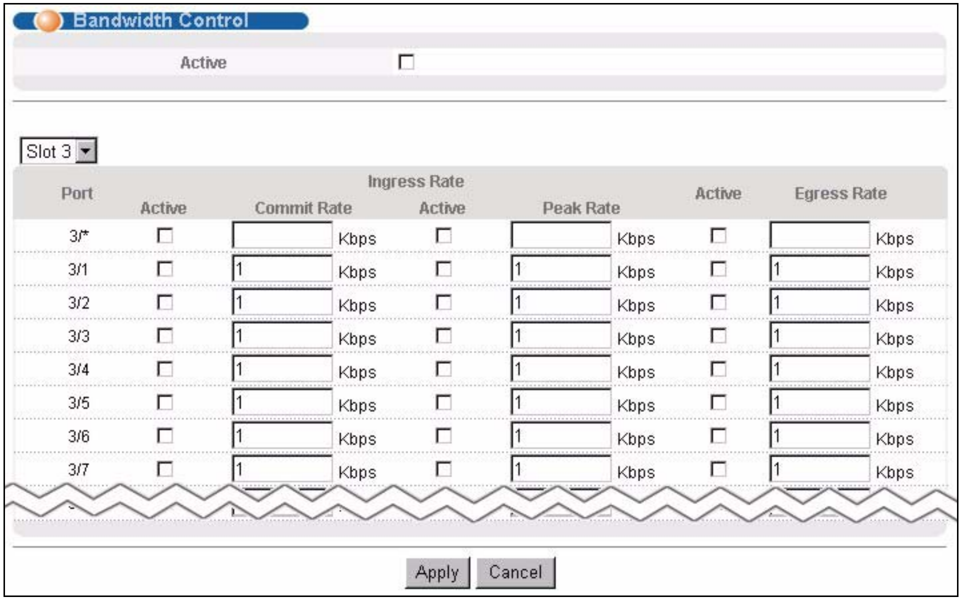
The CIR and PIR should be set for all ports that use the same uplink bandwidth. If the CIR is reached, packets are sent at the rate up to the PIR. When network congestion occurs, packets through the ingress port exceeding the CIR will be marked for drop.

✍ The CIR should be less than the PIR, and the sum of CIRs cannot be greater than or equal to the uplink bandwidth.

17.2 Bandwidth Control

Use this screen to specify the guaranteed bandwidth and maximum bandwidth for incoming (ingress) traffic on a port and to specify the maximum bandwidth for outgoing (egress) traffic on a port. To open this screen, click **Advanced Application** > **Bandwidth Control**.

Figure 39 Bandwidth Control



Bandwidth Control

Active □

Slot 3 ▾

Port	Ingress Rate				Active	Egress Rate
	Active	Commit Rate	Active	Peak Rate		
3/*	□	Kbps	□	Kbps	□	Kbps
3/1	□	1 Kbps	□	1 Kbps	□	1 Kbps
3/2	□	1 Kbps	□	1 Kbps	□	1 Kbps
3/3	□	1 Kbps	□	1 Kbps	□	1 Kbps
3/4	□	1 Kbps	□	1 Kbps	□	1 Kbps
3/5	□	1 Kbps	□	1 Kbps	□	1 Kbps
3/6	□	1 Kbps	□	1 Kbps	□	1 Kbps
3/7	□	1 Kbps	□	1 Kbps	□	1 Kbps

The following table describes the related labels in this screen.

Table 29 Bandwidth Control

LABEL	DESCRIPTION
Active	Select this check box to enable bandwidth control on the switch.
Slot	Select the slot at whose settings you want to look.
Port	This field displays the slot number and port number.
*	Settings in this row apply to all ports. Use this row only if you want to make some settings the same for all ports. Use this row first to set the common settings and then make adjustments on a port-by-port basis. Note: Changes in this row are copied to all the ports as soon as you make them.
Ingress Rate	
Active	Select this check box to activate commit rate limits on this port.
Commit Rate	Specify the guaranteed bandwidth allowed in kilobits per second (Kbps) for the incoming traffic flow on a port. The commit rate should be less than the peak rate. The sum of commit rates cannot be greater than or equal to the uplink bandwidth.
Active	Select this check box to activate peak rate limits on this port.
Peak Rate	Specify the maximum bandwidth allowed in kilobits per second (Kbps) for the incoming traffic flow on a port.
Active	Select this check box to activate egress rate limits on this port.
Egress Rate	Specify the maximum bandwidth allowed in kilobits per second (Kbps) for the out-going traffic flow on a port.
Apply	Click **Apply** to save your changes to the switch’s run-time memory. The switch loses these changes if it is turned off or loses power, so use the **Save** link on the top navigation panel to save your changes to the non-volatile memory when you are done configuring.
Cancel	Click **Cancel** to reset the fields.

18

Broadcast Storm Control

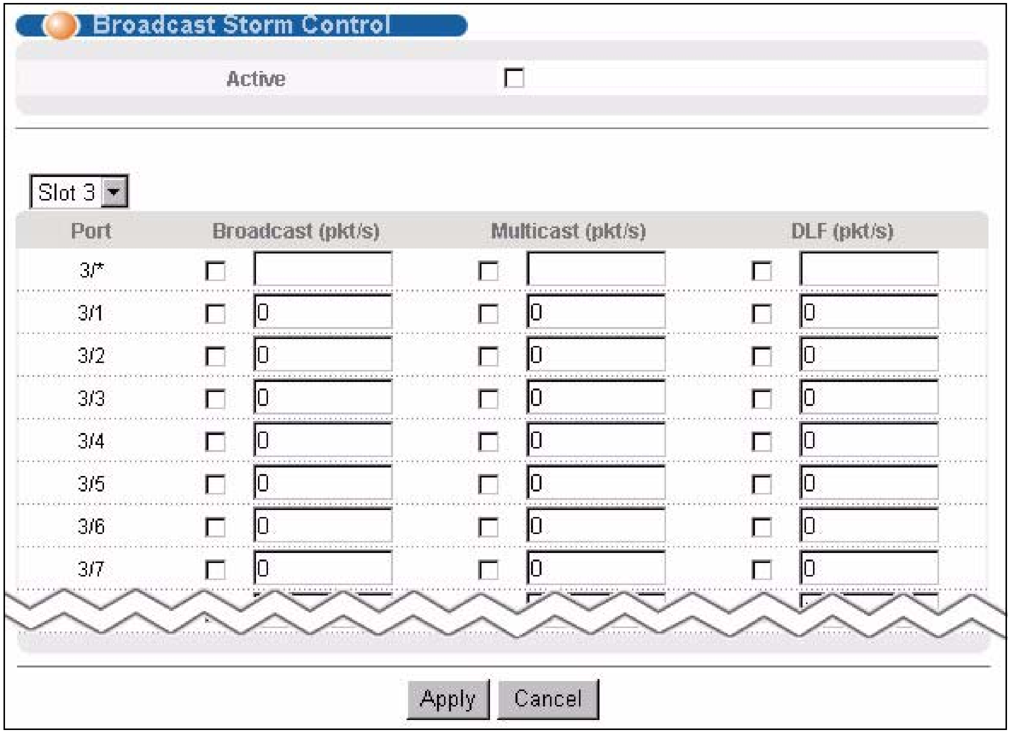
This chapter introduces and shows you how to configure the broadcast storm control feature.

18.1 Broadcast Storm Control

Use this screen to limit the number of broadcast, multicast and destination lookup failure (DLF) packets the switch receives per second on the ports. When the maximum number of allowable broadcast, multicast and/or DLF packets is reached per second, the subsequent packets are discarded. Enable this feature to reduce broadcast, multicast and/or DLF packets in your network. You can specify limits for each packet type on each port.

To open this screen, click **Advanced Application** > **Broadcast Storm Control**.

Figure 40 Broadcast Storm Control



Broadcast Storm Control

Active □

Slot 3

Port	Broadcast (pkt/s)		Multicast (pkt/s)		DLF (pkt/s)	
3/*	□		□		□	
3/1	□	0	□	0	□	0
3/2	□	0	□	0	□	0
3/3	□	0	□	0	□	0
3/4	□	0	□	0	□	0
3/5	□	0	□	0	□	0
3/6	□	0	□	0	□	0
3/7	□	0	□	0	□	0

The following table describes the labels in this screen.

Table 30 Broadcast Storm Control

LABEL	DESCRIPTION
Active	Select this check box to enable traffic storm control on the switch. Clear this check box to disable this feature.
Slot	Select the slot at whose settings you want to look.
Port	This field displays the slot number and port number.
*	Settings in this row apply to all ports. Use this row only if you want to make some settings the same for all ports. Use this row first to set the common settings and then make adjustments on a port-by-port basis. Note: Changes in this row are copied to all the ports as soon as you make them.
Broadcast (pkt/s)	Select this option and specify how many broadcast packets the port receives per second.
Multicast (pkt/s)	Select this option and specify how many multicast packets the port receives per second.
DLF (pkt/s)	Select this option and specify how many destination lookup failure (DLF) packets the port receives per second.
Apply	Click **Apply** to save your changes to the switch's run-time memory. The switch loses these changes if it is turned off or loses power, so use the **Save** link on the top navigation panel to save your changes to the non-volatile memory when you are done configuring.
Cancel	Click **Cancel** to reset the fields.

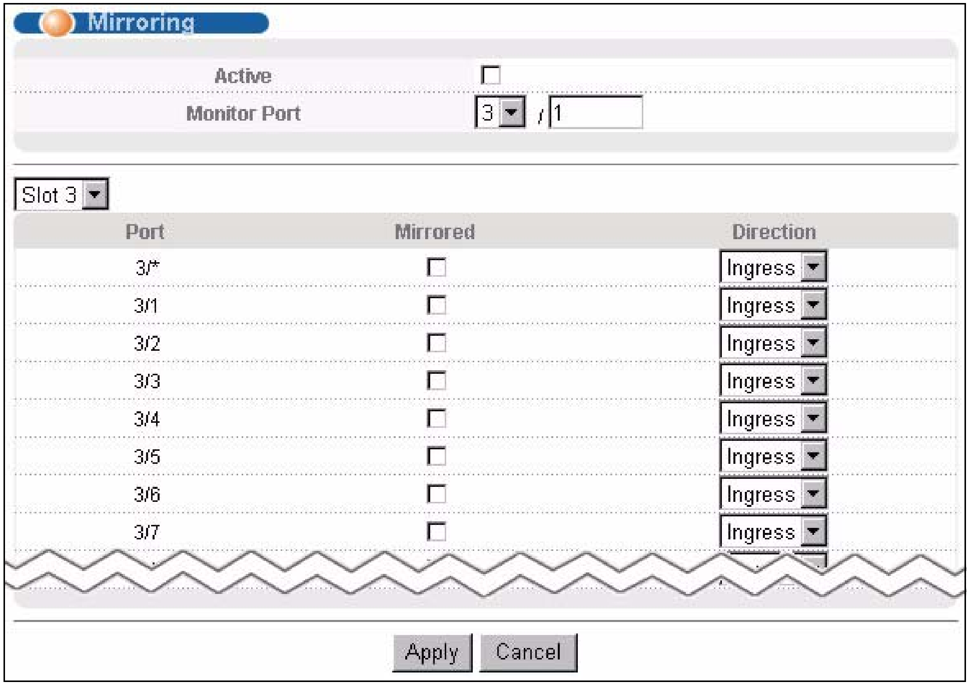
19

Mirroring

19.1 Mirroring

Use this screen to copy (“mirror”) traffic from one or more ports to a specified monitor port. You can examine the traffic on the monitor port without interfering with regular traffic flow. To open this screen, click **Advanced Application** > **Mirroring**.

Figure 41 Mirroring



Mirroring

Active □

Monitor Port 3 / 1

Slot 3

Port	Mirrored	Direction
3/*	□	Ingress
3/1	□	Ingress
3/2	□	Ingress
3/3	□	Ingress
3/4	□	Ingress
3/5	□	Ingress
3/6	□	Ingress
3/7	□	Ingress

The following table describes the labels in this screen.

Table 31 Mirroring

LABEL	DESCRIPTION
Active	Select this check box to activate port mirroring on the switch. Clear this check box to disable the feature.
Monitor Port	The monitor port is the port you copy the traffic to in order to examine it in more detail without interfering with the traffic flow on the original port(s). Select the slot, and enter the port number of the monitor port. Select **None** if this port is not yet configured.
Slot	Select the slot at whose settings you want to look.
Port	This field displays the slot number and port number.

Table 31 Mirroring (continued)

LABEL	DESCRIPTION
*	Settings in this row apply to all ports. Use this row only if you want to make some settings the same for all ports. Use this row first to set the common settings and then make adjustments on a port-by-port basis. Note: Changes in this row are copied to all the ports as soon as you make them.
Mirrored	Select this option to mirror the traffic on a port.
Direction	Specify the direction of the traffic to mirror by selecting from the drop-down list box. Choices are **Egress** (outgoing), **Ingress** (incoming) and **Both**.
Apply	Click **Apply** to save your changes to the switch's run-time memory. The switch loses these changes if it is turned off or loses power, so use the **Save** link on the top navigation panel to save your changes to the non-volatile memory when you are done configuring.
Cancel	Click **Cancel** to reset the fields.

20

Link Aggregation

This chapter shows you how to logically aggregate physical links to form one logical, higher-bandwidth link.

20.1 Link Aggregation Overview

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 beginning port of each trunk group must be physically connected to form a trunk group.

20.2 Dynamic Link Aggregation

The switch adheres to the IEEE 802.3ad standard for static and dynamic (LACP) port trunking.

The switch supports the link aggregation IEEE 802.3ad standard. This standard describes the Link Aggregate Control Protocol (LACP), which is a protocol that dynamically creates and manages 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, duplex mode and flow control settings.

Configure trunk groups or LACP before you connect the Ethernet switch to avoid causing network topology loops.

20.2.1 Link Aggregation ID

LACP aggregation ID consists of the following information[1]:

Table 32 Link Aggregation ID: Local Switch

SYSTEM PRIORITY	MAC ADDRESS	KEY	PORT PRIORITY	PORT NUMBER
0000	00-00-00-00-00-00	0000	00	0000

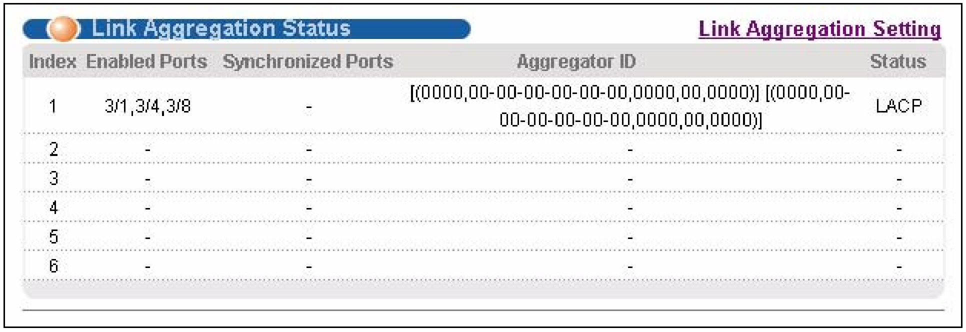
Table 33 Link Aggregation ID: Peer Switch

SYSTEM PRIORITY	MAC ADDRESS	KEY	PORT PRIORITY	PORT NUMBER
0000	00-00-00-00-00-00	0000	00	0000

20.3 Link Aggregation Control Protocol Status

Use this screen to look at the trunk groups that are on the switch. See Section 20.1 on page 113 for background information about trunk groups. To open this screen, click **Advanced Application > Link Aggregation**.

Figure 42 Link Aggregation Control Protocol Status



Index	Enabled Ports	Synchronized Ports	Aggregator ID	Status
1	3/1,3/4,3/8	-	[(0000,00-00-00-00-00-00,0000,00,0000)] [(0000,00-00-00-00-00-00,0000,00,0000)]	LACP
2	-	-	-	-
3	-	-	-	-
4	-	-	-	-
5	-	-	-	-
6	-	-	-	-

The following table describes the labels in this screen.

Table 34 Link Aggregation Control Protocol Status

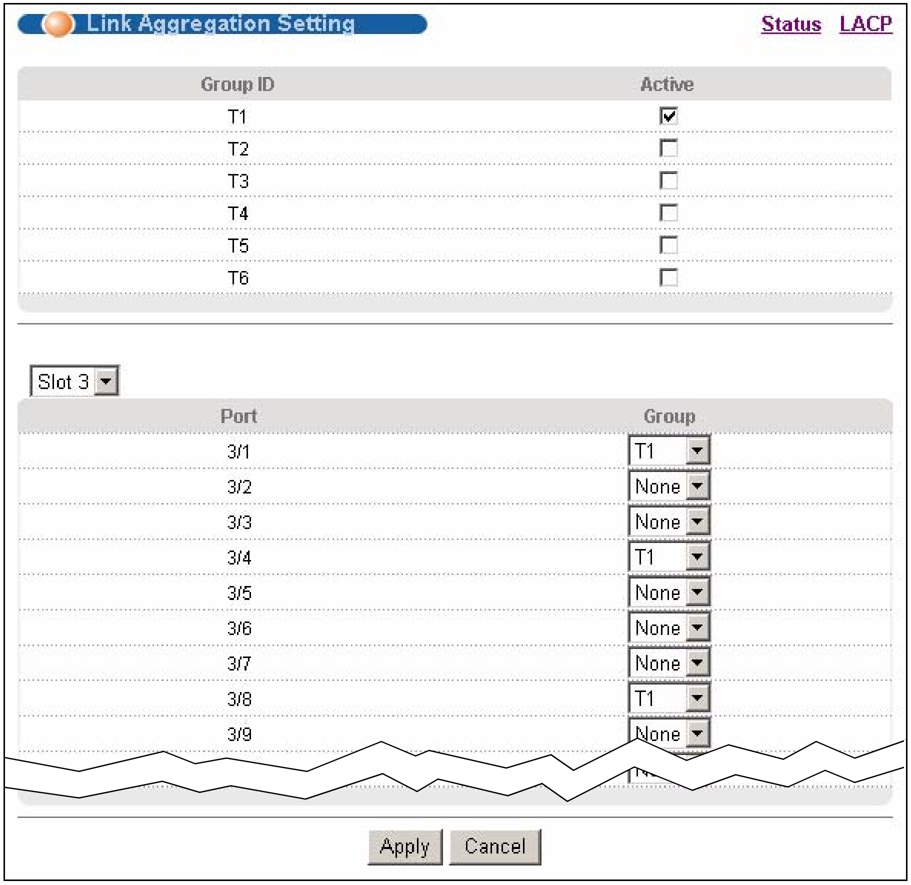
LABEL	DESCRIPTION
Index	This field displays the trunk ID to identify a trunk group, that is, one logical link containing multiple ports.
Enabled Port	These are the ports that are configured to be in the trunk group.
Synchronized Ports	These are the ports that are currently transmitting data as one logical link in this trunk group.
Aggregator ID	Link Aggregator ID consists of the following: system priority, MAC address, key, port priority and port number. See Section 20.2.1 on page 114 for more information. The ID displays only when there is a port belonging to this trunk group and LACP is also enabled for this group.
Status	This field displays how these ports were added to the trunk group. It displays: • **Static** - if the ports are configured as static members of a trunk group. • **LACP** - if the ports are configured to join a trunk group via LACP.

[1] Port Priority and Port Number are 0 as it is the aggregator ID for the trunk group, not the individual port.

20.4 Link Aggregation Setting

Use this screen to configure trunk groups on the switch. Click **Advanced Application** > **Link Aggregation** > **Link Aggregation Setting** to display the screen shown next. See Section 20.1 on page 113 for more information on link aggregation.

Figure 43 Advanced Application > Link Aggregation > Link Aggregation Setting



Group ID	Active
T1	☑
T2	□
T3	□
T4	□
T5	□
T6	□

Slot 3

Port	Group
3/1	T1
3/2	None
3/3	None
3/4	T1
3/5	None
3/6	None
3/7	None
3/8	T1
3/9	None

The following table describes the labels in this screen.

Table 35 Advanced Application > Link Aggregation > Link Aggregation Setting

LABEL	DESCRIPTION
Link Aggregation Setting	This is the only screen you need to configure to enable static link aggregation.
Group ID	The field identifies the link aggregation group, that is, one logical link containing multiple ports.
Active	Select this option to activate a trunk group.
Slot	Select the slot at whose settings you want to look.
Port	This field displays the port number.
Group	Select the trunk group to which a port belongs.

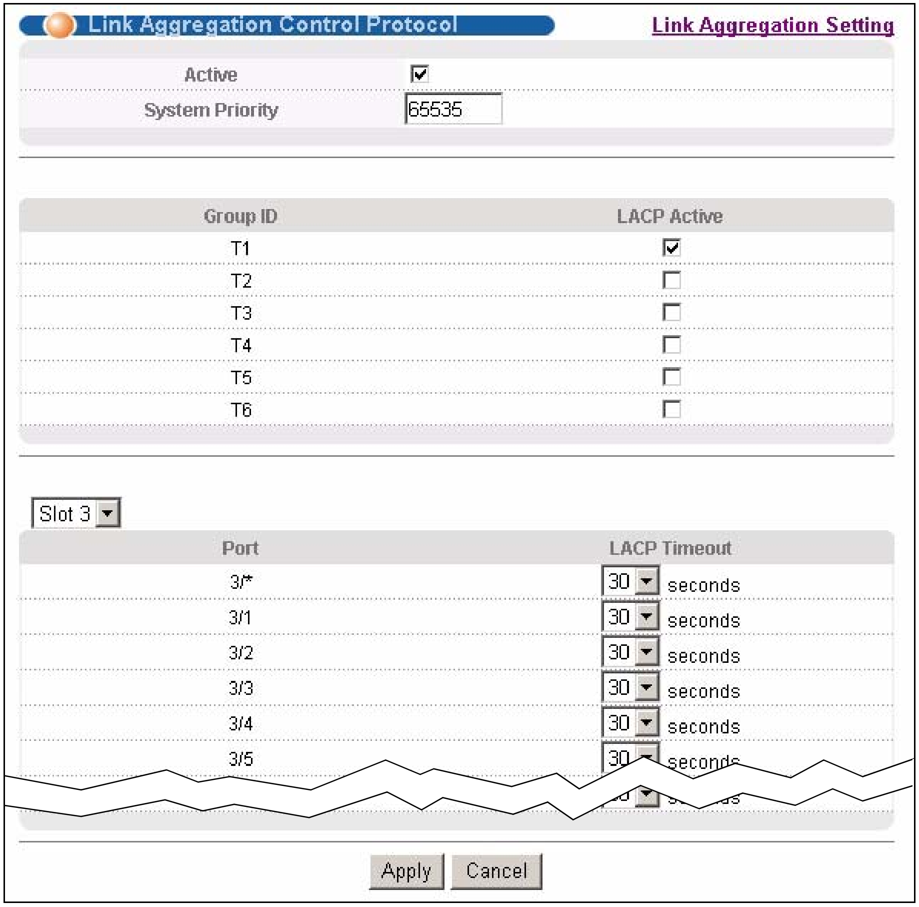
Table 35 Advanced Application > Link Aggregation > Link Aggregation Setting (continued)

LABEL	DESCRIPTION
Apply	Click **Apply** to save your changes to the switch's run-time memory. The switch loses these changes if it is turned off or loses power, so use the **Save** link on the top navigation panel to save your changes to the non-volatile memory when you are done configuring.
Cancel	Click **Cancel** to begin configuring this screen afresh.

20.5 Link Aggregation Control Protocol

Use this screen to configure LACP settings on the switch. See Section 20.1 on page 113 for more information on link aggregation. To open this screen, click **Advanced Application > Link Aggregation > Link Aggregation Setting** > **LACP**.

Figure 44 Link Aggregation Control Protocol



Active ☑
System Priority 65535

Group ID	LACP Active
T1	☑
T2	□
T3	□
T4	□
T5	□
T6	□

Slot 3

Port	LACP Timeout
3/*	30 seconds
3/1	30 seconds
3/2	30 seconds
3/3	30 seconds
3/4	30 seconds
3/5	30 seconds

The following table describes the labels in this screen.

Table 36 Link Aggregation Control Protocol

LABEL	DESCRIPTION
Active	Select this to enable Link Aggregation Control Protocol (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 Aggregate Control Protocol (LACP). The smaller the number, the higher the priority level.
Group ID	The field identifies the link aggregation group, that is, one logical link containing multiple ports.
Dynamic (LACP)	Select this check box to enable LACP for a trunk.
Slot	Select the slot at whose settings you want to look.
Port	This field displays the slot number and port number.
LACP Timeout	Timeout is the time interval between the individual port exchanges of LACP packets in order to check that the peer port in the trunk group is still up. If a port does not respond after three tries, then it is deemed to be “down” and is removed from the trunk. Set a short timeout (one second) for busy trunked links to ensure that disabled ports are removed from the trunk group as soon as possible. Select either 1 second or 30 seconds.
Apply	Click **Apply** to save your changes to the switch’s run-time memory. The switch loses these changes if it is turned off or loses power, so use the **Save** link on the top navigation panel to save your changes to the non-volatile memory when you are done configuring.
Cancel	Click **Cancel** to reset the fields.

21

Port Authentication

This chapter describes the 802.1x authentication method.

21.1 Port Authentication Overview

Port authentication is a way to validate access to ports on the switch to clients based on an external server (authentication server). IEEE 802.1x is an extended authentication protocol[2] that allows support of RADIUS (Remote Authentication Dial In User Service, RFC 2138, 2139) for centralized user profile and accounting management on a network RADIUS server.

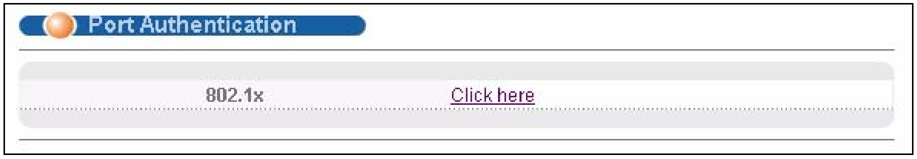
21.2 Port Authentication

Follow these steps to enable port authentication.

1. Activate IEEE 802.1x security on the switch and the port(s).
2. Configure the RADIUS server settings (see Chapter 28 on page 159 for detailed information).

To open this screen, click **Advanced Application** > **Port Authentication**.

Figure 45 Port Authentication



Port Authentication

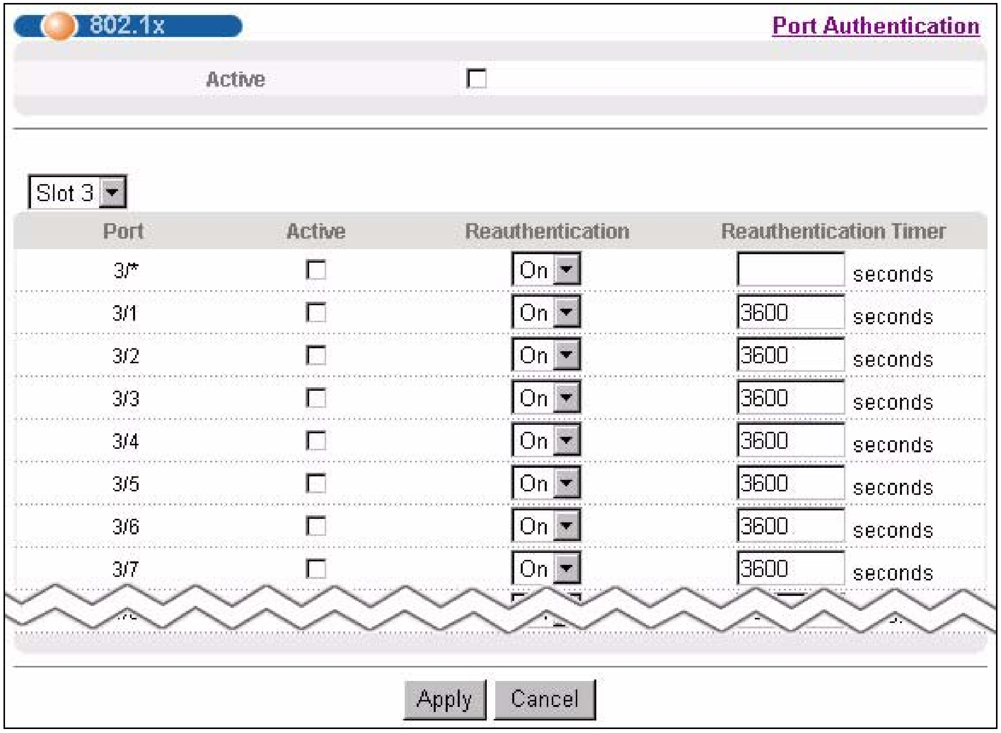
802.1x	Click here

21.2.1 802.1x

Use this screen to configure IEEE 802.1x security on the switch and on the ports. To open this screen, click **Advanced Application** > **Port Authentication** > **802.1x**.

[2] At the time of writing, only Windows XP of the Microsoft operating systems supports it. See the Microsoft web site for information on other Windows operating system support. For other operating systems, see its documentation. If your operating system does not support 802.1x, then you may need to install 802.1x client software.

Figure 46 802.1x



Active □

Slot 3

Port	Active	Reauthentication	Reauthentication Timer
3/*	□	On	seconds
3/1	□	On	3600 seconds
3/2	□	On	3600 seconds
3/3	□	On	3600 seconds
3/4	□	On	3600 seconds
3/5	□	On	3600 seconds
3/6	□	On	3600 seconds
3/7	□	On	3600 seconds

The following table describes the labels in this screen.

Table 37 802.1x

LABEL	DESCRIPTION
Active	Select this check box to permit 802.1x authentication on the switch. Note: You must first enable 802.1x authentication on the switch before configuring it on each port.
Slot	Select the slot at whose settings you want to look.
Port	This field displays the slot number and port number.
*	Settings in this row apply to all ports. Use this row only if you want to make some settings the same for all ports. Use this row first to set the common settings and then make adjustments on a port-by-port basis. Note: Changes in this row are copied to all the ports as soon as you make them.
Active	Select this to permit 802.1x authentication on this port. You must first allow 802.1x authentication on the switch before configuring it on each port.
Reauthentication	Specify if a subscriber has to periodically re-enter his or her username and password to stay connected to the port.
Reauthentication Timer	Specify how often a client has to re-enter his or her username and password to stay connected to the port.
Apply	Click **Apply** to save your changes to the switch's run-time memory. The switch loses these changes if it is turned off or loses power, so use the **Save** link on the top navigation panel to save your changes to the non-volatile memory when you are done configuring.
Cancel	Click **Cancel** to reset the fields.

22

Port Security

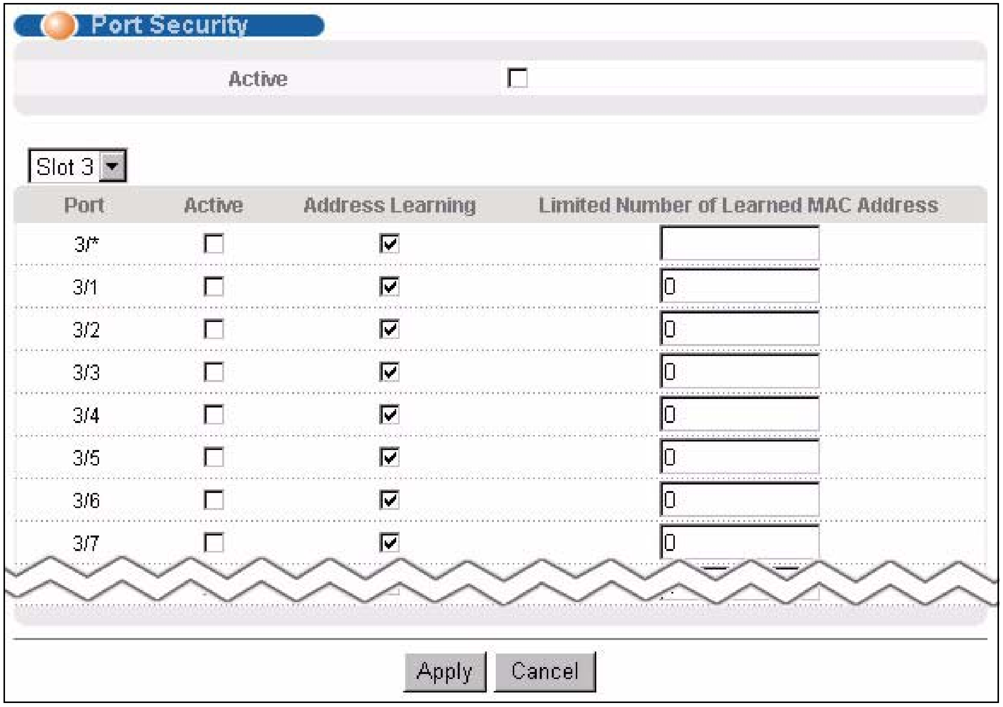
22.1 Port Security

Use this screen to allow only packets with dynamically learned MAC addresses and/or configured static MAC addresses to pass through a port on the switch. See Chapter 48 on page 269 for the maximum number of MAC addresses the switch can learn.

For maximum security, enable port security, disable MAC address learning and configure static MAC address(es) for a port. It is not recommended you disable port security together with MAC address learning as this will result in many broadcasts. By default, MAC address learning is still enabled even though the port security is not activated.

To open this screen, click **Advanced Application** > **Port Security**.

Figure 47 Port Security



Port Security

Active □

Slot 3

Port	Active	Address Learning	Limited Number of Learned MAC Address
3/*	□	☑	
3/1	□	☑	0
3/2	□	☑	0
3/3	□	☑	0
3/4	□	☑	0
3/5	□	☑	0
3/6	□	☑	0
3/7	□	☑	0

The following table describes the labels in this screen.

Table 38 Port Security

LABEL	DESCRIPTION
Active	Select this option to enable port security on the switch.
Slot	Select the slot at whose settings you want to look.

Table 38 Port Security (continued)

LABEL	DESCRIPTION
Port	This field displays the slot number and port number.
*	Settings in this row apply to all ports. Use this row only if you want to make some settings the same for all ports. Use this row first to set the common settings and then make adjustments on a port-by-port basis. Note: Changes in this row are copied to all the ports as soon as you make them.
Active	Select this check box to enable the port security feature on this port. The switch forwards packets whose MAC address(es) is in the MAC address table on this port. Packets with no matching MAC address(es) are dropped. Clear this check box to disable the port security feature. The switch forwards all packets on this port.
Address Learning	MAC address learning reduces outgoing broadcast traffic. For MAC address learning to occur on a port, the port itself must be active with address learning enabled.
Limited Number of Learned MAC Address	Use this field to limit the number of (dynamic) MAC addresses that may be learned on a port. For example, if you set this field to "5" on port 2, then only the devices with these five learned MAC addresses may access port 2 at any one time. A sixth device would have to wait until one of the five learned MAC addresses aged out. MAC address aging out time can be set in the **Switch Setup** screen. The valid range is from “0” to “16384”. “0” means this feature is disabled.
Apply	Click **Apply** to save your changes to the switch’s run-time memory. The switch loses these changes if it is turned off or loses power, so use the **Save** link on the top navigation panel to save your changes to the non-volatile memory when you are done configuring.
Cancel	Click **Cancel** to reset the fields.

23

Classifier

This chapter introduces the packet classifier and shows you how to configure it.

23.1 Packet Classifier and QoS

Quality of Service (QoS) refers to both a network's ability to deliver data with minimum delay, and the networking methods used to control the use of bandwidth. Without QoS, all traffic data is equally likely to be dropped when the network is congested. This can cause a reduction in network performance and make the network inadequate for time-critical application such as video-on-demand.

A classifier groups traffic into data flows according to specific criteria such as the source address, destination address, source port number, destination port number or incoming port number. For example, you can configure a classifier to select traffic from the same protocol port (such as Telnet) to form a flow.

Configure QoS on the switch to group and prioritize application traffic and fine-tune network performance. Setting up QoS involves two separate steps:

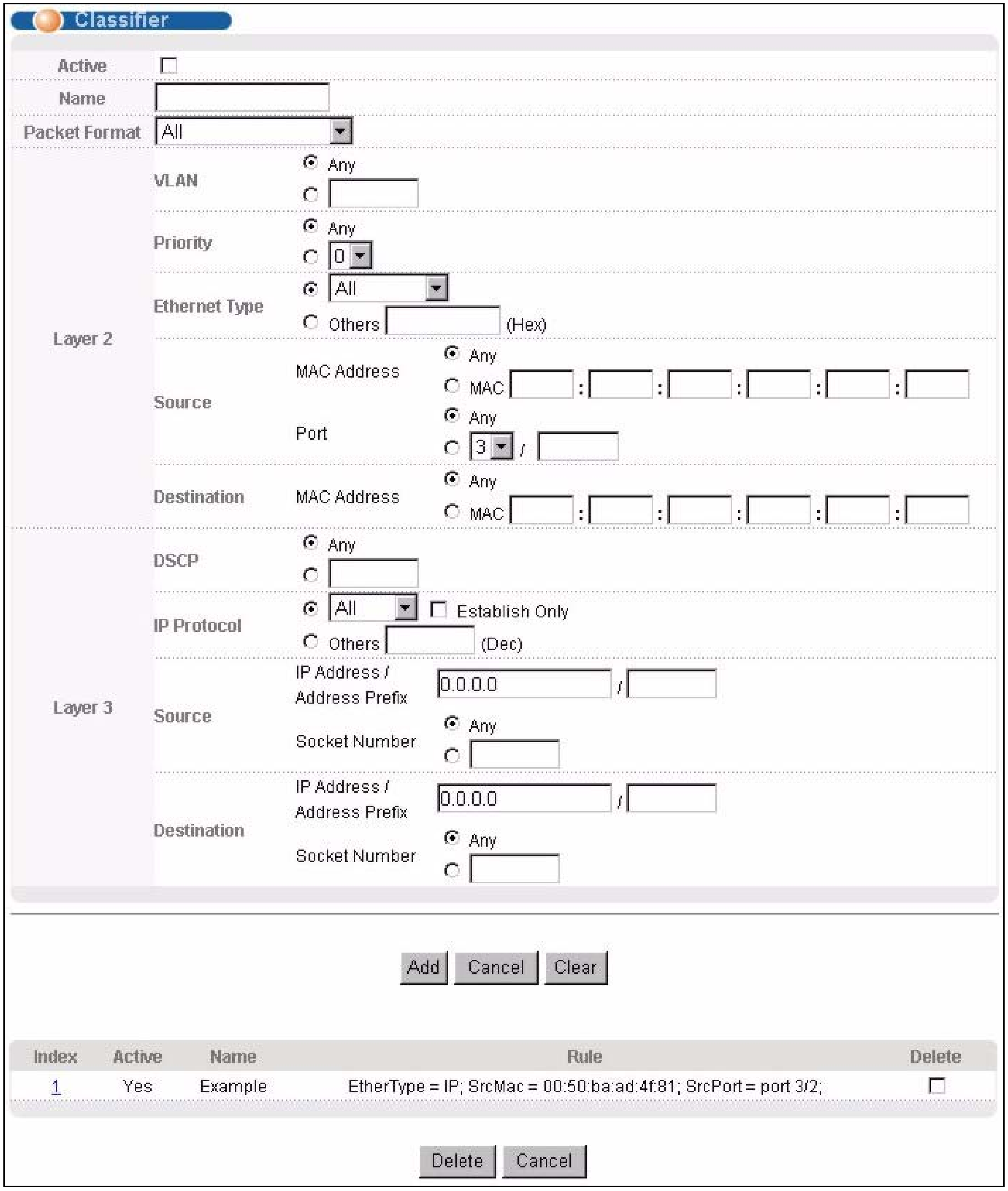
1. Configure classifiers to sort traffic into different flows.
2. Configure policy rules to define actions to be performed for a classified traffic flow (refer to Chapter 24 on page 129 to configure policy rules).

23.2 Classifier

Use this screen to configure classifiers for traffic. After you configure the classifier, you can specify actions ("policies") for traffic that matches the rules. See Chapter 24 on page 129 for more information about policies. To open this screen, click **Advanced Application** > **Classifier**.

When two rules conflict with each other, a higher layer rule has priority over lower layer rule.

Figure 48 Classifier



Classifier

Active □

Name

Packet Format: All

Layer 2

- VLAN: ● Any ○
- Priority: ● Any ○ 0
- Ethernet Type: ● All ○ Others (Hex)
- Source
  - MAC Address: ● Any ○ MAC : : : : :
  - Port: ● Any ○ 3 /
- Destination
  - MAC Address: ● Any ○ MAC : : : : :

Layer 3

- DSCP: ● Any ○
- IP Protocol: ● All □ Establish Only ○ Others (Dec)
- Source
  - IP Address / Address Prefix: 0.0.0.0 /
  - Socket Number: ● Any ○
- Destination
  - IP Address / Address Prefix: 0.0.0.0 /
  - Socket Number: ● Any ○

Index	Active	Name	Rule	Delete
1	Yes	Example	EtherType = IP; SrcMac = 00:50:ba:ad:4f:81; SrcPort = port 3/2;	□

The following table describes the labels in this screen.

Table 39 Classifier

LABEL	DESCRIPTION
Active	Select this option to enable this rule.
Name	Enter a descriptive name for this rule for identifying purposes.
Packet Format	Specify the format of the packet. Choices are **All**, **802.3 tagged**, **802.3 untagged**, **Ethernet II tagged** and **Ethernet II untagged**. A value of **802.3** indicates that the packets are formatted according to the IEEE 802.3 standards. A value of **Ethernet II** indicates that the packets are formatted according to RFC 894, Ethernet II encapsulation.
Layer 2	Specify the fields below to configure a layer 2 classifier.

Table 39 Classifier (continued)

LABEL	DESCRIPTION
VLAN	Select **Any** to classify traffic from any VLAN or select the second option and specify the source VLAN ID in the field provided.
Priority	Select **Any** to classify traffic from any priority level or select the second option and specify a priority level in the field provided.
Ethernet Type	Select an Ethernet type or select **Other** and enter the Ethernet type number in hexadecimal value. See Table 40 on page 126 for information.
Source	
MAC Address	Select **Any** to apply the rule to all MAC addresses. To specify a source, select the second choice and type a MAC address in valid MAC address format (six hexadecimal character pairs).
Port	Select the slot and type the port number to which the rule should be applied. You may choose one port only or all ports (**Any**).
Destination	
MAC Address	Select **Any** to apply the rule to all MAC addresses. To specify a destination, select the second choice and type a MAC address in valid MAC address format (six hexadecimal character pairs).
Layer 3	Specify the fields below to configure a layer 3 classifier.
DSCP	Select **Any** to classify traffic from any DSCP or select the second option and specify a DSCP (DiffServ Code Point) number between 0 and 63 in the field provided.
IP Protocol	Select an IP protocol type or select **Other** and enter the protocol number in decimal value. See Table 41 on page 126 for more information. You may select **Establish Only** for **TCP** protocol type. This means that the switch will pick out the packets that are sent to establish TCP connections.
Source	
IP Address/ Address Prefix	Enter a source IP address in dotted decimal notation. Specify the address prefix by entering the number of ones in the subnet mask.
Socket Number	Note: You must select either **UDP** or **TCP** in the **IP Protocol** field before you configure the socket numbers. Select **Any** to apply the rule to all TCP/UDP protocol port numbers or select the second option and enter a TCP/UDP protocol port number.
Destination	
IP Address/ Address Prefix	Enter a destination IP address in dotted decimal notation. Specify the address prefix by entering the number of ones in the subnet mask.
Socket Number	Note: You must select either **UDP** or **TCP** in the **IP Protocol** field before you configure the socket numbers. Select **Any** to apply the rule to all TCP/UDP protocol port numbers or select the second option and enter a TCP/UDP protocol port number.
Add	Click **Add** to insert the entry in the summary table below and save your changes to the switch's run-time memory. The switch loses these changes if it is turned off or loses power, so use the **Save** link on the top navigation panel to save your changes to the non-volatile memory when you are done configuring.

Table 39 Classifier (continued)

LABEL	DESCRIPTION
Cancel	Click **Cancel** to reset the fields back to your previous configuration.
Clear	Click **Clear** to set the above fields back to the factory defaults.
Index	This field displays the index number of the rule. Click an index number to edit the rule.
Active	This field displays **Yes** when the rule is activated and **No** when it is deactivated.
Name	This field displays the descriptive name for this rule. This is for identification purpose only.
Rule	This field displays a summary of the classifier rule's settings.
Delete	Click **Delete** to remove the selected entry from the summary table.
Cancel	Click **Cancel** to clear the **Delete** check boxes.

The following table shows some other common Ethernet types and the corresponding protocol number.

Table 40 Common Ethernet Types and Protocol Number

ETHERNET TYPE	PROTOCOL NUMBER
IP ETHII	0800
X.75 Internet	0801
NBS Internet	0802
ECMA Internet	0803
Chaosnet	0804
X.25 Level 3	0805
XNS Compat	0807
Banyan Systems	0BAD
BBN Simnet	5208
IBM SNA	80D5
AppleTalk AARP	80F3

Some of the most common IP ports are:

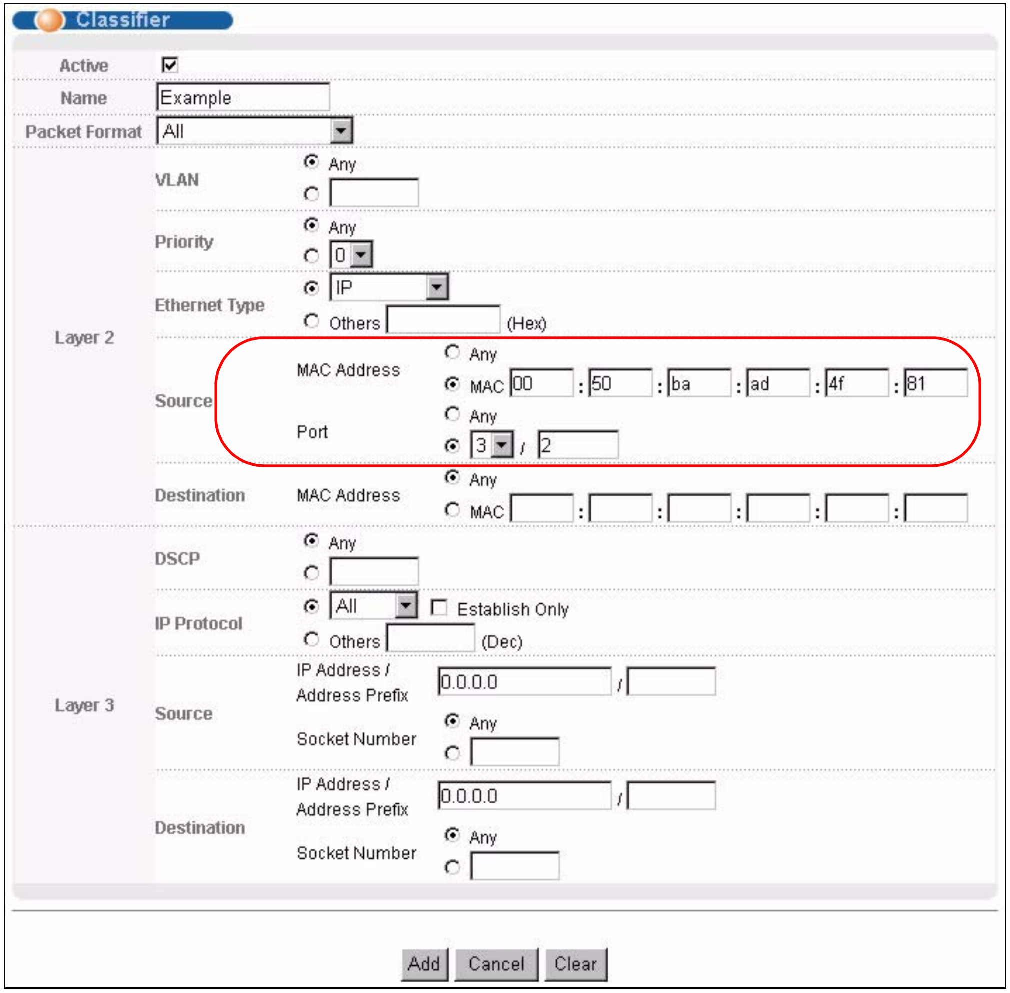
Table 41 Common IP Ports

PORT NUMBER	PORT NAME
21	FTP
23	Telnet
25	SMTP
53	DNS
80	HTTP
110	POP3

23.3 Classifier Example

The following screen shows an example where you configure a classifier that identifies all traffic from MAC address 00:50:ba:ad:4f:81 on port 2 in slot 3.

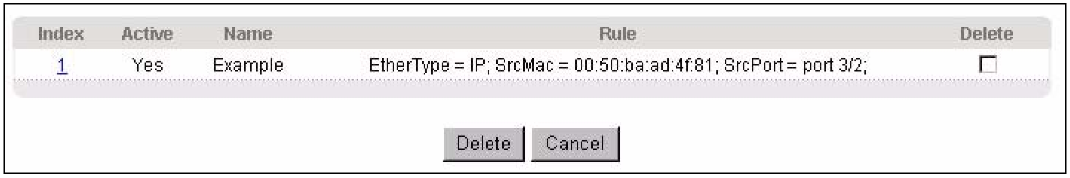
Figure 49 Example: Configuring a Classifier



Active			☑
Name			Example
Packet Format			All
Layer 2	VLAN		● Any ○
	Priority		● Any ○ 0
	Ethernet Type		● IP ○ Others (Hex)
	Source	MAC Address	○ Any ● MAC 00 : 50 : ba : ad : 4f : 81
		Port	○ Any ● 3 / 2
	Destination	MAC Address	● Any ○ MAC : : : : :
Layer 3	DSCP		● Any ○
	IP Protocol		● All ☐ Establish Only ○ Others (Dec)
	Source	IP Address / Address Prefix	0.0.0.0 /
		Socket Number	● Any ○
	Destination	IP Address / Address Prefix	0.0.0.0 /
		Socket Number	● Any ○

The resulting entry in the summary table is shown below.

Figure 50 Example: Looking at the Classifier in the Summary Table



Index	Active	Name	Rule	Delete
1	Yes	Example	EtherType = IP; SrcMac = 00:50:ba:ad:4f:81; SrcPort = port 3/2;	☐

After you have configured a classifier, you can configure a policy (in the **Policy** screen) to define action(s) on the classified traffic flow.

24

Policy Rule

This chapter introduces policy rules and shows you how to configure them.

24.1 Policy Rules Overview

A classifier distinguishes traffic into flows based on the configured criteria. A policy rule ensures that a traffic flow gets the requested treatment in the network. See Chapter 23 on page 123 for more information about classifiers.

24.1.1 DiffServ

DiffServ (Differentiated Services) is a class of service (CoS) model that marks packets so that they receive specific per-hop treatment at DiffServ-compliant network devices along the route based on the application types and traffic flow. Packets are marked with DiffServ Code Points (DSCPs) indicating the level of service desired. This allows the intermediary DiffServ-compliant network devices to handle the packets differently depending on the code points without the need to negotiate paths or remember state information for every flow. In addition, applications do not have to request a particular service or give advanced notice of where the traffic is going.

24.1.2 DSCP and Per-Hop Behavior

DiffServ defines a new DS (Differentiated Services) field to replace the Type of Service (TOS) field in the IP header. The DS field contains a 2-bit unused field and a 6-bit DSCP field which can define up to 64 service levels. The following figure illustrates the DS field.

DSCP is backward compatible with the three precedence bits in the ToS octet so that non-DiffServ compliant, ToS-enabled network device will not conflict with the DSCP mapping.

DSCP (6 bits)	Unused (2 bits)

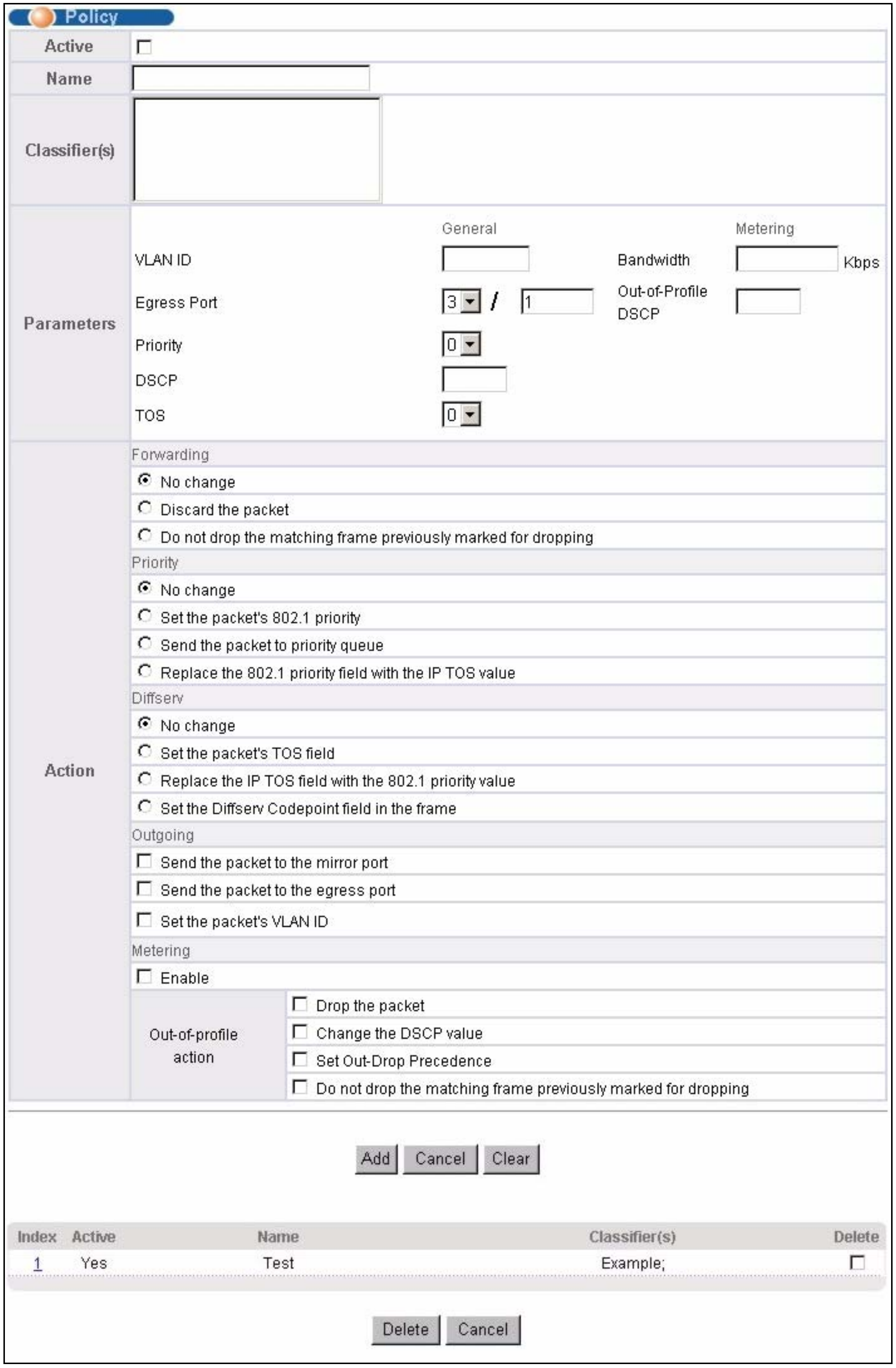
The DSCP value determines the forwarding behavior, the PHB (Per-Hop Behavior), that each packet gets across the DiffServ network. Based on the marking rule, different kinds of traffic can be marked for different kinds of forwarding. Resources can then be allocated according to the DSCP values and the configured policies.

24.2 Configuring Policy Rules

You must first configure a classifier in the **Classifier** screen. See Chapter 23 on page 123 for more information about classifiers.

Use this screen to configure policy rules for classified traffic. To open this screen, click **Advanced Applications** > **Policy Rule**.

Figure 51 Policy



Policy

Active	□
Name	
Classifier(s)	
Parameters	General: VLAN ID; Egress Port 3 / 1; Priority 0; DSCP; TOS 0 Metering: Bandwidth Kbps; Out-of-Profile DSCP
Action	Forwarding ● No change ○ Discard the packet ○ Do not drop the matching frame previously marked for dropping Priority ● No change ○ Set the packet's 802.1 priority ○ Send the packet to priority queue ○ Replace the 802.1 priority field with the IP TOS value Diffserv ● No change ○ Set the packet's TOS field ○ Replace the IP TOS field with the 802.1 priority value ○ Set the Diffserv Codepoint field in the frame Outgoing □ Send the packet to the mirror port □ Send the packet to the egress port □ Set the packet's VLAN ID Metering □ Enable Out-of-profile action: □ Drop the packet □ Change the DSCP value □ Set Out-Drop Precedence □ Do not drop the matching frame previously marked for dropping

Add Cancel Clear

Index	Active	Name	Classifier(s)	Delete
1	Yes	Test	Example;	□

Delete Cancel

The following table describes the labels in this screen.

Table 42 Policy

LABEL	DESCRIPTION
Active	Select this option to enable the policy.
Name	Enter a descriptive name for identification purposes.

Table 42 Policy (continued)

LABEL	DESCRIPTION
Classifier(s)	This field displays the active classifier(s) you configure in the **Classifier** screen. Select the classifier(s) to which this policy rule applies. To select more than one classifier, press [SHIFT] or [CTRL] and select the choices at the same time.
Parameters	Set the fields below for this policy. You only have to set the field(s) that is related to the action(s) you configure in the **Action** field.
General	
VLAN ID	Specify a VLAN ID number.
Egress Port	Select the slot and type the number of the port to which to forward packets for classified traffic flow.
Priority	Specify a priority level.
DSCP	Specify a DSCP (DiffServ Code Point) number between 0 and 63.
TOS	Specify the type of service (TOS) priority level.
Metering	You can configure the desired bandwidth available to a traffic flow. Traffic that exceeds the maximum bandwidth allocated (in cases where the network is congested) is called out-of-profile traffic.
Bandwidth	Specify the bandwidth in kilobit per second (Kbps). Enter a number between 1 and 1000000.
Out-of-Profile DSCP	Specify a new DSCP number (between 0 and 63) if you want to replace or remark the DSCP number for out-of-profile traffic.
Action	Specify the action(s) the switch takes on the associated classified traffic flow.
Forwarding	Select **No change** to forward the packets. Select **Discard the packet** to drop the packets. Select **Do not drop the matching frame previously marked for dropping** to retain the frames that were marked to be dropped before.
Priority	Select **No change** to keep the priority setting of the frames. Select **Set the packet's 802.1 priority** to replace the packet's 802.1 priority field with the value you set in the Priority field. Select **Send the packet to priority queue** to put the packets in the designated queue. Select **Replace the 802.1 priority field with the IP TOS value** to replace the packet's 802.1 priority field with the value you set in the **TOS** field.
Diffserv	Select **No change** to keep the TOS and/or DSCP fields in the packets. Select **Set the packet's TOS field** to set the TOS field with the value you configure in the **TOS** field. Select **Replace the IP TOS with the 802.1 priority value** to replace the TOS field with the value you configure in the **Priority** field. Select **Set the Diffserv Codepoint field in the frame** to set the DSCP field with the value you configure in the **DSCP** field.
Outgoing	Select **Send the packet to the mirror port** to send the packet to the mirror port. Select **Send the packet to the egress port** to send the packet to the egress port. Select **Set the packet's VLAN ID** to set the VLAN ID of the packet with the value you configure in the **VLAN ID** field.
Metering	Select **Enable** to activate bandwidth limitation on the traffic flow(s) then set the actions to be taken on out-of-profile packets.

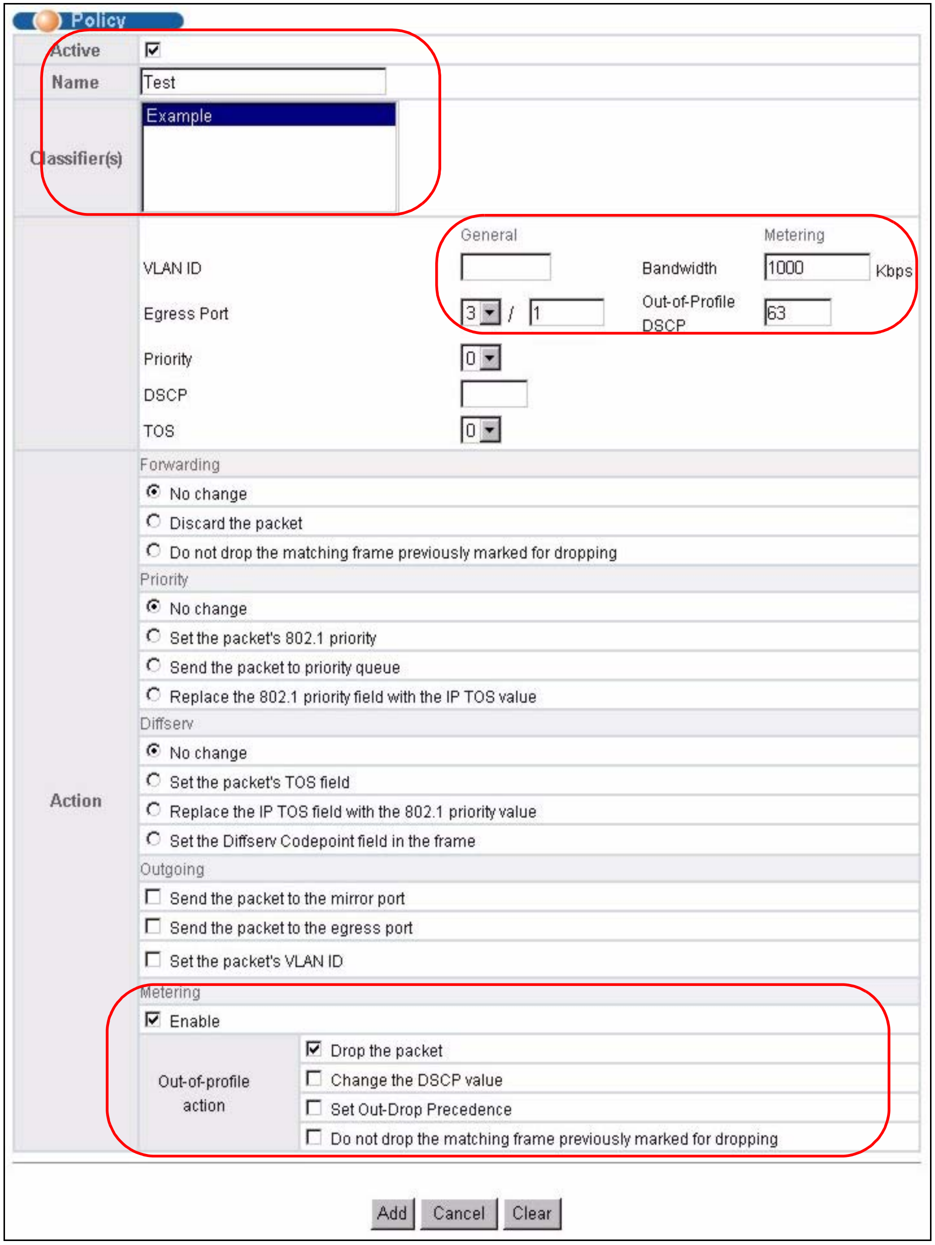
Table 42 Policy (continued)

LABEL	DESCRIPTION
Out-of-profile action	Select the action(s) to be performed for out-of-profile traffic. Select **Drop the packet** to discard the out-of-profile traffic. Select **Change the DSCP value** to replace the DSCP field with the value specified in the **Out of profile DSCP** field. Select **Set Out-Drop Precedence** to mark out-of-profile traffic and drop it when network is congested. Select **Do not drop the matching frame previously marked for dropping** to queue the frames that are marked to be dropped.
Add	Click **Add** to inset the entry to the summary table below and save your changes to the switch's run-time memory. The switch loses these changes if it is turned off or loses power, so use the **Save** link on the top navigation panel to save your changes to the non-volatile memory when you are done configuring.
Cancel	Click **Cancel** to reset the fields back to your previous configuration.
Clear	Click **Clear** to set the above fields back to the factory defaults.
Index	This field displays the policy index number. Click an index number to edit the policy.
Active	This field displays **Yes** when policy is activated and **No** when is it deactivated.
Name	This field displays the name you have assigned to this policy.
Classifier(s)	This field displays the name(s) of the classifier to which this policy applies.
Delete	Click **Delete** to remove the selected entry from the summary table.
Cancel	Click **Cancel** to clear the **Delete** check boxes.

24.3 Policy Example

The figure below shows an example **Policy** screen where you configure a policy to limit bandwidth and discard out-of-profile traffic on a traffic flow classified using the **Example** classifier (created in Section 23.3 on page 126).

Figure 52 Example: Policy



Policy

Active	☑
Name	Test
Classifier(s)	Example

	General		Metering	
VLAN ID		Bandwidth	1000	Kbps
Egress Port	3 / 1	Out-of-Profile DSCP	63	
Priority	0			
DSCP				
TOS	0			

Action

Forwarding
- ● No change
- ○ Discard the packet
- ○ Do not drop the matching frame previously marked for dropping

Priority
- ● No change
- ○ Set the packet's 802.1 priority
- ○ Send the packet to priority queue
- ○ Replace the 802.1 priority field with the IP TOS value

Diffserv
- ● No change
- ○ Set the packet's TOS field
- ○ Replace the IP TOS field with the 802.1 priority value
- ○ Set the Diffserv Codepoint field in the frame

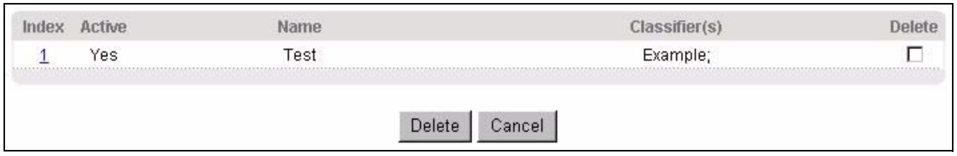
Outgoing
- □ Send the packet to the mirror port
- □ Send the packet to the egress port
- □ Set the packet's VLAN ID

Metering
- ☑ Enable

Out-of-profile action
- ☑ Drop the packet
- □ Change the DSCP value
- □ Set Out-Drop Precedence
- □ Do not drop the matching frame previously marked for dropping

The resulting entry in the summary table is shown below.

Figure 53 Example: Looking at the Classifier in the Summary Table



Index	Active	Name	Classifier(s)	Delete
1	Yes	Test	Example;	□

25

Queuing Method

This chapter introduces the queuing methods supported and then explains the screen for configuring them.

25.1 Queuing Method Overview

Queuing is used to help solve performance degradation when there is network congestion. Use the **Queuing Method** screen to configure queuing algorithms for outgoing traffic. See also **Priority Queue Assignment** in **Switch Setup** (Chapter 9 on page 71) and **802.1p Priority** in **Port Setup** (Chapter 12 on page 79) for related information.

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

25.1.1 Strictly Priority Queuing

Strictly Priority Queuing (SPQ) services queues based on priority only. As traffic comes into the switch, traffic on the highest priority queue, Q7 is transmitted first. When that queue empties, traffic on the next highest-priority queue, Q6 is transmitted until Q6 empties, and then traffic is transmitted on Q5 and so on. If higher priority queues never empty, then traffic on lower priority queues never gets sent. SPQ does not automatically adapt to changing network requirements.

25.1.2 Weighted Round Robin Scheduling (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 a 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 Scheduling (WRR) 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.

25.1.3 Weighted Fair Queuing

Weighted Fair Queuing (WFQ) is used to guarantee each queue’s minimum bandwidth based on its bandwidth weight (portion) when there is traffic congestion. WFQ is activated only when a port has more traffic than it can handle. Queues with larger weights get more guaranteed bandwidth than queues with smaller weights. This queuing mechanism is highly efficient in that it divides any available bandwidth across the different traffic queues. By default, the weight for Q0 is 1, for Q1 is 2, for Q2 is 3, and so on. Guaranteed bandwidth is calculated as follows:

$$\frac{\text{Queue Weight}}{\text{Total Queue Weight}} \times \text{Port Speec}$$

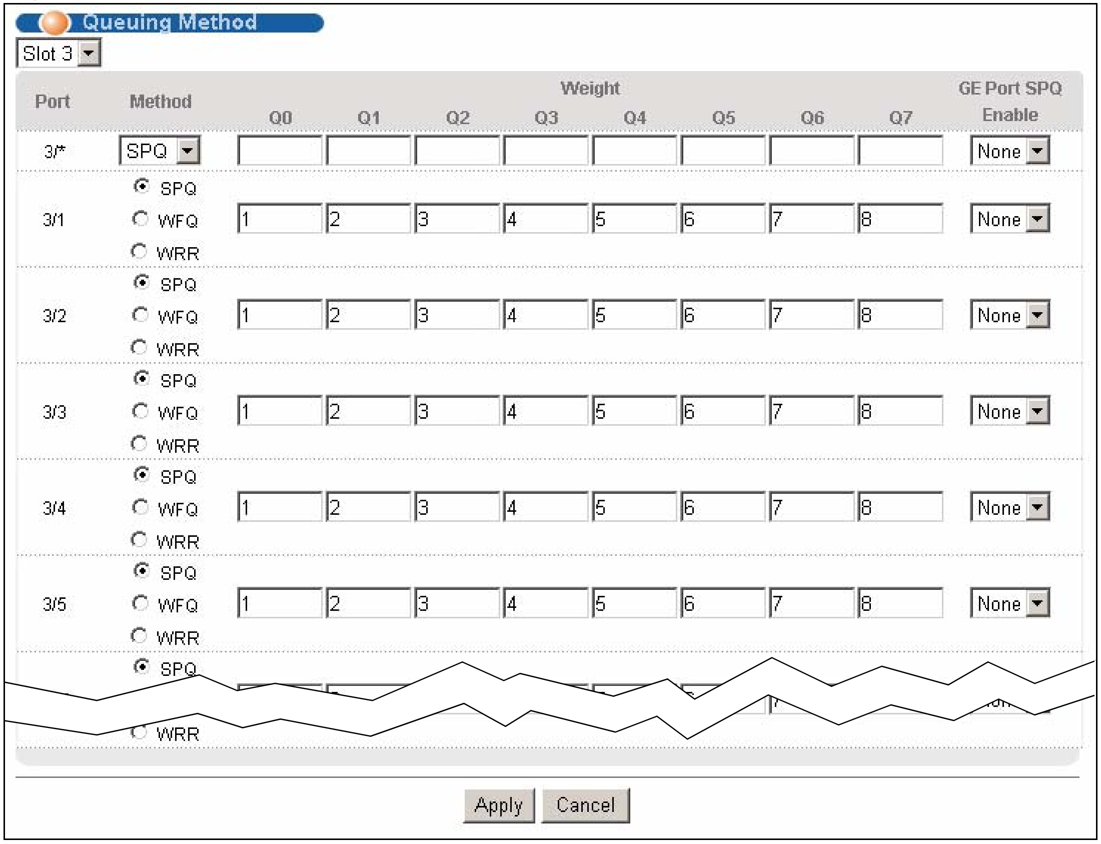
For example, using the default setting, Q0 on Port 1 gets a guaranteed bandwidth of:

$$\frac{1}{1+2+3+4+5+6+7+8} \times 100 \text{ Mbps} = 3 \text{ Mbps}$$

25.2 Queuing Method

Use this screen to configure queuing methods to handle network congestion. To open this screen, click **Advanced Application > Queuing Method**.

Figure 54 Queuing Method



Queuing Method

Slot 3

Port	Method	Q0	Q1	Q2	Q3	Q4	Q5	Q6	Q7	GE Port SPQ Enable
		Weight								
3/*	SPQ									None
3/1	● SPQ ○ WFQ ○ WRR	1	2	3	4	5	6	7	8	None
3/2	● SPQ ○ WFQ ○ WRR	1	2	3	4	5	6	7	8	None
3/3	● SPQ ○ WFQ ○ WRR	1	2	3	4	5	6	7	8	None
3/4	● SPQ ○ WFQ ○ WRR	1	2	3	4	5	6	7	8	None
3/5	● SPQ ○ WFQ ○ WRR	1	2	3	4	5	6	7	8	None
	● SPQ ○ WRR							7		

The following table describes the labels in this screen.

Table 43 Queuing Method

LABEL	DESCRIPTION
Slot	Select the slot at whose settings you want to look.
Port	This field displays the slot number and port number.
Method	Select **SPQ** (Strict Priority Queuing, **WFQ**, or **WRR** (Weighted Round Robin). Strict Priority Queuing (SPQ) services queues based on priority only. When the highest priority queue empties, traffic on the next highest-priority queue begins. Q7 has the highest priority and Q0 the lowest. Weighted Fair Scheduling (WFQ) is used to guarantee each queue’s minimum bandwidth based on their bandwidth portion (weight), the number you assign in the **Weight** field. Queues with larger weights get more guaranteed bandwidth than queues with smaller weights. Weighted Round Robin Scheduling (WRR) services queues on a rotating basis based on their queue weight (the number you configure in the queue **Weight** field). Queues with larger weights get more service than queues with smaller weights.
Q0~Q7 Weight	When you select **WRR** or **WFQ,** enter the queue weight here. Bandwidth is divided across the different traffic queues according to their weights. Queues with larger weights get more service than queues with smaller weights.
GE Port SPQ Enable	When you select **WRR** or **WFQ,** select a queue (Q0~Q7) to have the switch use Strict Priority to service the specified queue and subsequent queues. For example, if you select **Q5**, the switch services traffic on **Q5**, **Q6**, and **Q7** using Strict Priority. Select **None** if you want to always use WRR or WFQ.
Apply	Click **Apply** to save your changes to the switch’s run-time memory. The switch loses these changes if it is turned off or loses power, so use the **Save** link on the top navigation panel to save your changes to the non-volatile memory when you are done configuring.
Cancel	Click **Cancel** to begin configuring this screen afresh.

26

VLAN Stacking

This chapter shows you how to configure VLAN stacking on your switch. See Chapter 13 on page 83 for background information about VLANs.

26.1 VLAN Stacking Overview

A service provider can use VLAN stacking to allow it to distinguish multiple customers VLANs, even those with the same (customer-assigned) VLAN ID, within its network.

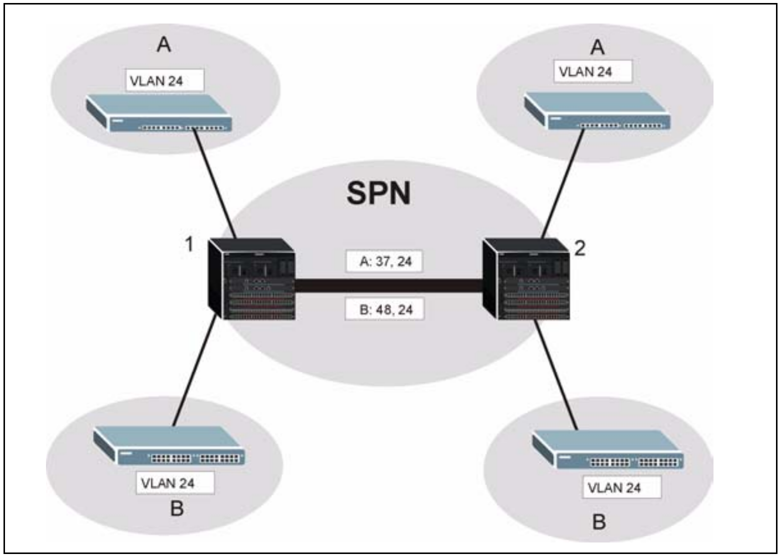
Use VLAN stacking to add an outer VLAN tag to the inner IEEE 802.1Q tagged frames that enter the network. By tagging the tagged frames (“double-tagged” frames), the service provider can manage up to 4,094 VLAN groups with each group containing up to 4,094 customer VLANs. This allows a service provider to provide different service, based on specific VLANs, for many different customers.

A service provider’s customers may require a range of VLANs to handle multiple applications. A service provider’s customers can assign their own inner VLAN tags on ports for these applications. The service provider can assign an outer VLAN tag for each customer. Therefore, there is no VLAN tag overlap among customers, so traffic from different customers is kept separate.

26.1.1 VLAN Stacking Example

In the following example figure, both **A** and **B** are Service Provider’s Network (SPN) customers with VPN tunnels between their head offices and branch offices respectively. Both have an identical VLAN tag for their VLAN group. The service provider can separate these two VLANs within its network by adding tag 37 to distinguish customer **A** and tag 48 to distinguish customer **B** at edge device **1** and then stripping those tags at edge device **2** as the data frames leave the network.

Figure 55 VLAN Stacking Example



26.2 VLAN Stacking Port Roles

Each port can have these VLAN stacking “roles”: **Access Port** and **Tunnel** (the latter is for Gigabit ports only).

- Select **Access Port** for ingress ports on the service provider's edge devices (**1** and **2** in the VLAN stacking example figure). The incoming frame is treated as "untagged", so a second VLAN tag (outer VLAN tag) can be added.

✍ Static VLAN **Tx Tagging** MUST be disabled on a port where you choose **Normal** or **Access Port**.

- Select **Tunnel Port** (available for Gigabit ports only) for egress ports at the edge of the service provider's network. All VLANs belonging to a customer can be aggregated into a single service provider's VLAN (using the outer VLAN tag defined by SP VID).

✍ Static VLAN **Tx Tagging** MUST be enabled on a port where you choose **Tunnel Port**.

26.3 VLAN Tag Format

A VLAN tag (service provider VLAN stacking or customer IEEE 802.1Q) consists of the following three fields.

Table 44 VLAN Tag Format

Type	Priority	VID

Type is a standard Ethernet type code identifying the frame and indicates that whether the frame carries IEEE 802.1Q tag information. **SP TPID** (Service Provider Tag Protocol Identifier) is the service provider VLAN stacking tag type. Many vendors use 0x8100 or 0x9100.

TPID (Tag Protocol Identifier) is the customer IEEE 802.1Q tag.

- If the VLAN stacking port role is **Access Port**, then the switch adds the **SP TPID** tag to all incoming frames on the service provider's edge devices (1 and 2 in the VLAN stacking example figure).
- If the VLAN stacking port role is **Tunnel Port**, then the switch only adds the **SP TPID** tag to all incoming frames on the service provider's edge devices (1 and 2 in the VLAN stacking example figure) that have an **SP TPID** different to the one configured on the switch. (If an incoming frame’s **SP TPID** is the same as the one configured on the switch, then the switch will not add the tag.)

Priority refers to the IEEE 802.1p standard that allows the service provider to prioritize traffic based on the class of service (CoS) the customer has paid for.

- On the switch, configure priority level of inner IEEE 802.1Q tag in the **Port Setup** screen.

- "0" is the lowest priority level and "7" is the highest.

VID is the VLAN ID. **SP VID** is the VID for the second (service provider’s) VLAN tag.

26.3.1 Frame Format

The frame format for an untagged Ethernet frame, a single-tagged 802.1Q frame (customer) and a “double-tagged” 802.1Q frame (service provider) is shown next.

Configure the fields as circled in the switch **VLAN Stacking** screen.

Table 45 Single and Double Tagged 802.1Q Frame Format

						DA	SA	Len/ Etype	Data	FCS	Untagged Ethernet frame
			DA	SA	**TPID**	**Priority**	**VID**	Len/ Etype	Data	FCS	IEEE 802.1Q customer tagged frame
DA	SA	**SPTPID**	**Priority**	**VID**	**TPID**	**Priority**	**VID**	Len/ Etype	Data	FCS	Double-tagged frame

Table 46 802.1Q Frame

DA	Destination Address	Priority	802.1p Priority
SA	Source Address	Len/ Etype	Length and type of Ethernet frame

Table 46 802.1Q Frame

(SP)TPID	(Service Provider) Tag Protocol IDentifier	Data	Frame data
VID	VLAN ID	FCS	Frame Check Sequence

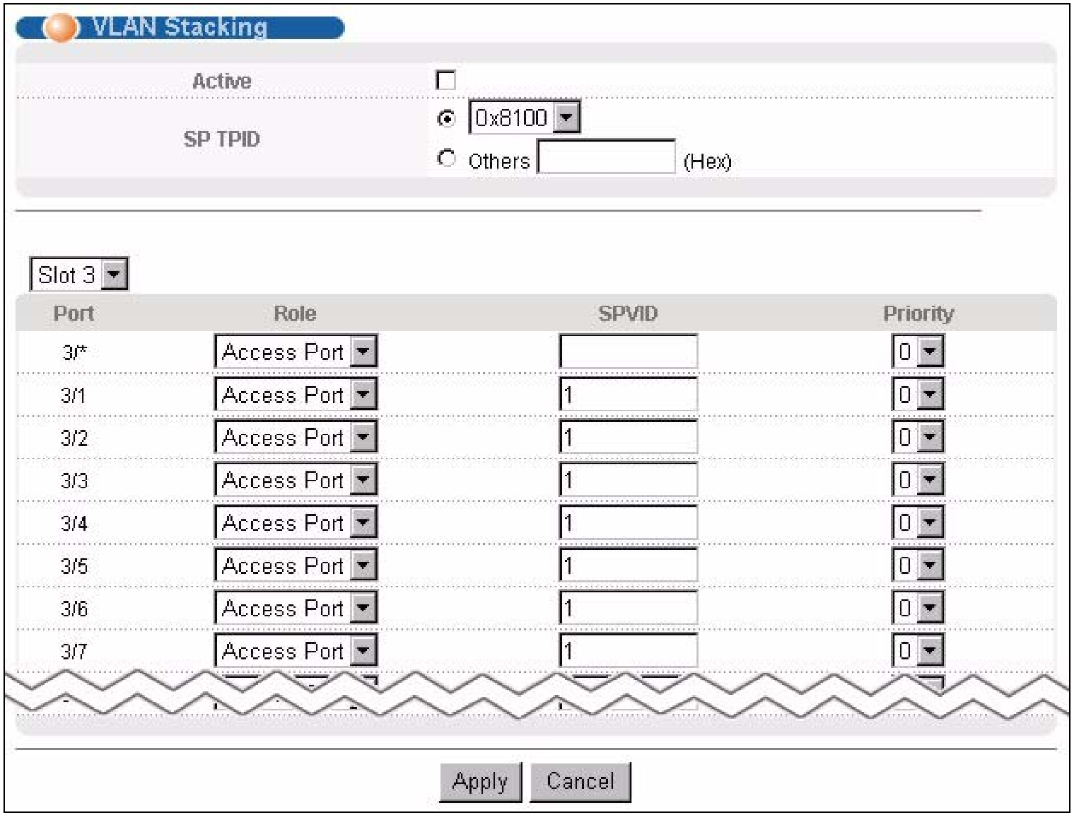
26.4 VLAN Stacking

Use this screen to add an outer VLAN tag to the inner IEEE 802.1Q tagged frames that enter the network. If a service provider assigns an outer VLAN tag for each customer, the service provider's customers can assign their own inner VLAN tags without creating overlapping VLANs in the service provider's network.

This allows a service provider to provide different service, based on specific VLANs, for many different customers and to distinguish between multiple customers' VLANs, even if they have the same VLAN ID, within its network.

To open this screen, click **Advanced Applications** > **VLAN Stacking**.

Figure 56 VLAN Stacking



VLAN Stacking

Active	□
SP TPID	● 0x8100 ○ Others ______ (Hex)

Slot 3

Port	Role	SPVID	Priority
3/*	Access Port		0
3/1	Access Port	1	0
3/2	Access Port	1	0
3/3	Access Port	1	0
3/4	Access Port	1	0
3/5	Access Port	1	0
3/6	Access Port	1	0
3/7	Access Port	1	0

The following table describes the labels in this screen.

Table 47 VLAN Stacking

LABEL	DESCRIPTION
Active	Select this to enable VLAN stacking on the switch.
SP TPID	**SP TPID** is a standard Ethernet type code identifying the frame and indicates whether the frame carries IEEE 802.1Q tag information. Choose **0x8100** or **0x9100** from the drop-down list box or select **Others** and then enter a four-digit hexadecimal number from 0x0000 to 0xFFFF. 0x denotes a hexadecimal number. It does not have to be typed in the **Others** text field.
Slot	Select the slot at whose settings you want to look.
Port	This field displays the slot number and port number.
*	Settings in this row apply to all ports. Use this row only if you want to make some settings the same for all ports. Use this row first to set the common settings and then make adjustments on a port-by-port basis. Note: Changes in this row are copied to all the ports as soon as you make them.
Role	Select **Access Port** to have the switch add the **SP TPID** tag to all incoming frames received on this port. Select **Access Port** for ingress ports at the edge of the service provider's network. Select **Tunnel Port** (available for Gigabit ports only) for egress ports at the edge of the service provider's network. In order to support VLAN stacking on a port, the port must be able to allow frames of 1526 Bytes (1522 Bytes + 4 Bytes for the second tag) to pass through it.
SPVID	**SPVID** is the service provider's VLAN ID (the outer VLAN tag). Enter the service provider ID (from 1 to 4094) for frames received on this port. See Chapter 13 on page 83 for more background information on VLAN ID.
Priority	On the switch, configure priority level of inner IEEE 802.1Q tag in the **Port Setup** screen. "0" is the lowest priority level and "7" is the highest.
Apply	Click **Apply** to save your changes to the switch's run-time memory. The switch loses these changes if it is turned off or loses power, so use the **Save** link on the top navigation panel to save your changes to the non-volatile memory when you are done configuring.
Cancel	Click **Cancel** to begin configuring this screen afresh.

27

Multicast

This chapter shows you how to configure various multicast features.

27.1 Multicast Overview

Traditionally, IP packets are transmitted in one of either two ways - Unicast (1 sender to 1 recipient) or Broadcast (1 sender to everybody on the network). Multicast delivers IP packets to just a group of hosts on the network.

IGMP (Internet Group Multicast Protocol) is a network-layer protocol used to establish membership in a multicast group - it is not used to carry user data. Refer to RFC 1112 and RFC 2236 for information on IGMP versions 1 and 2 respectively.

27.1.1 IP Multicast Addresses

In IPv4, a multicast address allows a device to send packets to a specific group of hosts (multicast group) in a different subnetwork. A multicast IP address represents a traffic receiving group, not individual receiving devices. IP addresses in the Class D range (224.0.0.0 to 239.255.255.255) are used for IP multicasting. Certain IP multicast numbers are reserved by IANA for special purposes (see the IANA web site for more information).

27.1.2 IGMP Filtering

With the IGMP filtering feature, you can control which IGMP groups a subscriber on a port can join. This allows you to control the distribution of multicast services (such as content information distribution) based on service plans and types of subscription.

You can set the switch to filter the multicast group join reports on a per-port basis by configuring an IGMP filtering profile and associating the profile to a port.

27.1.3 IGMP Snooping

A switch can passively snoop on IGMP Query, Report and Leave (IGMP version 2) 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.

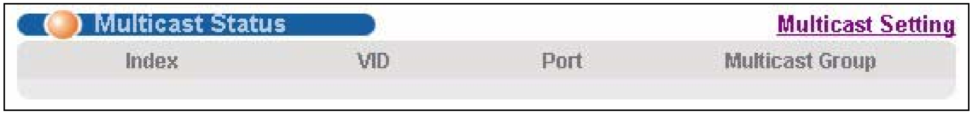
27.1.4 IGMP Snooping and VLANs

The switch can perform IGMP snooping on up to 16 VLANs. You can configure the switch to automatically learn multicast group membership of any VLANs. The switch then performs IGMP snooping on the first 16 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.

27.2 Multicast Status

Use this screen to look at current multicast groups. See Section 27.1 on page 145 for background information about multicasting. To open this screen, click **Advanced Application** > **Multicast**.

Figure 57 Multicast Status



Index	VID	Port	Multicast Group

The following table describes the labels in this screen.

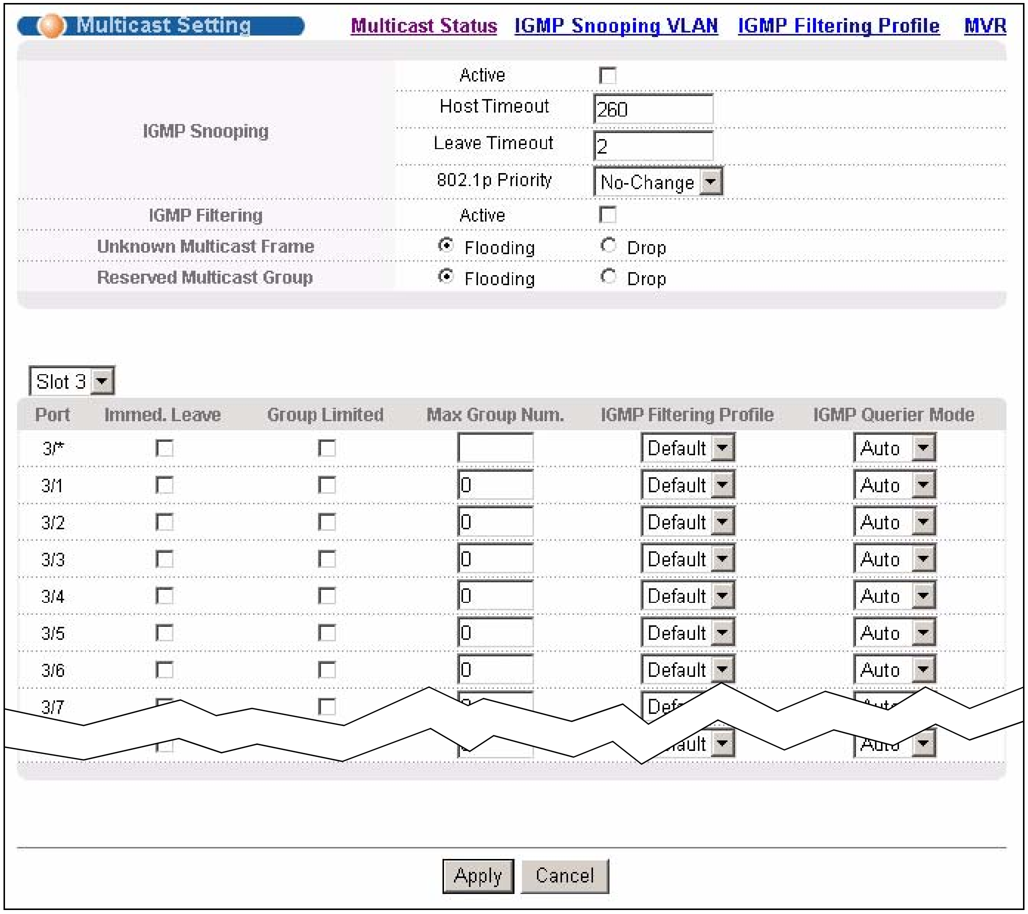
Table 48 Multicast Status

LABEL	DESCRIPTION
Index	This is the index number of the entry.
VID	This field displays the multicast VLAN ID.
Port	This field displays the slot number and port number that belongs to the multicast group.
Multicast Group	This field displays IP multicast group addresses.

27.3 Multicast Setting

Use this screen to configure multicast settings for the switch or for the ports. See Section 27.1 on page 145 for more information on multicasting. To open this screen, click **Advanced Application** > **Multicast** > **Multicast Setting**.

Figure 58 Multicast Setting



IGMP Snooping	Active	□
	Host Timeout	260
	Leave Timeout	2
	802.1p Priority	No-Change
IGMP Filtering	Active	□
Unknown Multicast Frame	● Flooding	○ Drop
Reserved Multicast Group	● Flooding	○ Drop

Slot 3

Port	Immed. Leave	Group Limited	Max Group Num.	IGMP Filtering Profile	IGMP Querier Mode
3/*	□	□		Default	Auto
3/1	□	□	0	Default	Auto
3/2	□	□	0	Default	Auto
3/3	□	□	0	Default	Auto
3/4	□	□	0	Default	Auto
3/5	□	□	0	Default	Auto
3/6	□	□	0	Default	Auto
3/7	□	□			

The following table describes the labels in this screen.

Table 49 Multicast Setting

LABEL	DESCRIPTION
IGMP Snooping	Use these settings to configure IGMP Snooping.
Active	Select **Active** to enable IGMP Snooping to forward group multicast traffic only to ports that are members of that group.
Host Timeout	Specify the time (from 1 to 16,711,450) in seconds that elapses before the switch removes an IGMP group membership entry if it does not receive report messages from the port.
Leave Timeout	Enter an IGMP leave timeout value (from 1 to 16,711,450) in seconds. This defines how many seconds the switch waits for an IGMP report before removing an IGMP snooping membership entry when an IGMP leave message is received from a host.
802.1p Priority	Select a priority level (0-7) to which the switch changes the priority in outgoing IGMP control packets. Otherwise, select **No-Change** to not replace the priority.
IGMP Filtering	Select **Active** to enable IGMP filtering to control which IGMP groups a subscriber on a port can join.
Unknown Multicast Frame	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.

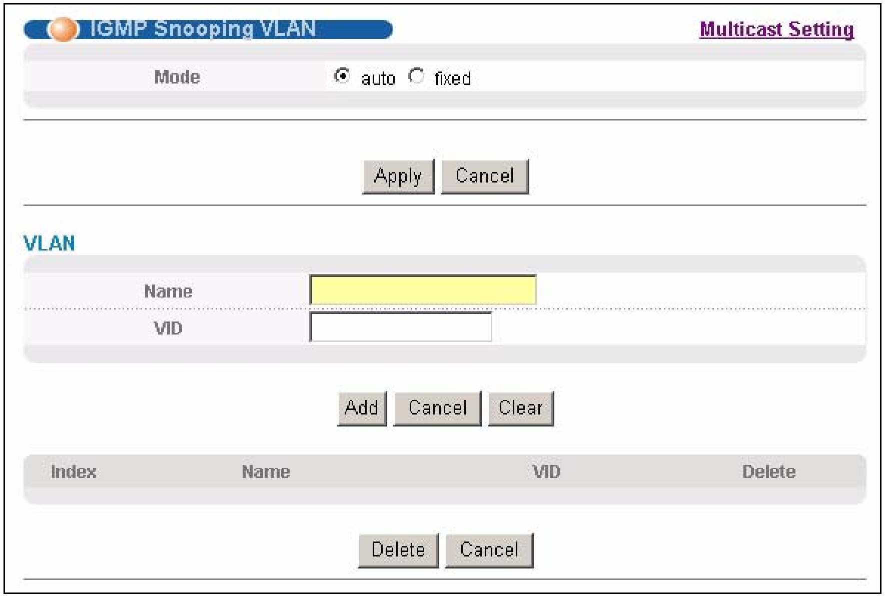
Table 49 Multicast Setting (continued)

LABEL	DESCRIPTION
Reserved Multicast Group	The IP address range of 224.0.0.0 to 224.0.0.255 are reserved for multicasting on the local network only. For example, 224.0.0.1 is for all hosts on a local network segment and 224.0.0.9 is used to send RIP routing information to all RIP v2 routers on the same network segment. A multicast router will not forward a packet with the destination IP address within this range to other networks. See the IANA web site for more information. Specify the action to perform when the switch receives a frame with a reserved multicast address. Select **Drop** to discard the frame(s). Select **Flooding** to send the frame(s) to all ports.
Slot	Select the slot at whose settings you want to look.
Port	This field displays the slot number and port number.
*	Settings in this row apply to all ports. Use this row only if you want to make some settings the same for all ports. Use this row first to set the common settings and then make adjustments on a port-by-port basis. Note: Changes in this row are copied to all the ports as soon as you make them.
Immed. Leave	Select this option to set the switch to remove this port from the multicast tree when an IGMP version 2 leave message is received on this port. Select this option if there is only one host connected to this port.
Group Limited	Select this option to limit the number of multicast groups this port is allowed to join.
Max Group Num.	Enter the number of multicast groups this port is allowed to join. Once a port is registered in the specified number of multicast groups, any new IGMP join report frame(s) is dropped on this port.
IGMP Filtering Profile	Select the name of the IGMP filtering profile to use for this port. Otherwise, select **Default** to prohibit the port from joining any multicast group.
IGMP Querier Mode	The switch treats an IGMP query port as being connected to an IGMP multicast router (or server). The switch forwards IGMP join or leave packets to an IGMP query port. Select **Auto** to have the switch use the port as an IGMP query port if the port receives IGMP query packets. Select **Fixed** to have the switch always use the port as an IGMP query port. Select this when you connect an IGMP multicast server to the port. Select **Edge** to stop the switch from using the port as an IGMP query port. The switch will not keep any record of an IGMP router being connected to this port. The switch does not forward IGMP join or leave packets to this port.
Apply	Click **Apply** to save your changes to the switch's run-time memory. The switch loses these changes if it is turned off or loses power, so use the **Save** link on the top navigation panel to save your changes to the non-volatile memory when you are done configuring.
Cancel	Click **Cancel** to reset the fields.

27.4 IGMP Snooping VLAN

Click **Advanced Applications** > **Multicast** in the navigation panel. Click the **Multicast Setting** link and then the **IGMP Snooping VLAN** link to display the screen as shown. See Section 27.1.4 on page 146 for more information on IGMP Snooping VLAN.

Figure 59 IGMP Snooping VLAN



Mode ● auto ○ fixed

The following table describes the labels in this screen.

Table 50 IGMP Snooping VLAN

LABEL	DESCRIPTION
Mode	Select **auto** to have the switch learn multicast group membership information of any VLANs automatically. Select **fixed** to have the switch only learn multicast group membership information of the VLAN(s) that you specify below. In either **auto** or **fixed** mode, the switch can learn up to 16 VLANs (including up to three VLANs you configured in the **MVR** screen). For example, if you have configured one multicast VLAN in the **MVR** screen, you can only specify up to 15 VLANs in this screen. The switch drops any IGMP control messages which do not belong to these 16 VLANs. Note: You must also enable IGMP snooping in the **Multicast Setting** screen first.
Apply	Click **Apply** to save your changes to the switch's run-time memory. The switch loses these changes if it is turned off or loses power, so use the **Save** link on the top navigation panel to save your changes to the non-volatile memory when you are done configuring.
Cancel	Click **Cancel** to begin configuring this screen afresh.
VLAN	Use this section of the screen to add VLANs upon which the switch is to perform IGMP snooping.
Name	Enter the descriptive name of the VLAN for identification purposes.
VID	Enter the ID of a static VLAN; the valid range is between 1 and 4094. Note: You cannot configure the same VLAN ID as in the **MVR** screen.
Add	Click **Add** to insert the entry in the summary table below and save your changes to the switch's run-time memory. The switch loses these changes if it is turned off or loses power, so use the **Save** link on the top navigation panel to save your changes to the non-volatile memory when you are done configuring.

Table 50 IGMP Snooping VLAN (continued)

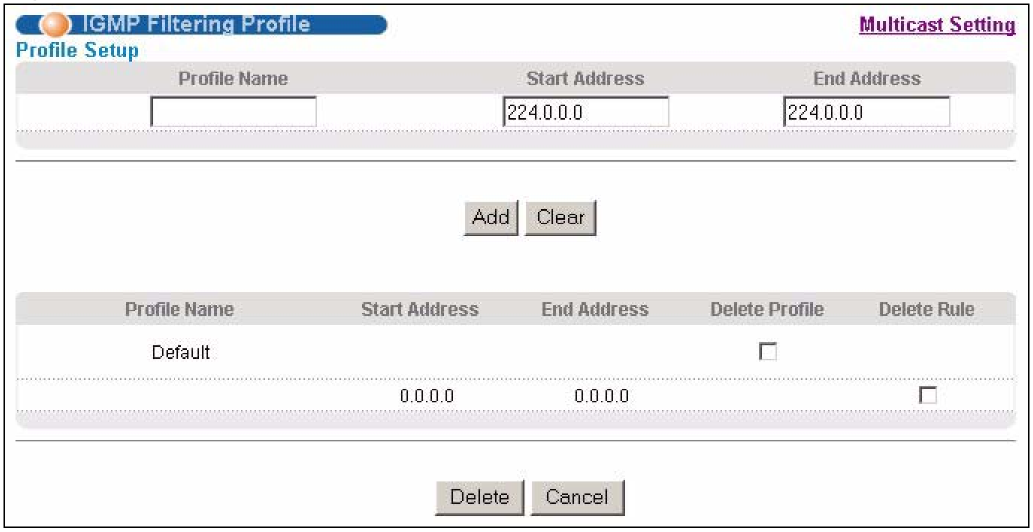
LABEL	DESCRIPTION
Cancel	Click **Cancel** to reset the fields to your previous configuration.
Clear	Click this to clear the fields.
Index	This is the number of the IGMP snooping VLAN entry in the table.
Name	This field displays the descriptive name for this VLAN group.
VID	This field displays the ID number of the VLAN group.
Delete	Check the rule(s) that you want to remove in the **Delete** column, then click the **Delete** button.
Cancel	Click **Cancel** to clear the **Delete** check boxes.

27.5 IGMP Filtering Profile

IGMP filter profiles allow you to control access to IGMP multicast groups. This allows you to have a service available to a specific IGMP multicast group. You can configure an IGMP filter profile for an IGMP multicast group that has access to a service (like a SIP server for example). Within a profile, configure an IGMP filter to specify the multicast IP address ranges. Then, assign the IGMP filter profile to the ports (in the **Multicast Setting** screen) that are allowed to use the service.

To open this screen, click **Advanced Application** > **Multicast** > **Multicast Setting** > **IGMP Filtering Profile**.

Figure 60 IGMP Filtering Profile



Profile Name	Start Address	End Address
	224.0.0.0	224.0.0.0

Profile Name	Start Address	End Address	Delete Profile	Delete Rule
Default			□	
	0.0.0.0	0.0.0.0		□

The following table describes the labels in this screen.

Table 51 IGMP Filtering Profile

LABEL	DESCRIPTION
Profile Name	Enter a descriptive name for the profile for identification purposes. To configure additional rule(s) for a profile that you have already added, enter the profile name and specify a different IP multicast address range.
Start Address	Type the starting multicast IP address for a range of multicast IP addresses that you want to belong to the IGMP filter profile.
End Address	Type the ending multicast IP address for a range of IP addresses that you want to belong to the IGMP filter profile. If you want to add a single multicast IP address, enter it in both the **Start Address** and **End Address** fields.
Add	Click **Add** to save the profile to the switch's run-time memory. The switch loses these changes if it is turned off or loses power, so use the **Save** link on the top navigation panel to save your changes to the non-volatile memory when you are done configuring.
Clear	Click **Clear** to clear the fields to the factory defaults.
Profile Name	This field displays the descriptive name of the profile.
Start Address	This field displays the start of the multicast address range.
End Address	This field displays the end of the multicast address range.
Delete	To delete the profile(s) and all the accompanying rules, select the profile(s) that you want to remove in the **Delete Profile** column, then click the **Delete** button. To delete a rule(s) from a profile, select the rule(s) that you want to remove in the **Delete Rule** column, then click the **Delete** button.
Cancel	Click **Cancel** to clear the **Delete Profile**/**Delete Rule** check boxes.

27.6 MVR Overview

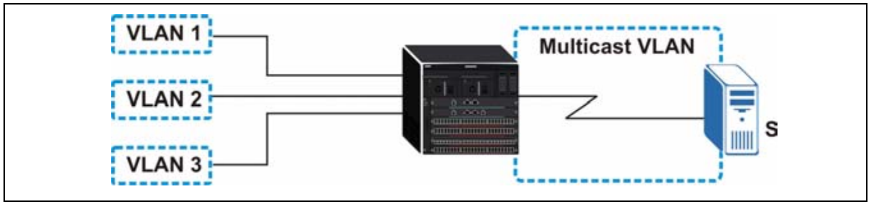
Multicast VLAN Registration (MVR) is designed for applications (such as Media-on-Demand (MoD)) that use multicast traffic across an Ethernet ring-based service provider network.

MVR allows one single multicast VLAN to be shared among different subscriber VLANs on the network. While isolated in different subscriber VLANs, connected devices can subscribe to and unsubscribe from the multicast stream in the multicast VLAN. This improves bandwidth utilization with reduced multicast traffic in the subscriber VLANs and simplifies multicast group management.

You must enable IGMP snooping to use MVR. However, MVR only responds to IGMP join and leave control messages from multicast groups that are configured under MVR. Join and leave reports from other multicast groups are managed by IGMP snooping.

The following figure shows a network example. The subscriber VLAN (**1**, **2** and **3**) information is hidden from the streaming media server, **S**. In addition, the multicast VLAN information is only visible to the switch and **S**.

Figure 61 MVR Network Example



27.6.1 Types of MVR Ports

In MVR, a source port is a port on the switch that can send and receive multicast traffic in a multicast VLAN while a receiver port can only receive multicast traffic. Once configured, the switch maintains a forwarding table that matches the multicast stream to the associated multicast group.

27.6.2 MVR Modes

You can set your switch to operate in either dynamic or compatible mode.

In dynamic mode, the switch sends IGMP leave and join reports to the other multicast devices (such as multicast routers or servers) in the multicast VLAN. This allows the multicast devices to update the multicast forwarding table to forward or not forward multicast traffic to the receiver ports.

In compatible mode, the switch does not send any IGMP reports. In this case, you must manually configure the forwarding settings on the multicast devices in the multicast VLAN.

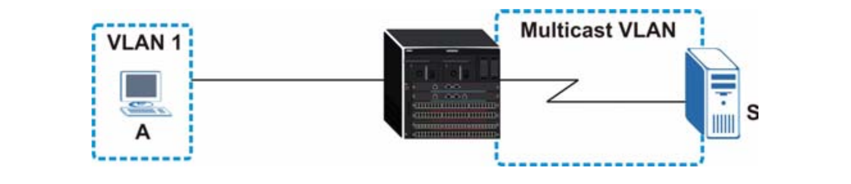
27.6.3 How MVR Works

The following figure shows a multicast television example where a subscriber device (such as a computer) in VLAN 1 receives multicast traffic from the streaming media server, **S**, via the switch. Multiple subscriber devices can connect through a port configured as the receiver on the switch.

When the subscriber selects a television channel, computer **A** sends an IGMP report to the switch to join the appropriate multicast group. If the IGMP report matches one of the configured MVR multicast group addresses on the switch, an entry is created in the forwarding table on the switch. This maps the subscriber VLAN to the list of forwarding destinations for the specified multicast traffic.

When the subscriber changes the channel or turns off the computer, an IGMP leave message is sent to the switch to leave the multicast group. The switch sends a query to VLAN 1 on the receiver port (in this case, a DSL port on the switch). If there is another subscriber device connected to this port in the same subscriber VLAN, the receiving port will still be on the list of forwarding destination for the multicast traffic. Otherwise, the switch removes the receiver port from the forwarding table.

Figure 62 MVR Multicast Television Example

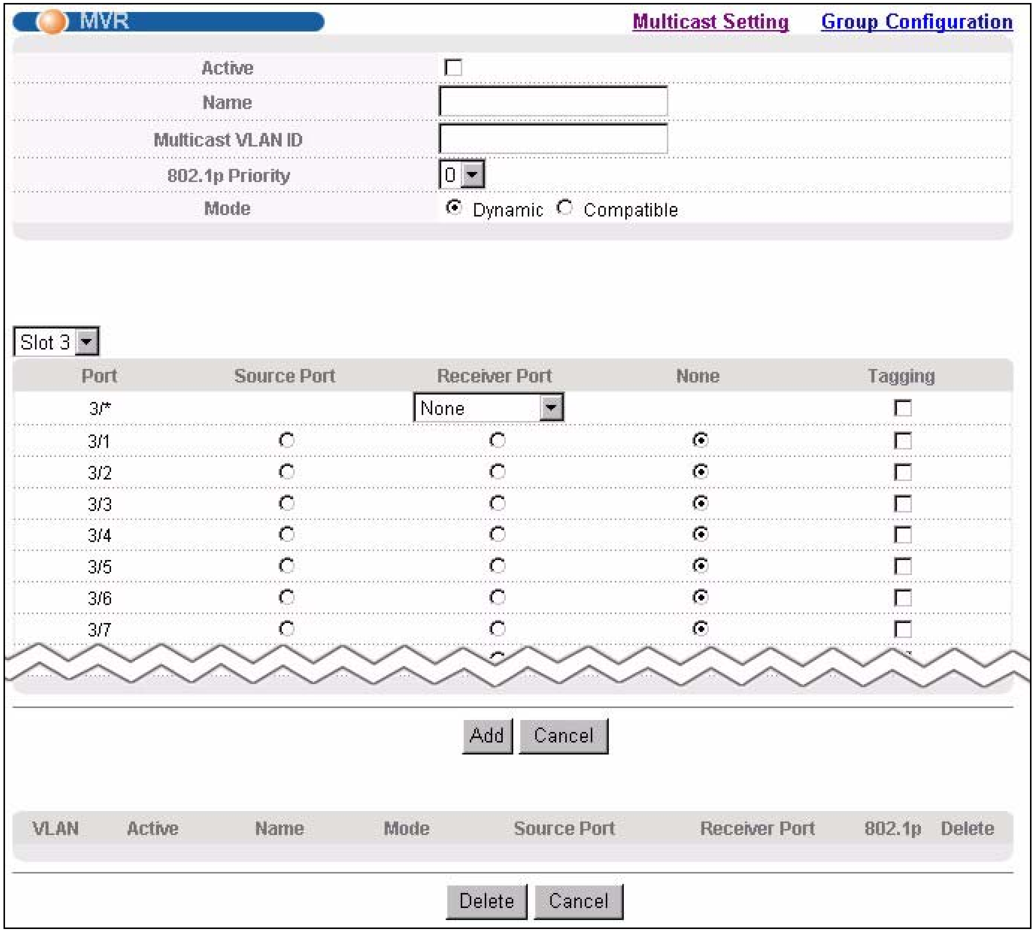


27.7 MVR

Use this screen to create multicast VLANs and to select the receiver port(s) and a source port for each multicast VLAN. See Section 27.6 on page 151 for background information about MVR. The switch automatically creates a static VLAN (with the same VID) when you create a multicast VLAN in this screen. To open this screen, click **Advanced Application** > **Multicast** > **Multicast Setting** > **MVR**.

You must enable IGMP snooping to use MVR. However, MVR only responds to IGMP messages from multicast groups that are configured under MVR.

Figure 63 MVR



Active	□
Name	
Multicast VLAN ID	
802.1p Priority	0
Mode	● Dynamic ○ Compatible

Slot 3

Port	Source Port	Receiver Port	None	Tagging
3/*		None		□
3/1	○	○	●	□
3/2	○	○	●	□
3/3	○	○	●	□
3/4	○	○	●	□
3/5	○	○	●	□
3/6	○	○	●	□
3/7	○	○	●	□

VLAN	Active	Name	Mode	Source Port	Receiver Port	802.1p	Delete

The following table describes the related labels in this screen.

Table 52 MVR

LABEL	DESCRIPTION
Active	Select this check box to enable MVR to allow one single multicast VLAN to be shared among different subscriber VLANs on the network.
Name	Enter a descriptive name (up to 32 printable English keyboard characters) for identification purposes.
Multicast VLAN ID	Enter the VLAN ID (1 to 4094) of the multicast VLAN.
802.1p Priority	Select a priority level (0-7) with which the switch replaces the priority in outgoing IGMP control packets (belonging to this multicast VLAN).
Mode	Specify the MVR mode on the switch. Choices are **Dynamic** and **Compatible**. Select **Dynamic** to send IGMP reports to all MVR source ports in the multicast VLAN. Select **Compatible** to set the switch not to send IGMP reports.
Slot	Select the slot at whose settings you want to look.
Port	This field displays the slot number and port number.

Table 52 MVR (continued)

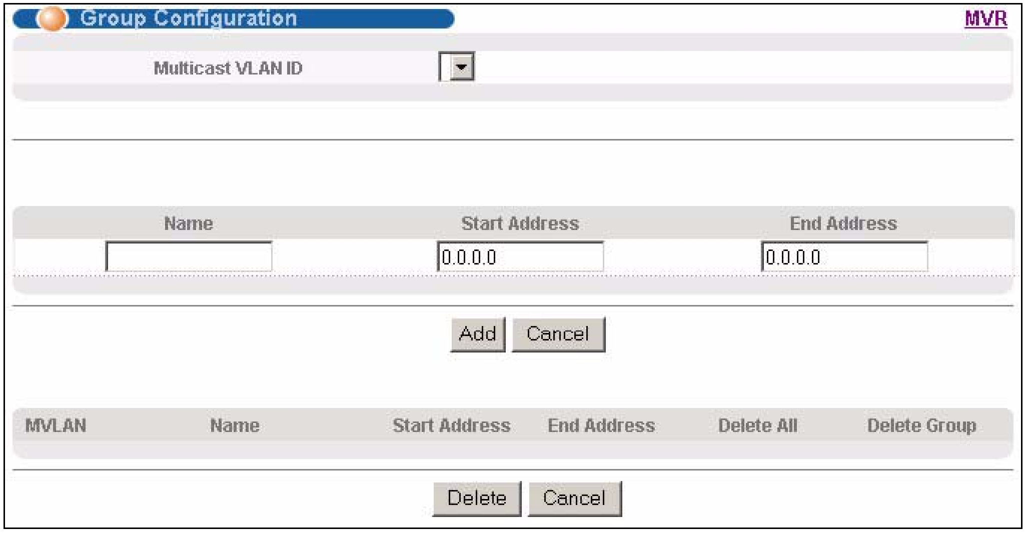
LABEL	DESCRIPTION
*	Settings in this row apply to all ports. Use this row only if you want to make some settings the same for all ports. Use this row first to set the common settings and then make adjustments on a port-by-port basis. Note: Changes in this row are copied to all the ports as soon as you make them.
Source Port	Select this option to set this port as the MVR source port that sends and receives multicast traffic. All source ports must belong to a single multicast VLAN.
Receiver Port	Select this option to set this port as a receiver port that only receives multicast traffic.
None	Select this option to set the port not to participate in MVR. No MVR multicast traffic is sent or received on this port.
Tagging	Select this if you want the port to tag the VLAN ID in all outgoing frames transmitted.
Add	Click **Add** to save your changes to the switch’s run-time memory. The switch loses these changes if it is turned off or loses power, so use the **Save** link on the top navigation panel to save your changes to the non-volatile memory when you are done configuring.
Cancel	Click **Cancel** to reset the fields.
VLAN	This field displays the multicast VLAN ID.
Active	This field displays whether the multicast group is enabled or not.
Name	This field displays the descriptive name for this setting.
Mode	This field displays the MVR mode.
Source Port	This field displays the source port number(s).
Receiver Port	This field displays the receiver port number(s).
802.1p	This field displays the priority level.
Delete	To delete a multicast VLAN(s), select the rule(s) that you want to remove in the **Delete** column, then click the **Delete** button.
Cancel	Click **Cancel** to clear the **Delete** check boxes.

27.8 Group Configuration

Use this screen to configure MVR IP multicast group addresses. All source ports and receiver ports belonging to a multicast group can receive multicast data sent to MVR IP multicast groups. See Section 27.6 on page 151 for background information about MVR. To open this screen, click **Advanced Application** > **Multicast** > **Multicast Setting** > **MVR** > **Group Configuration**.

A port can belong to more than one multicast VLAN. However, IP multicast group addresses in different multicast VLANs cannot overlap.

Figure 64 Group Configuration



The following table describes the labels in this screen.

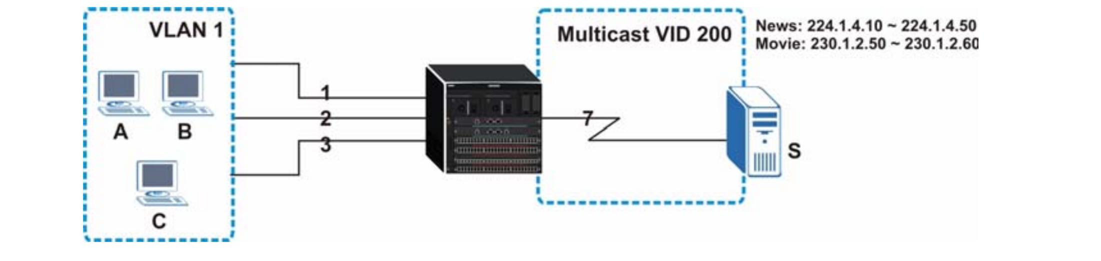
Table 53 Group Configuration

LABEL	DESCRIPTION
Multicast VLAN ID	Select a multicast VLAN ID (that you configured in the **MVR** screen) from the drop-down list box.
Name	Enter a descriptive name for identification purposes.
Start Address	Enter the starting IP multicast address of the multicast group in dotted decimal notation. See Section 27.1.1 on page 145 for more information about multicast addresses.
End Address	Enter the ending IP multicast address of the multicast group in dotted decimal notation. Enter the same IP address as the **Start Address** field if you want to configure only one IP address for a multicast group. See Section 27.1.1 on page 145 for more information about multicast addresses.
Add	Click **Add** to save your changes to the switch's run-time memory. The switch loses these changes if it is turned off or loses power, so use the **Save** link on the top navigation panel to save your changes to the non-volatile memory when you are done configuring.
Cancel	Click **Cancel** to reset the fields.
MVLAN	This field displays the multicast VLAN ID.
Name	This field displays the descriptive name for this setting.
Start Address	This field displays the starting IP address of the multicast group.
End Address	This field displays the ending IP address of the multicast group.
Delete	Select **Delete Group** and click **Delete** to remove the selected entry(ies) from the table.
Cancel	Select **Cancel** to clear the checkbox(es) in the table.

27.8.1 MVR Configuration Example

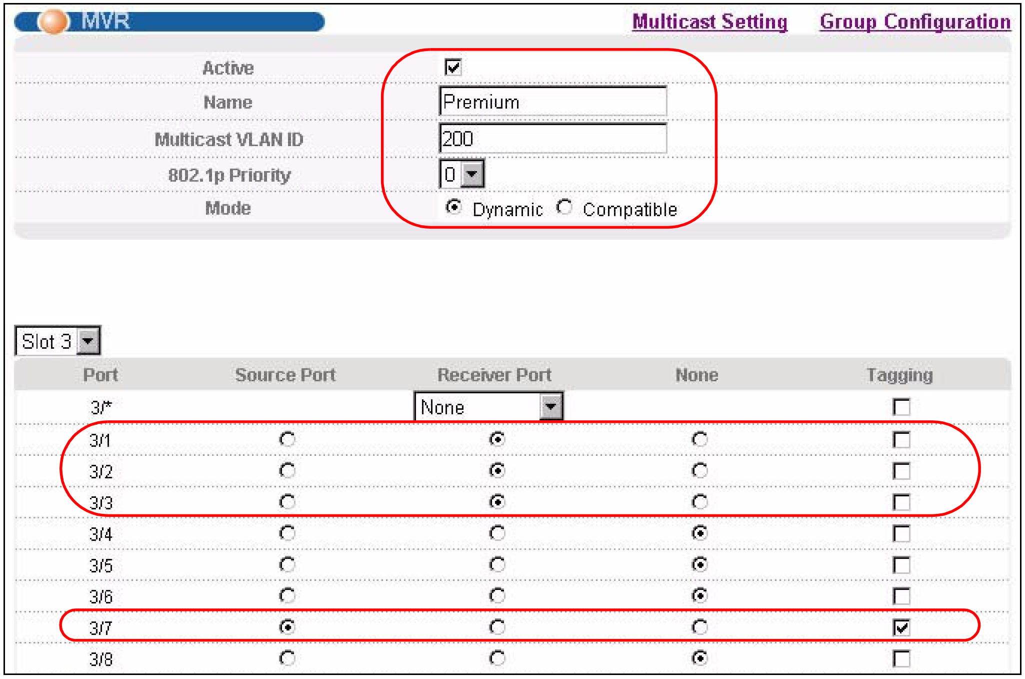
The following figure shows a network example where ports 1, 2 and 3 (in slot 3) on the switch belong to VLAN 1. In addition, port 7 (also in slot 3) belongs to the multicast group with VID 200 to receive multicast traffic (the **News** and **Movie** channels) from the remote streaming media server, **S**. Computers A, B and C in VLAN are able to receive the traffic.

Figure 65 MVR Configuration Example



To configure the MVR settings on the switch, create a multicast group in the **MVR** screen and set the receiver and source ports.

Figure 66 MVR Configuration Example



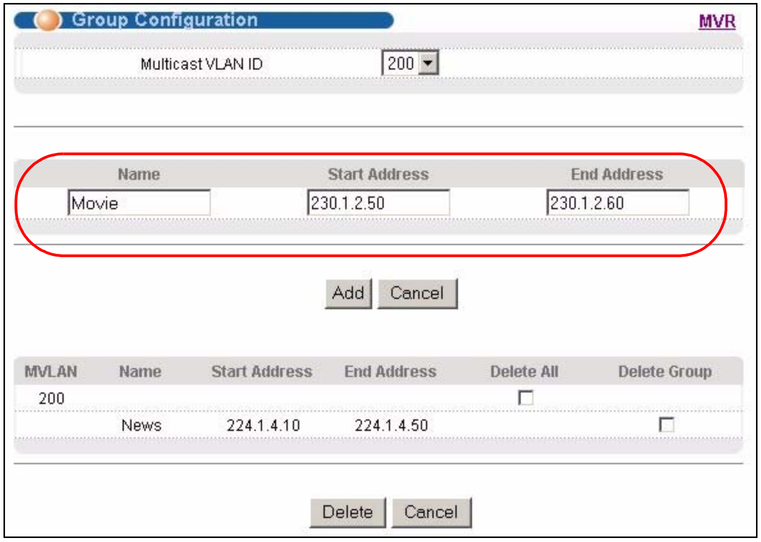
Active	☑
Name	Premium
Multicast VLAN ID	200
802.1p Priority	0
Mode	● Dynamic ○ Compatible

Slot 3

Port	Source Port	Receiver Port	None	Tagging
3/*		None		□
3/1	○	●	○	□
3/2	○	●	○	□
3/3	○	●	○	□
3/4	○	○	●	□
3/5	○	○	●	□
3/6	○	○	●	□
3/7	●	○	○	☑
3/8	○	○	●	□

To set the switch to forward the multicast group traffic to the subscribers, configure multicast group settings in the **Group Configuration** screen. The following figure shows an example where two multicast groups (**News** and **Movie**) are configured for the multicast VLAN 200.

Figure 67 MVR Group Configuration Example

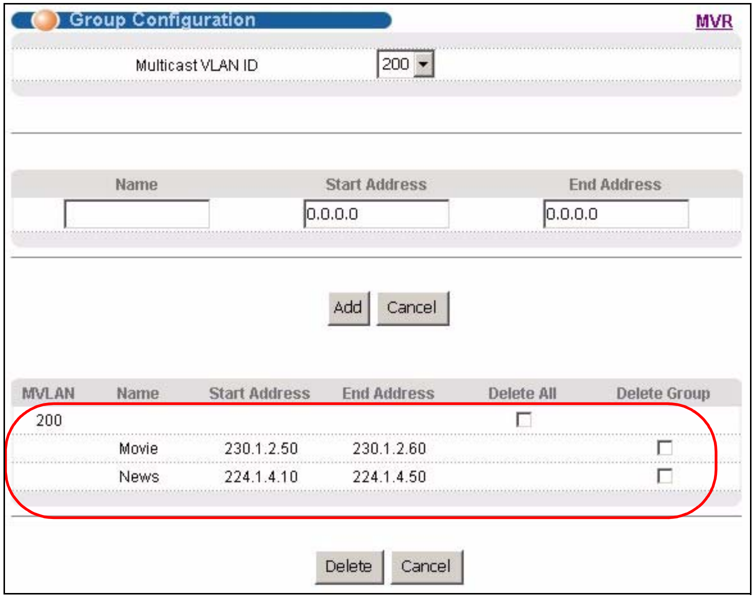


Multicast VLAN ID: 200

Name	Start Address	End Address
Movie	230.1.2.50	230.1.2.60

MVLAN	Name	Start Address	End Address	Delete All	Delete Group
200				□	
	News	224.1.4.10	224.1.4.50		□

Figure 68 MVR Group Configuration Example



Multicast VLAN ID: 200

Name	Start Address	End Address
	0.0.0.0	0.0.0.0

MVLAN	Name	Start Address	End Address	Delete All	Delete Group
200				□	
	Movie	230.1.2.50	230.1.2.60		□
	News	224.1.4.10	224.1.4.50		□

28

Authentication and Accounting

This chapter describes how to configure authentication and accounting settings on the switch.

28.1 Authentication, Authorization and Accounting (AAA)

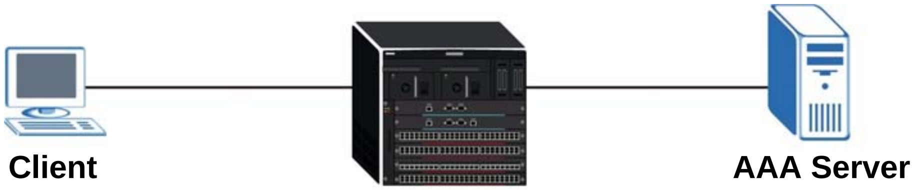
Authentication is the process of determining who a user is and validating access to the switch. The switch can authenticate users who try to log in based on user accounts configured on the switch itself. The switch can also use an external authentication server to authenticate a large number of users

Authorization is the process of determining what a user is allowed to do. Different user accounts may have higher or lower privilege levels associated with them. For example, user A may have the right to create new login accounts on the switch but user B cannot. The switch can authorize users based on user accounts configured on the switch itself or it can use an external server to authorize a large number of users.

Accounting is the process of recording what a user is doing. The switch can use an external server to track when users log in, log out, execute commands and so on. Accounting can also record system related actions such as boot up and shut down times of the switch.

The external servers that perform authentication, authorization and accounting functions are known as AAA servers. The switch supports RADIUS (Remote Authentication Dial-In User Service, see Section 28.1.2 on page 160) and TACACS+ (Terminal Access Controller Access-Control System Plus, see Section 28.1.2 on page 160) as external authentication, authorization and accounting servers.

Figure 69 AAA Server



28.1.1 Local User Accounts

By storing user profiles locally on the switch, your switch is able to authenticate and authorize users without interacting with a network AAA server. However, there is a limit on the number of users you may authenticate in this way (See Chapter 33 on page 271).

28.1.2 RADIUS and TACACS+

RADIUS and TACACS+ are security protocols used to authenticate users by means of an external server instead of (or in addition to) an internal device user database that is limited to the memory capacity of the device. In essence, RADIUS and TACACS+ authentication both allow you to validate an unlimited number of users from a central location.

The following table describes some key differences between RADIUS and TACACS+.

Table 54 RADIUS vs TACACS+

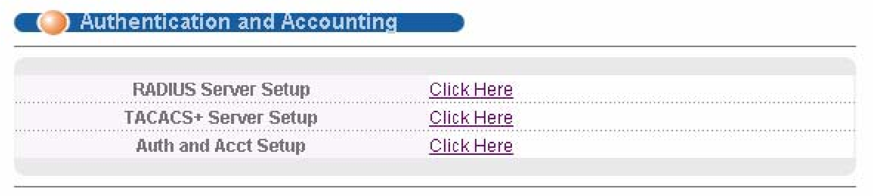
	RADIUS	TACACS+
Transport Protocol	UDP (User Datagram Protocol)	TCP (Transmission Control Protocol)
Encryption	Encrypts the password sent for authentication.	All communication between the client (the switch) and the TACACS server is encrypted.

28.2 Authentication and Accounting Screens

The **Authentication and Accounting** screens allow you to enable authentication, accounting or all of them on the switch. First, configure your authentication and accounting server settings (RADIUS, TACACS+ or both) and then set up the authentication priority and accounting settings.

Click **Advanced Application** > **Auth and Acct** in the navigation panel to display the screen as shown.

Figure 70 Authentication and Accounting



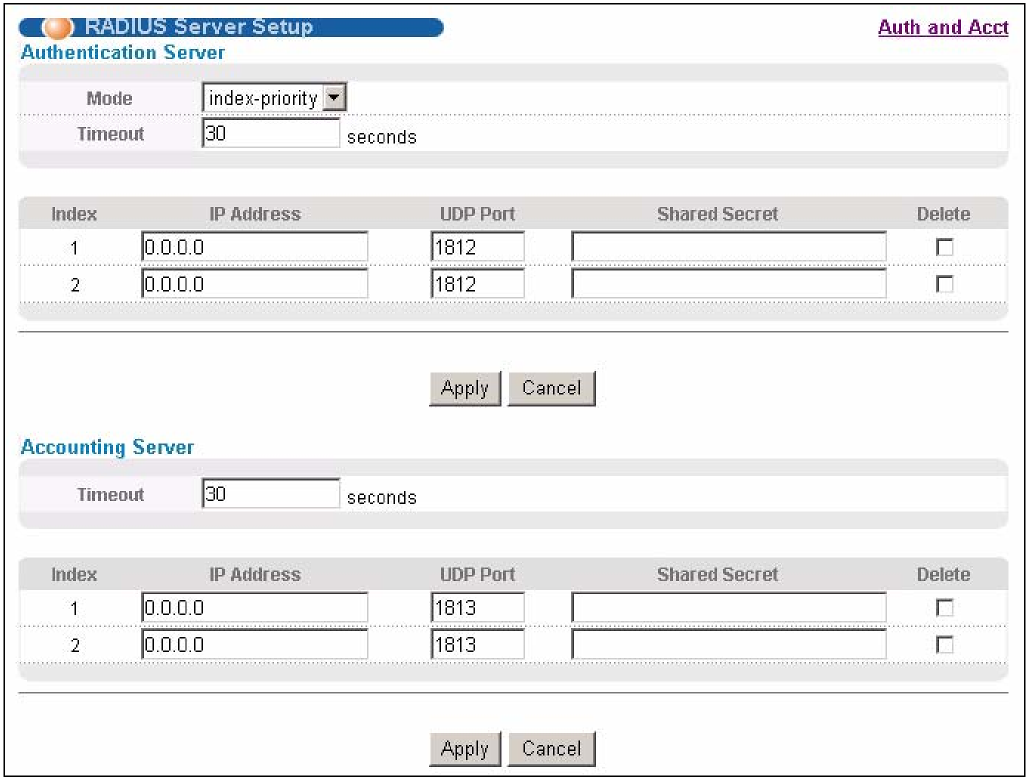
Authentication and Accounting

RADIUS Server Setup	Click Here
TACACS+ Server Setup	Click Here
Auth and Acct Setup	Click Here

28.2.1 RADIUS Server Setup

Use this screen to configure your RADIUS server settings. See Section 28.1.2 on page 160 for more information on RADIUS servers. Click on the **RADIUS Server Setup** link in the **Authentication and Accounting** screen to view the screen as shown.

Figure 71 RADIUS Server Setup



Authentication Server

Mode	index-priority ▾
Timeout	30 seconds

Index	IP Address	UDP Port	Shared Secret	Delete
1	0.0.0.0	1812		□
2	0.0.0.0	1812		□

Accounting Server

Timeout	30 seconds

Index	IP Address	UDP Port	Shared Secret	Delete
1	0.0.0.0	1813		□
2	0.0.0.0	1813		□

The following table describes the labels in this screen.

Table 55 RADIUS Server Setup

LABEL	DESCRIPTION
Authentication Server	Use this section to configure your RADIUS authentication settings.
Mode	This field is only valid if you configure multiple RADIUS servers. Select **index-priority** and the switch tries to authenticate with the first configured RADIUS server, if the RADIUS server does not respond then the switch tries to authenticate with the second RADIUS server. Select **round-robin** to alternate between the RADIUS servers that it sends authentication requests to.
Timeout	Specify the amount of time in seconds that the switch waits for an authentication request response from the RADIUS server. If you are using **index-priority** for your authentication and you are using two RADIUS servers then the timeout value is divided between the two RADIUS servers. For example, if you set the timeout value to 30 seconds, then the switch waits for a response from the first RADIUS server for 15 seconds and then tries the second RADIUS server.
Index	This is a read-only number representing a RADIUS server entry.
IP Address	Enter the IP address of an external RADIUS server in dotted decimal notation.
UDP Port	The default port of a RADIUS server for authentication is **1812**. You need not change this value unless your network administrator instructs you to do so.
Shared Secret	Specify a password (up to 32 alphanumeric characters) as the key to be shared between the external RADIUS server and the switch. This key is not sent over the network. This key must be the same on the external RADIUS server and the switch.
Delete	Check this box if you want to remove an existing RADIUS server entry from the switch. This entry is deleted when you click **Apply**.

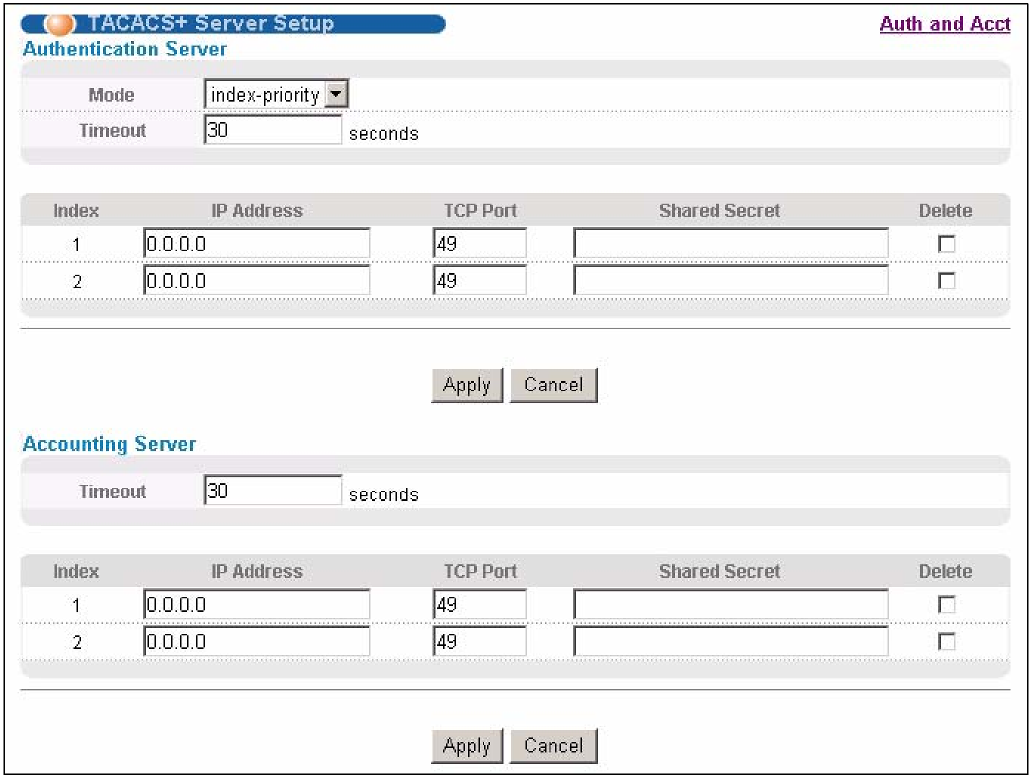
Table 55 RADIUS Server Setup (continued)

LABEL	DESCRIPTION
Apply	Click **Apply** to save your changes to the switch’s run-time memory. The switch loses these changes if it is turned off or loses power, so use the **Save** link on the top navigation panel to save your changes to the non-volatile memory when you are done configuring.
Cancel	Click **Cancel** to begin configuring this screen afresh.
Accounting Server	Use this section to configure your RADIUS accounting server settings.
Timeout	Specify the amount of time in seconds that the switch waits for an accounting request response from the RADIUS accounting server.
Index	This is a read-only number representing a RADIUS accounting server entry.
IP Address	Enter the IP address of an external RADIUS accounting server in dotted decimal notation.
UDP Port	The default port of a RADIUS server for accounting is **1813**. You need not change this value unless your network administrator instructs you to do so.
Shared Secret	Specify a password (up to 32 alphanumeric characters) as the key to be shared between the external RADIUS accounting server and the switch. This key is not sent over the network. This key must be the same on the external RADIUS accounting server and the switch.
Delete	Check this box if you want to remove an existing RADIUS accounting server entry from the switch. This entry is deleted when you click **Apply**.
Apply	Click **Apply** to save your changes to the switch’s run-time memory. The switch loses these changes if it is turned off or loses power, so use the **Save** link on the top navigation panel to save your changes to the non-volatile memory when you are done configuring.
Cancel	Click **Cancel** to begin configuring this screen afresh.

28.2.2 TACACS+ Server Setup

Use this screen to configure your TACACS+ server settings. See Section 28.1.2 on page 160 for more information on TACACS+ servers. Click on the **TACACS+ Server Setup** link in the **Authentication and Accounting** screen to view the screen as shown.

Figure 72 TACACS+ Server Setup



Authentication Server

Mode	index-priority
Timeout	30 seconds

Index	IP Address	TCP Port	Shared Secret	Delete
1	0.0.0.0	49		□
2	0.0.0.0	49		□

Accounting Server

Timeout	30 seconds

Index	IP Address	TCP Port	Shared Secret	Delete
1	0.0.0.0	49		□
2	0.0.0.0	49		□

The following table describes the labels in this screen.

Table 56 TACACS+ Server Setup

LABEL	DESCRIPTION
Authentication Server	Use this section to configure your TACACS+ authentication settings.
Mode	This field is only valid if you configure multiple TACACS+ servers. Select **index-priority** and the switch tries to authenticate with the first configured TACACS+ server, if the TACACS+ server does not respond then the switch tries to authenticate with the second TACACS+ server. Select **round-robin** to alternate between the TACACS+ servers that it sends authentication requests to.
Timeout	Specify the amount of time in seconds that the switch waits for an authentication request response from the TACACS+ server. If you are using **index-priority** for your authentication and you are using two TACACS+ servers then the timeout value is divided between the two TACACS+ servers. For example, if you set the timeout value to 30 seconds, then the switch waits for a response from the first TACACS+ server for 15 seconds and then tries the second TACACS+ server.
Index	This is a read-only number representing a TACACS+ server entry.
IP Address	Enter the IP address of an external TACACS+ server in dotted decimal notation.
TCP Port	The default port of a TACACS+ server for authentication is **49**. You need not change this value unless your network administrator instructs you to do so.
Shared Secret	Specify a password (up to 32 alphanumeric characters) as the key to be shared between the external TACACS+ server and the switch. This key is not sent over the network. This key must be the same on the external TACACS+ server and the switch.

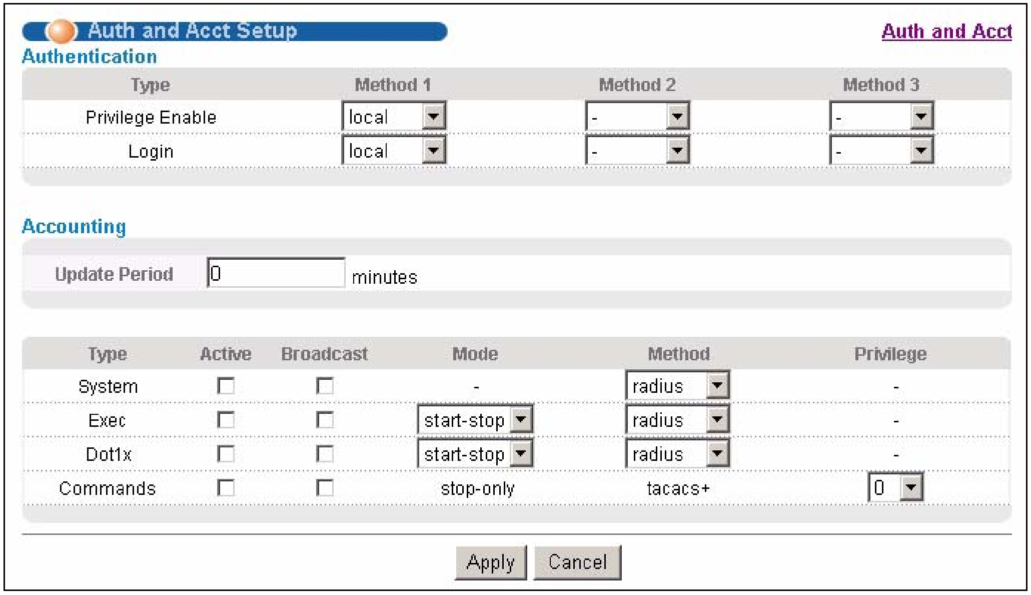
Table 56 TACACS+ Server Setup (continued)

LABEL	DESCRIPTION
Delete	Check this box if you want to remove an existing TACACS+ server entry from the switch. This entry is deleted when you click **Apply**.
Apply	Click **Apply** to save your changes to the switch's run-time memory. The switch loses these changes if it is turned off or loses power, so use the **Save** link on the top navigation panel to save your changes to the non-volatile memory when you are done configuring.
Cancel	Click **Cancel** to begin configuring this screen afresh.
Accounting Server	Use this section to configure your TACACS+ accounting settings.
Timeout	Specify the amount of time in seconds that the switch waits for an accounting request response from the TACACS+ server.
Index	This is a read-only number representing a TACACS+ accounting server entry.
IP Address	Enter the IP address of an external TACACS+ accounting server in dotted decimal notation.
TCP Port	The default port of a TACACS+ server for accounting is **49**. You need not change this value unless your network administrator instructs you to do so.
Shared Secret	Specify a password (up to 32 alphanumeric characters) as the key to be shared between the external TACACS+ accounting server and the switch. This key is not sent over the network. This key must be the same on the external TACACS+ accounting server and the switch.
Delete	Check this box if you want to remove an existing TACACS+ accounting server entry from the switch. This entry is deleted when you click **Apply**.
Apply	Click **Apply** to save your changes to the switch's run-time memory. The switch loses these changes if it is turned off or loses power, so use the **Save** link on the top navigation panel to save your changes to the non-volatile memory when you are done configuring.
Cancel	Click **Cancel** to begin configuring this screen afresh.

28.2.3 Authentication and Accounting Setup

Use this screen to configure authentication and accounting settings on the switch. Click on the **Auth and Acct Setup** link in the **Authentication and Accounting** screen to view the screen as shown.

Figure 73 Auth and Acct Setup



Authentication

Type	Method 1	Method 2	Method 3
Privilege Enable	local	-	-
Login	local	-	-

Accounting

Update Period 0 minutes

Type	Active	Broadcast	Mode	Method	Privilege
System	□	□	-	radius	-
Exec	□	□	start-stop	radius	-
Dot1x	□	□	start-stop	radius	-
Commands	□	□	stop-only	tacacs+	0

The following table describes the labels in this screen.

Table 57 Auth and Acct Setup

LABEL	DESCRIPTION
Authentication	Use this section to specify the methods used to authenticate users accessing the switch.
Privilege Enable	These fields specify which database the switch should use (first, second and third) to authenticate access privilege level for administrator accounts (users for switch management). Configure the access privilege of accounts via commands (see the CLI Reference Guide) for **local** authentication. The **TACACS+** and **RADIUS** are external servers. Before you specify the priority, make sure you have set up the corresponding database correctly first. You can specify up to three methods for the switch to authenticate the access privilege level of administrators. The switch checks the methods in the order you configure them (first **Method 1**, then **Method 2** and finally **Method 3**). You must configure the settings in the **Method 1** field. If you want the switch to check other sources for access privilege level specify them in **Method 2** and **Method 3** fields. Select **local** to have the switch check the access privilege configured for local authentication. Select **radius** or **tacacs+** to have the switch check the access privilege via the external servers.

Table 57 Auth and Acct Setup (continued)

LABEL	DESCRIPTION
Login	These fields specify which database the switch should use (first, second and third) to authenticate administrator accounts (users for switch management). Configure the local user accounts in the **Access Control > Logins** screen. The TACACS+ and RADIUS are external servers. Before you specify the priority, make sure you have set up the corresponding database correctly first. You can specify up to three methods for the switch to authenticate administrator accounts. The switch checks the methods in the order you configure them (first **Method 1**, then **Method 2** and finally **Method 3**). You must configure the settings in the **Method 1** field. If you want the switch to check other sources for administrator accounts, specify them in **Method 2** and **Method 3** fields. Select **local** to have the switch check the administrator accounts configured in the **Access Control > Logins** screen. Select **radius** to have the switch check the administrator accounts configured via your RADIUS server. Select **tacacs+** to have the switch check the administrator accounts configured via your TACACS+ server.
Accounting	Use this section to configure accounting settings on the switch.
Update Period	This is the amount of time in minutes before the switch sends an update to the accounting server. This is only valid if you select the **start-stop** option for the **Exec** or **Dot1x** entries.
Type	The MM-7201 supports the following types of events to be sent to the accounting server(s): • **System** - Configure the switch to send information when the following system events occur: system boots up, system shuts down, system accounting is enabled, system accounting is disabled • **Exec** - Configure the switch to send information when an administrator logs in and logs out via the console port, telnet or SSH. • **Dot1x** - Configure the switch to send information when an IEEE 802.1x client begins a session (authenticates via the switch), ends a session as well as interim updates of a session. • **Commands** - Configure the switch to send information when commands of specified privilege level and higher are executed on the switch.
Active	Select this to activate accounting for a specified event types.
Broadcast	Select this to have the switch send accounting information to all configured accounting servers at the same time. If you don’t select this and you have two accounting servers set up, then the switch sends information to the first accounting server and if it doesn’t get a response from the accounting server then it tries the second accounting server.
Mode	The switch supports two modes of recording login events. Select: • **start-stop** - to have the switch send information to the accounting server when a user begins a session, during a user’s session (if it lasts past the **Update Period**), and when a user ends a session. • **stop-only** - to have the switch send information to the accounting server only when a user ends a session.
Method	Select whether you want to use RADIUS or TACACS+ for accounting of specific types of events. TACACS+ is the only method for recording **Commands** type of event.
Privilege	This field is only configurable for **Commands** type of event. Select the threshold command privilege level for which the switch should send accounting information. The switch will send accounting information when commands at the level you specify and higher are executed on the switch.

Table 57 Auth and Acct Setup (continued)

LABEL	DESCRIPTION
Apply	Click **Apply** to save your changes to the switch's run-time memory. The switch loses these changes if it is turned off or loses power, so use the **Save** link on the top navigation panel to save your changes to the non-volatile memory when you are done configuring.
Cancel	Click **Cancel** to begin configuring this screen afresh.

28.2.4 Vendor Specific Attribute

A Vendor Specific Attribute (VSA) is an attribute-value pair that is sent between a RADIUS server and the switch. Configure VSAs on the RADIUS server to set the switch to perform the following actions on an authenticated user:

- Limit bandwidth on incoming or outgoing traffic
- Assign account privilege levels

Refer to the documentation that comes with your RADIUS server on how to configure a VSA.

The following table describes the VSAs supported on the switch.

Table 58 Supported VSA

FUNCTION	ATTRIBUTE
Ingress Bandwidth Assignment	`Vendor-Id =` **`890`** (ZyXEL) `Vendor-Type =` **`1`** `Vendor-data =` ingress rate (decimal)
Egress Bandwidth Assignment	`Vendor-Id =` **`890`** (ZyXEL) `Vendor-Type =` **`2`** `Vendor-data =` egress rate (decimal)
Privilege Assignment	`Vendor-ID =` **`890`** (ZyXEL) `Vendor-Type =` **`3`** `Vendor-Data = "`**`shell:priv-lvl=`**`N"` or `Vendor-ID =` **`9`** (CISCO) `Vendor-Type =` **`1`** (CISCO-AVPAIR) `Vendor-Data = "`**`shell:priv-lvl=`**`N"` where `N` is a privilege level (from 0 to 14). Note: If you set the privilege level of a login account differently on the RADIUS server(s) and the switch, the user is assigned a privilege level from the database (RADIUS or local) the switch uses first for user authentication.

28.2.5 Tunnel Protocol Attribute

You can configure tunnel protocol attributes on the RADIUS server to assign a port on the switch to a VLAN (fixed, untagged). This will also set the port’s VID. Refer to RFC 3580 for more information.

Table 59 Supported Tunnel Protocol Attribute

FUNCTION	ATTRIBUTE

VLAN Assignment	`Tunnel-Type =` **`VLAN(13)`**
	`Tunnel-Medium-Type =` **`802(6)`**
	`Tunnel-Private-Group-ID =` VLAN ID
	Note: You must also create a VLAN with the specified VID on the switch.

PART V
IP

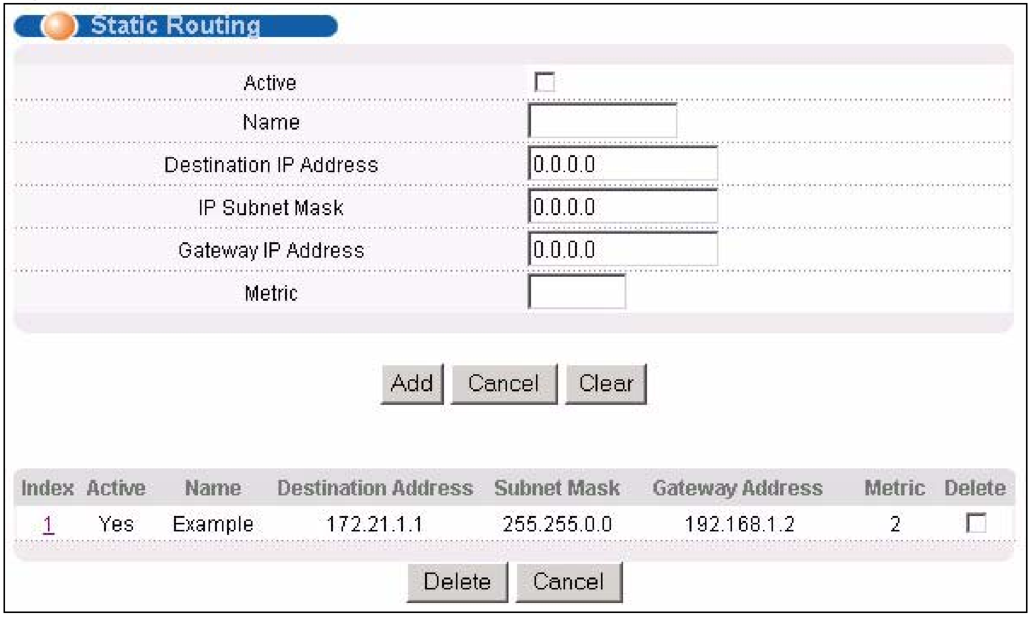
29

Static Route

29.1 Static Routing

Use this screen to tell the switch how to forward IP traffic when you configure the TCP/IP parameters manually. To open this screen, click **IP Application** > **Static Routing**.

Figure 74 Static Routing



Static Routing

Active	□
Name	
Destination IP Address	0.0.0.0
IP Subnet Mask	0.0.0.0
Gateway IP Address	0.0.0.0
Metric	

Index	Active	Name	Destination Address	Subnet Mask	Gateway Address	Metric	Delete
1	Yes	Example	172.21.1.1	255.255.0.0	192.168.1.2	2	□

The following table describes the related labels you use to create a static route.

Table 60 Static Routing

LABEL	DESCRIPTION
Active	Select this to activate this static route. Clear this to deactivate this static route.
Name	Enter a descriptive name (up to 32 printable English keyboard characters) for identification purposes.
Destination IP Address	This parameter specifies the IP network address of the final destination. Routing is always based on network number. If you need to specify a route to a single host, use a subnet mask of 255.255.255.255 in the subnet mask field to force the network number to be identical to the host ID.
IP Subnet Mask	Enter the subnet mask for this destination.
Gateway IP Address	Enter the IP address of the gateway. The gateway is an immediate neighbor of your switch that will forward the packet to the destination. The gateway must be a router on the same segment as your switch.

Table 60 Static Routing (continued)

LABEL	DESCRIPTION
Metric	The metric represents the “cost” of transmission for routing purposes. IP routing uses hop count as the measurement of cost, with a minimum of 1 for directly connected networks. Enter a number that approximates the cost for this link. The number need not be precise, but it must be between 1 and 15. In practice, 2 or 3 is usually a good number.
Add	Click **Add** to insert a new static route to the switch’s run-time memory. The switch loses these changes if it is turned off or loses power, so use the **Save** link on the top navigation panel to save your changes to the non-volatile memory when you are done configuring.
Cancel	Click **Cancel** to reset the above fields to your previous configuration.
Clear	Click **Clear** to set the above fields back to the factory defaults.
Index	This field displays the index number of the route. Click a number to edit the static route entry.
Active	This field displays **Yes** when the static route is activated and **No** when it is deactivated.
Name	This field displays the descriptive name for this route. This is for identification purpose only.
Destination Address	This field displays the IP network address of the final destination.
Subnet Mask	This field displays the subnet mask for this destination.
Gateway Address	This field displays the IP address of the gateway. The gateway is an immediate neighbor of your switch that will forward the packet to the destination.
Metric	This field displays the cost of transmission for routing purposes.
Delete	Click **Delete** to remove the selected entry from the summary table.
Cancel	Click **Cancel** to clear the **Delete** check boxes.

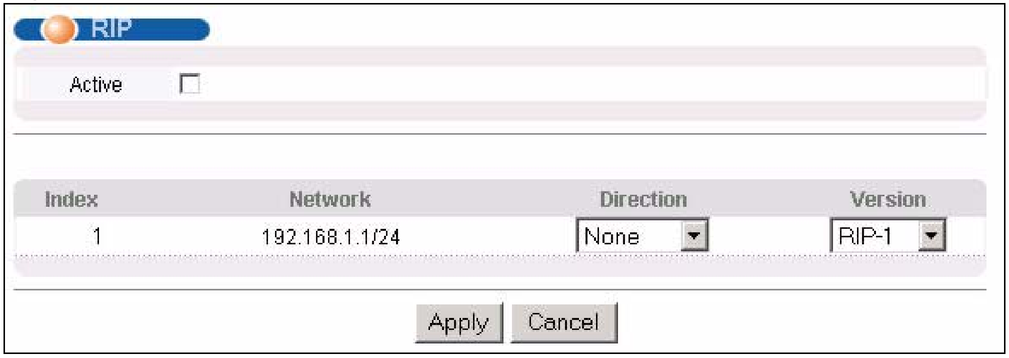
30

RIP

30.1 RIP

RIP (Routing Information Protocol) allows a routing device to exchange routing information with other routers. Use this screen to configure RIP on the switch. To open this screen, click **IP Application** > **RIP**. You cannot manually configure a new entry. Each entry in the table is automatically created when you configure a new IP domain in the **IP Setup** screen. See Section 10.2 on page 73.

Figure 75 RIP



Active □

Index	Network	Direction	Version
1	192.168.1.1/24	None	RIP-1

The following table describes the labels in this screen.

Table 61 RIP

LABEL	DESCRIPTION
Active	Select this check box to enable RIP on the switch.
Index	This field displays the index number of an IP interface.
Network	This field displays the IP interface configured on the switch. Refer to the section on IP Setup for more information on configuring IP domains.
Direction	Select the RIP direction from the drop-down list box. Choices are **Outgoing**, **Incoming**, **Both** and **None**. **Both**: The switch will broadcast its routing table periodically and incorporate the RIP information that it receives. **Incoming**: The switch will not send any RIP packets but will accept all RIP packets received. **Outgoing**: the switch will send out RIP packets but will not accept any RIP packets received. **None**: The switch will not send any RIP packets and will ignore any RIP packets received.

Table 61 RIP (continued)

LABEL	DESCRIPTION
Version	Select the RIP version from the drop-down list box. Choices are **RIP-1**, **RIP-2B** and **RIP-2M**. The **Version** field controls the format and the broadcasting method of the RIP packets that the switch sends (it recognizes both formats when receiving). **RIP-1** is universally supported; but RIP-2 carries more information. **RIP-1** is probably adequate for most networks, unless you have an unusual network topology. Both **RIP-2B** and **RIP-2M** send the routing data in RIP-2 format; the difference being that **RIP-2B** uses subnet broadcasting while **RIP-2M** uses multicasting.
Apply	Click **Apply** to save your changes to the switch's run-time memory. The switch loses these changes if it is turned off or loses power, so use the **Save** link on the top navigation panel to save your changes to the non-volatile memory when you are done configuring.
Cancel	Click **Cancel** to begin configuring the fields again.

31

OSPF

This chapter describes the OSPF (Open Shortest Path First) routing protocol and shows you how to configure OSPF.

31.1 OSPF Overview

OSPF (Open Shortest Path First) is a link-state protocol designed to distribute routing information within an autonomous system (AS). An autonomous system is a collection of networks using a common routing protocol to exchange routing information.

OSPF offers some advantages over traditional vector-space routing protocols (such as RIP). The following table summarizes some of the major differences between OSPF and RIP.

Table 62 OSPF vs. RIP

	OSPF	RIP
Network Size	Large	Small (with up to 15 routers)
Metrics	Bandwidth, hop count, throughput, round trip time and reliability.	Hop count
Convergence	Fast	Slow

31.1.1 OSPF Autonomous Systems and Areas

An OSPF autonomous system can be divided into logical areas. Each area represents a group of adjacent networks. All areas are connected to a backbone (also known as area 0). The backbone is the transit area to route packets between two areas. A stub area, at the edge of an AS, is not a transit area since there is only one connection to the stub area.

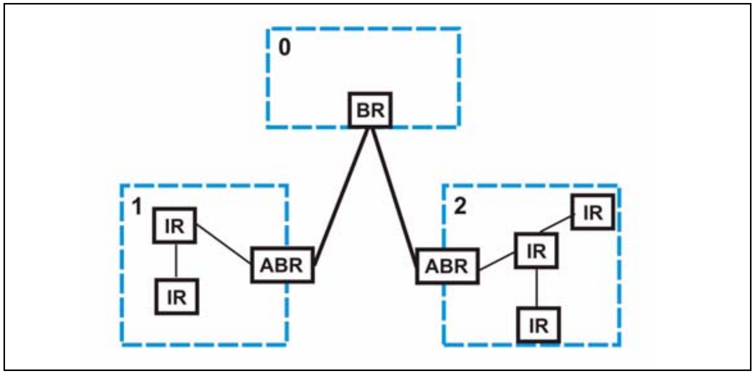
The following table describes the four classes of OSPF routers.

Table 63 OSPF: Router Types

TYPE	DESCRIPTION
Internal Router (IR)	An Internal or intra-area router is a router in an area.
Area Border Router (ABR)	An Area Border Router connects two or more areas.
Backbone Router (BR)	A backbone router has an interface to the backbone.
AS Boundary Router	An AS boundary router exchanges routing information with routers in other ASes.

The following figure depicts an OSPF network example. The backbone is area 0 with a backbone router. The internal routers are in area 1 and 2. The area border routers connect area 1 and 2 to the backbone.

Figure 76 OSPF Network Example



31.1.2 How OSPF Works

Layer 3 devices exchange routing information to build synchronized link state database within the same AS or area. They do this by exchanging Hello messages to confirm which neighbor (layer 3) devices exist and then they exchange database descriptions (DDs) to create the link state database. The link state database in constantly updated through LSAs (Link State Advertisements).

The link state database contains records of router IDs, their associated links and path costs. Each device can then use the link state database and Dijkstra algorithm to compute the least cost paths to network destinations.

31.1.3 Interfaces and Virtual Links

An OSPF interface is a link between a layer 3 device and an OSPF network. An interface has state information, an IP address and subnet mask associated with it. When you configure an OSPF interface, you first set an interface to transmit OSPF traffic and add the interface to an area.

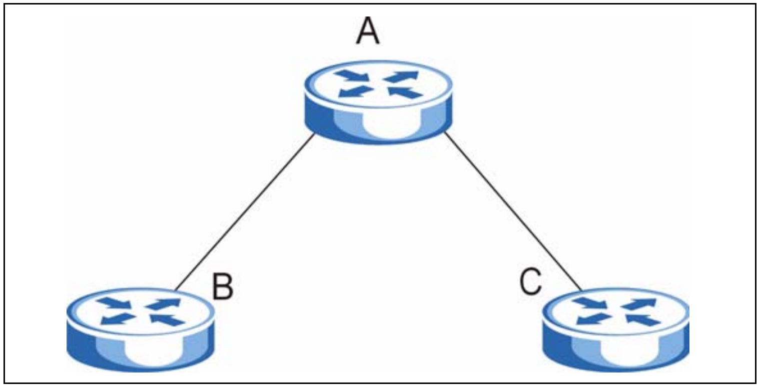
You can configure a virtual link to establish/maintain connectivity between a non-backbone area and the backbone. The virtual link must be configured on both layer 3 devices in the non-backbone area and the backbone.

31.1.4 OSPF and Router Elections

The OSPF protocol provides for automatic election of Designated Router (DR) and Backup Designated Router (BDR) on network segments. The DR and BDR keep track of link state updates in their area and make sure LSAs are sent to the rest of the network.

In most cases the default DR/BDR election is fine, but in some situations it must be controlled. In the following figure only router **A** has direct connectivity with all the other routers on the network segment. Routers **B** and **C** do not have a direct connection with each other. Therefore they should not be allowed to become DR or BDR. Only router A should become the DR.

Figure 77 OSPF Router Election Example



You can assign a priority to an interface which determines whether this router will be elected to be a DR or BDR. The router with the highest priority becomes the DR, while a router with a priority of 0 does not participate in router elections. In Figure 77 on page 177 you can assign a priority of 0 to routers **B** and **C**, thereby ensuring they do not become DR or BDR and assign a priority of 1 to router **A** to make sure that it does become the DR.

31.1.5 Configuring OSPF

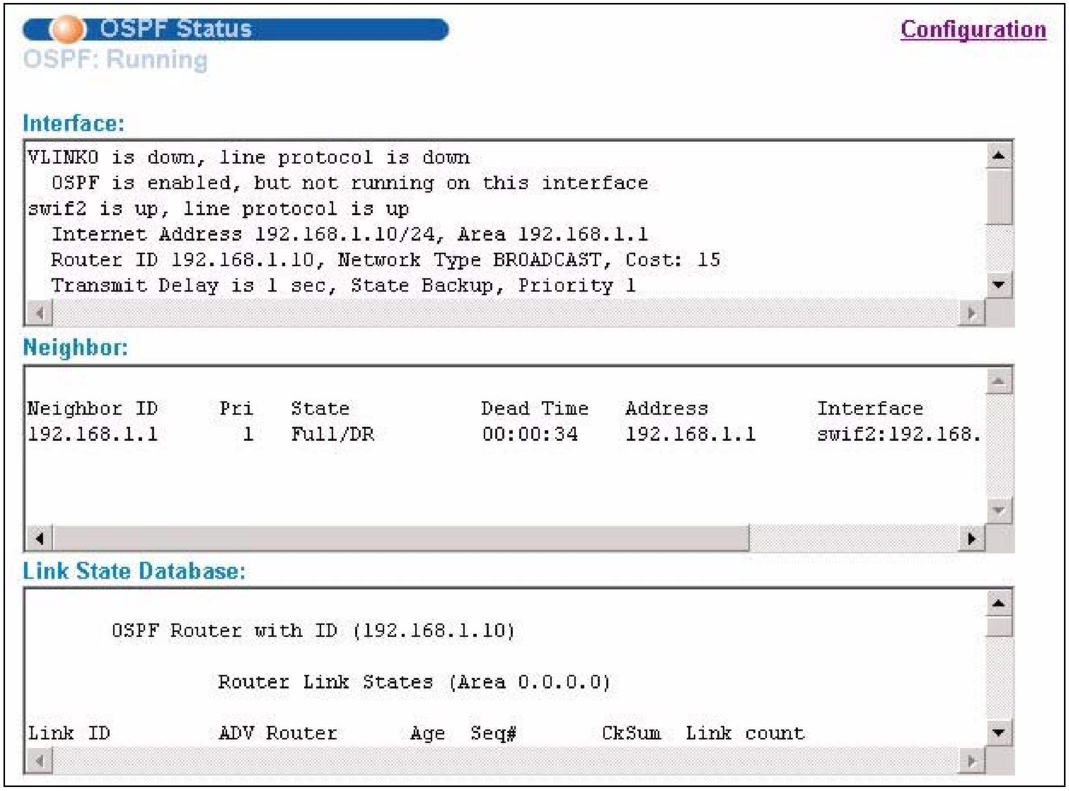
To configure OSPF on the switch, do the following tasks

1. Enable OSPF
2. Create OSPF areas
3. Create and associate interface(s) to an area
4. Create virtual links to maintain backbone connectivity.

31.2 OSPF Status

Use this screen to look at the current status of OSPF on the switch. See Section 31.1 on page 175 for more information on OSPF. To open this screen, click **IP Application** >**OSPF**.

Figure 78 OSPF Status



OSPF: Running

Interface:

```
VLINK0 is down, line protocol is down
  OSPF is enabled, but not running on this interface
swif2 is up, line protocol is up
  Internet Address 192.168.1.10/24, Area 192.168.1.1
  Router ID 192.168.1.10, Network Type BROADCAST, Cost: 15
  Transmit Delay is 1 sec, State Backup, Priority 1
```

Neighbor:

```
Neighbor ID     Pri   State           Dead Time   Address         Interface
192.168.1.1       1   Full/DR         00:00:34    192.168.1.1     swif2:192.168.
```

Link State Database:

```
       OSPF Router with ID (192.168.1.10)

                Router Link States (Area 0.0.0.0)

Link ID         ADV Router      Age  Seq#       CkSum  Link count
```

The following table describes the labels in this screen.

Table 64 OSPF Status

LABEL	DESCRIPTION
OSPF	This field displays whether OSPF is activated (**Running**) or not (**Down**).
Interface	The text box displays the OSPF status of the interface(s) on the switch.
Neighbor	The text box displays the status of the neighboring router participating in the OSPF network.
Link State Database	The text box displays information in the link state database which contains data in the LSAs.

The following table describes some common output fields.

Table 65 OSPF Status: Common Output Fields

FIELD	DESCRIPTION
Interface	
Internet Address	This field displays the IP address and subnet bits of an IP routing domain.
Area	This field displays the area ID.
Router ID	This field displays the unique ID of the switch.
Transmit Delay	This field displays the transmission delay in seconds.
State	This field displays the state of the switch (**backup** or **DR** (designated router)).
Priority	This field displays the priority of the switch. This number is used in the designated router election.
Designated Router	This field displays the router ID of the designated router.

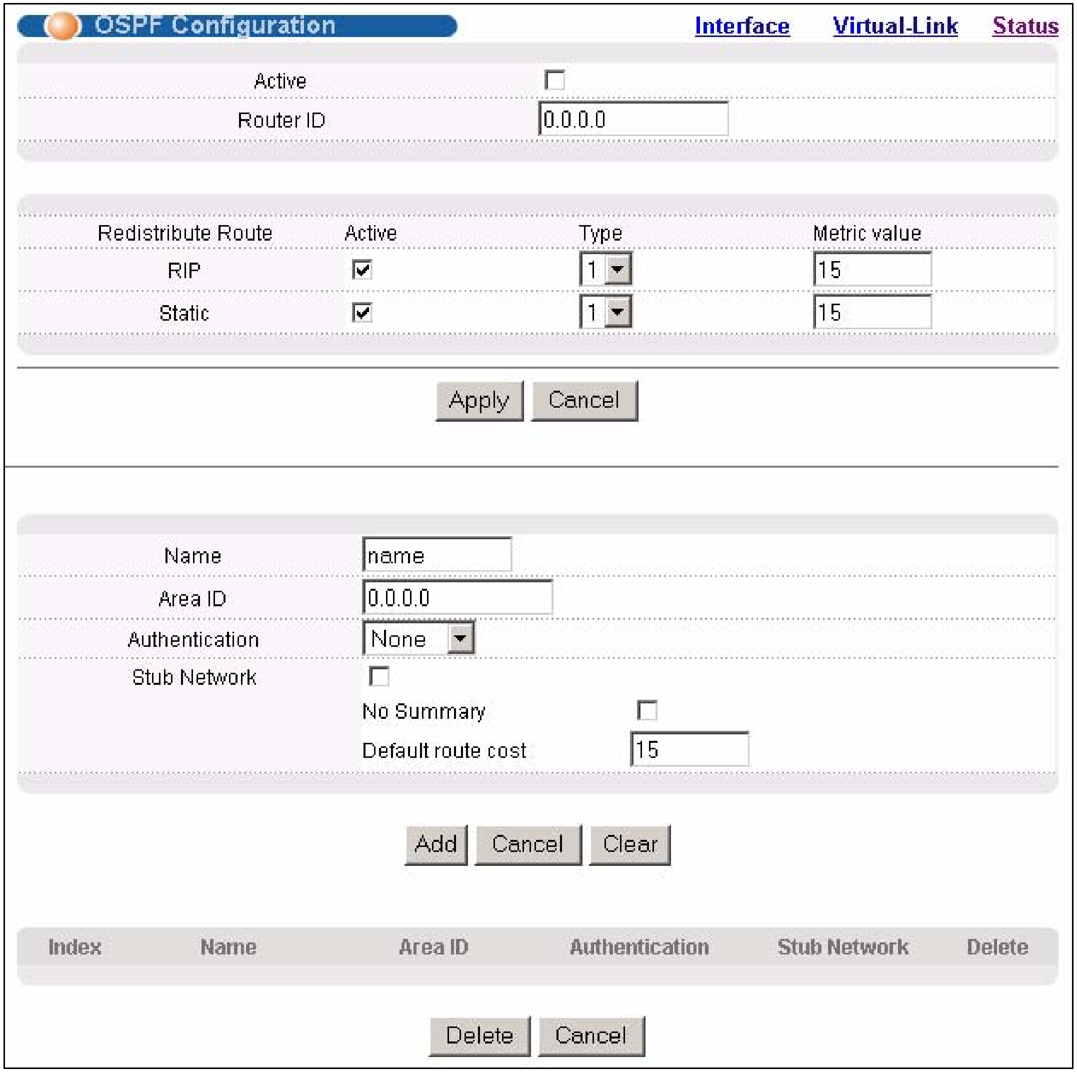
Table 65 OSPF Status: Common Output Fields (continued)

FIELD	DESCRIPTION
Backup Designated Router	This field displays the router ID of a backup designated router.
Time Intervals Configured	This field displays the time intervals (in seconds) configured.
Neighbor Count	This field displays the number of neighbor routers.
Adjacent Neighbor Count	This field displays the number of neighbor router(s) that is adjacent to the switch.
Neighbor	
Neighbor ID	This field displays the router ID of the neighbor.
Pri	This field displays the priority of the neighbor. This number is used in the designated router election.
State	This field displays the state of the neighbor (**backup** or **DR** (designated router)).
Dead Time	This field displays the dead time in seconds.
Address	This field displays the IP address of a neighbor.
Interface	This field displays the MAC address of a device.
Link State Database	
Link ID	This field displays the ID of a router or subnet.
ADV Router	This field displays the IP address of the layer-3 device that sends the LSAs.
Age	This field displays the time (in seconds) since the last LSA was sent.
Seq #	This field displays the link sequence number of the LSA.
Checksum	This field displays the checksum value of the LSA.
Link Count	This field displays the number of links in the LSA.

31.3 OSPF Configuration

Use this screen to activate OSPF, set general settings, and configure areas. See Section 31.1 on page 175 for more information on OSPF. To open this screen, click **IP Application** > **OSPF** > **Configuration**.

Figure 79 OSPF Configuration



Active □

Router ID 0.0.0.0

Redistribute Route	Active	Type	Metric value
RIP	☑	1	15
Static	☑	1	15

Name name

Area ID 0.0.0.0

Authentication None

Stub Network □

No Summary □

Default route cost 15

Index	Name	Area ID	Authentication	Stub Network	Delete

The follow table describes the related labels in this screen.

Table 66 OSPF Configuration

LABEL	DESCRIPTION
	Use this section to activate OSPF and to configure general settings for it.
Active	OSPF is disabled by default. Select this option to enable it.
Router ID	Router ID uniquely identifies the switch in an OSPF. Enter a unique ID (that uses the format of an IP address in dotted decimal notation) for the switch.
Redistribute Route	Route redistribution allows your switch to import and translate external routes learned through other routing protocols (**RIP** and **Static**) into the OSPF network transparently.
Active	Select this option to activate route redistribution for routes learn through the selected protocol.
Type	Select **1** for routing protocols (such as RIP) whose external metrics are directly comparable to the internal OSPF cost. When selecting a path, the internal OSPF cost is added to the AB boundary router to the external metrics. Select **2** for routing protocols whose external metrics are not comparable to the OSPF cost. In this case, the external cost of the AB boundary router is used in path decision to a destination.

Table 66 OSPF Configuration (continued)

LABEL	DESCRIPTION
Metric Value	Enter a route cost (between 0 and 16777214).
Apply	Click **Apply** to save your changes to the switch's run-time memory. The switch loses these changes if it is turned off or loses power, so use the **Save** link on the top navigation panel to save your changes to the non-volatile memory when you are done configuring.
Cancel	Click **Cancel** to start configuring the above fields again.
	Use this section to create or edit areas in OSPF.
Name	Enter a descriptive name (up to 32 printable English keyboard characters) for identification purposes.
Area ID	Enter a 32-bit ID (that uses the format of an IP address in dotted decimal notation) that uniquely identifies an area. A value of **0.0.0.0** indicates that this is a backbone (also known as Area 0). You can create only one backbone area on the switch.
Authentication	Select an authentication method (**Simple** or **MD5**) to activate authentication. Select **None** (default) to disable authentication. To ensure that the switch receives only routing information from a trusted layer 3 devices, activate authentication. OSPF supports three authentication methods: **None** – no authentication is used. **Simple** – authenticate link state updates using an 8 printable English keyboard character password. **MD5** – authenticate link state updates using a 16 printable English keyboard character password. Usually interface(s) and virtual interface(s) should use the same authentication method as the associated area. If interface(s) and virtual interface(s) use different authentication methods than the associated area, the authentication methods are based on the interface(s) and virtual interface(s) settings.
Stub Network	Select this option to set the area as a stub area. If you enter **0.0.0.0** in the **Area ID** field, the settings in the **Stub Area** fields are ignored.
No Summary	Select this option to set the switch to not send/receive LSAs.
Default Route Cost	Specify a cost (between 0 and 16777214) used to add a default route into a stub area for routes which are external to an OSPF domain. If you do not set a route cost, no default route is added.
Add	Click **Add** to save your changes to the switch's run-time memory. The switch loses these changes if it is turned off or loses power, so use the **Save** link on the top navigation panel to save your changes to the non-volatile memory when you are done configuring.
Cancel	Click **Cancel** to start configuring the above fields again.
Clear	Click **Clear** to set the above fields back to the factory defaults.
	Use this section to look at a summary of all the areas.
Index	This field displays the index number of an area.
Name	This field displays the descriptive name of an area.
Area ID	This field displays the area ID (that uses the format of an IP address in dotted decimal notation) that uniquely identifies an area. An area ID of **0.0.0.0** indicates the backbone.
Authentication	This field displays the authentication method used (**None**, **Simple** or **MD5**).
Stub Network	This field displays whether an area is a stub network (**Yes**) or not (**No**).

Table 66 OSPF Configuration (continued)

LABEL	DESCRIPTION
Delete	Click **Delete** to remove the selected entry from the summary table.
Cancel	Click **Cancel** to clear the **Delete** check boxes.

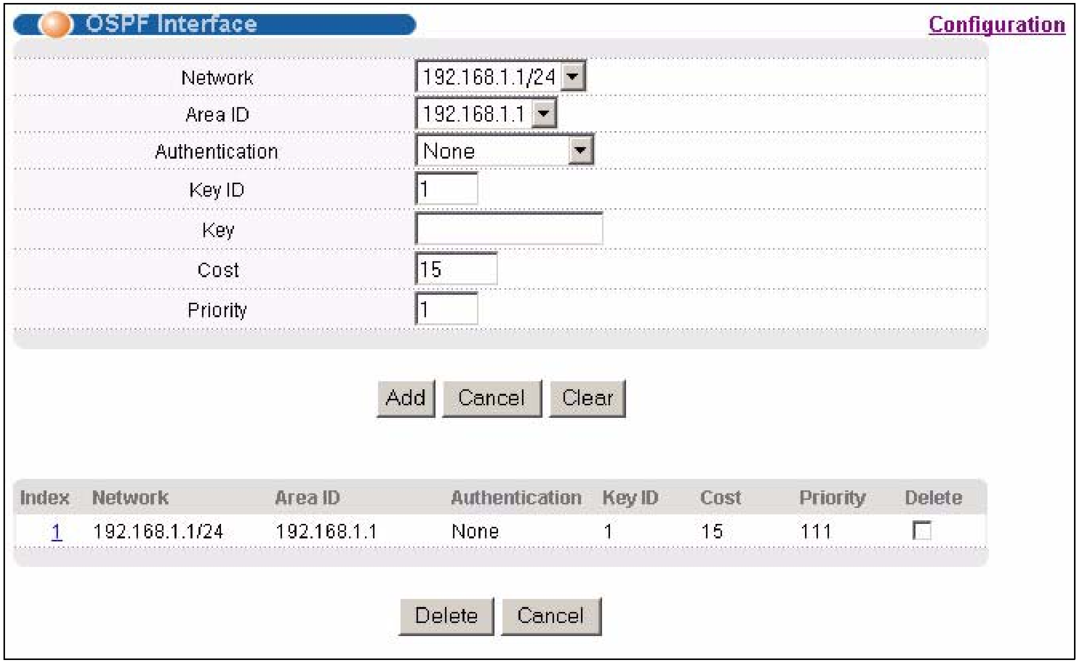
31.4 OSPF Interface

Use this screen to configure an OSPF interface. See Section 31.1 on page 175 for more information on OSPF.

You have to create an IP routing domain in the **IP Setup** screen first. Once you create an IP routing domain, an OSPF interface entry is automatically created. See Section 10.2 on page 73 for more information about IP routing domains.

To open this screen, click **IP Application** > **OSPF** > **Configuration** > **Interface**.

Figure 80 OSPF Interface



OSPF Interface

Configuration

Network	192.168.1.1/24
Area ID	192.168.1.1
Authentication	None
Key ID	1
Key	
Cost	15
Priority	1

Index	Network	Area ID	Authentication	Key ID	Cost	Priority	Delete
1	192.168.1.1/24	192.168.1.1	None	1	15	111	□

The following table describes the labels in this screen.

Table 67 OSPF Interface

LABEL	DESCRIPTION
Network	Select an IP interface.
Area ID	Select the area ID (that uses the format of an IP address in dotted decimal notation) of an area to associate the interface to that area.

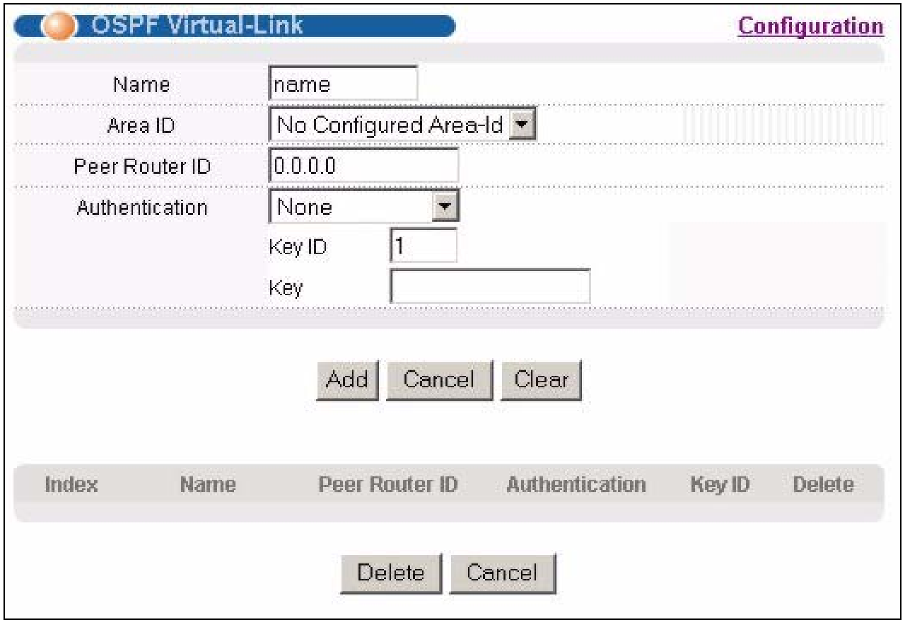
Table 67 OSPF Interface (continued)

LABEL	DESCRIPTION
Authentication	Note: OSPF Interface(s) must use the same authentication method within the same area. Select an authentication method. Choices are **Same-as-Area**, **None** (default), **Simple** and **MD5**. To participate in an OSPF network, you must set the authentication method and/or password the same as the associated area. Select **Same-as-Area** to use the same authentication method within the area and set the related fields when necessary. Select **None** to disable authentication. This is the default setting. Select **Simple** and set the **Key** field to authenticate OSPF packets transmitted through this interface using simple password authentication. Select **MD5** and set the **Key ID** and **Key** fields to authenticate OSPF packets transmitted through this interface using MD5 authentication.
Key ID	When you select **MD5** in the **Authentication** field, specify the identification number of the authentication you want to use.
Key	When you select **Simple** in the **Authentication** field, enter a password eight-character long. Characters after the eighth character will be ignored. When you select **MD5** in the **Authentication** field, enter a password 16-character long.
Cost	The interface cost is used for calculating the routing table. Enter a number between 0 and 65535. The default interface cost is 15.
Priority	The priority you assign to the interface is used in router elections to decide which router is going to be the Designated Router (DR) or the Backup Designated Router (BDR). You can assign a number between 0 and 255. A priority of 0 means that the router will not participate in router elections.
Add	Click **Add** to save your changes to the switch’s run-time memory. The switch loses these changes if it is turned off or loses power, so use the **Save** link on the top navigation panel to save your changes to the non-volatile memory when you are done configuring.
Cancel	Click **Cancel** to start configuring the above fields again.
Clear	Click **Clear** to set the above fields back to the factory defaults.
Index	This field displays the index number for an interface.
Network	This field displays the IP interface information.
Area ID	This field displays the area ID (that uses the format of an IP address in dotted decimal notation) of an area to associate the interface to that area.
Authentication	This field displays the authentication method used (**Same-as-Area**, **None**, **Simple** or **MD5**).
Key ID	When the **Authentication** field displays **MD5**, this field displays the identification number of the key used.
Cost	This field displays the interface cost used for calculating the routing table.
Priority	This field displays the priority for this OSPF interface.
Delete	Click **Delete** to remove the selected entry from the summary table.
Cancel	Click **Cancel** to start configuring the above fields again.

31.5 OSPF Virtual-Link

Use this screen to configure and view virtual link settings. See Section 31.1 on page 175 for more information on OSPF. To open this screen, click **IP Application** > **OSPF** > **Configuration** > **Virtual-Link**.

Figure 81 OSPF Virtual-Link



Name: name
Area ID: No Configured Area-Id
Peer Router ID: 0.0.0.0
Authentication: None
Key ID: 1

The following table describes the related labels in this screen.

Table 68 OSPF Virtual-Link

LABEL	DESCRIPTION
Name	Enter a descriptive name (up to 32 printable English keyboard characters) for identification purposes.
Area ID	Select the area ID (that uses the format of an IP address in dotted decimal notation) of an area to associate the interface to that area.
Peer Router ID	Enter the ID of a peer border router.
Authentication	Note: Virtual interface(s) must use the same authentication method within the same area. Select an authentication method. Choices are **Same-as-Area**, **None** (default), **Simple** and **MD5**. To exchange OSPF packets with peer border router, you must set the authentication method and/or password the same as the peer border router. Select **Same-as-Area** to use the same authentication method within the area and set the related fields when necessary. Select **None** to disable authentication. This is the default setting. Select **Simple** to authenticate OSPF packets transmitted through this interface using a simple password. Select **MD5** to authenticate OSPF packets transmitted through this interface using MD5 authentication.
Key ID	When you select **MD5** in the **Authentication** field, specify the identification number of the authentication you want to use.

Table 68 OSPF Virtual-Link (continued)

LABEL	DESCRIPTION
Key	When you select **Simple** in the **Authentication** field, enter a password eight-character long. When you select **MD5** in the **Authentication** field, enter a password 16-character long.
Add	Click **Add** to save your changes to the switch's run-time memory. The switch loses these changes if it is turned off or loses power, so use the **Save** link on the top navigation panel to save your changes to the non-volatile memory when you are done configuring.
Cancel	Click **Cancel** to start configuring the above fields again.
Clear	Click **Clear** to set the above fields back to the factory defaults.
Index	This field displays an index number of an entry.
Name	This field displays a descriptive name of a virtual link.
Peer Router ID	This field displays the ID (that uses the format of an IP address in dotted decimal notation) of a peer border router.
Authentication	This field displays the authentication method used (**Same-as-Area**, **None**, **Simple** or **MD5**).
Key ID	When the **Authentication** field displays **MD5**, this field displays the identification number of the key used.
Delete	Click **Delete** to remove the selected entry from the summary table.
Cancel	Click **Cancel** to clear the **Delete** check boxes.

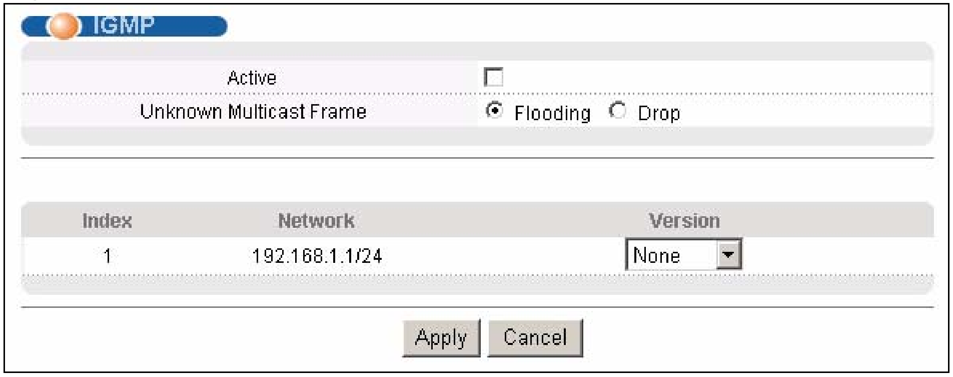
32

IGMP

32.1 IGMP

IGMP (Internet Group Multicast Protocol) is a session-layer protocol used to establish membership in a multicast group. It is not used to carry user data. See RFC 1112 and RFC 2236 for information on IGMP versions 1 and 2, respectively. To open this screen, click **IP Application** > **IGMP**. Each entry in the table is automatically created when you configure a new IP domain in the **IP Setup** screen. See Section 10.2 on page 73.

Figure 82 IGMP



Active □

Unknown Multicast Frame ● Flooding ○ Drop

Index	Network	Version
1	192.168.1.1/24	None

The following table describes the labels in this screen.

Table 69 IGMP

LABEL	DESCRIPTION
Active	Select this check box to enable IGMP on the switch. Note: You *cannot* enable both IGMP snooping and IGMP at the same time.
Unknown Multicast Frame	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.
Index	This field displays an index number of an entry.
Network	This field displays the IP domain configured on the switch. See Section 10.2 on page 73 for more information on configuring IP domains.
Version	Select an IGMP version from the drop-down list box. Choices are **IGMP-v1**, **IGMP-v2**, **IGMP-v3** and **None**. The switch supports both IGMP version 1 (**IGMP-v1**), version 2 (**IGMP-v2**) and version 3 (**IGMP-v3**). At start up, the switch queries all directly connected networks to gather group membership. After that, the switch periodically updates this information.

Table 69 IGMP (continued)

LABEL	DESCRIPTION
Apply	Click **Apply** to save your changes to the switch's run-time memory. The switch loses these changes if it is turned off or loses power, so use the **Save** link on the top navigation panel to save your changes to the non-volatile memory when you are done configuring.
Cancel	Click **Cancel** to begin configuring the fields again.

33

DVMRP

This chapter introduces DVMRP and tells you how to configure it.

33.1 DVMRP Overview

DVMRP (Distance Vector Multicast Routing Protocol) is a protocol used for routing multicast data within an autonomous system (AS). This DVMRP implementation is based on draft-ietf-idmr-dvmrp-v3-10. DVMRP provides multicast forwarding capability to a layer 3 switch that runs both the IPv4 protocol (with IP Multicast support) and the IGMP protocol. The DVMRP metric is a hop count of 32.

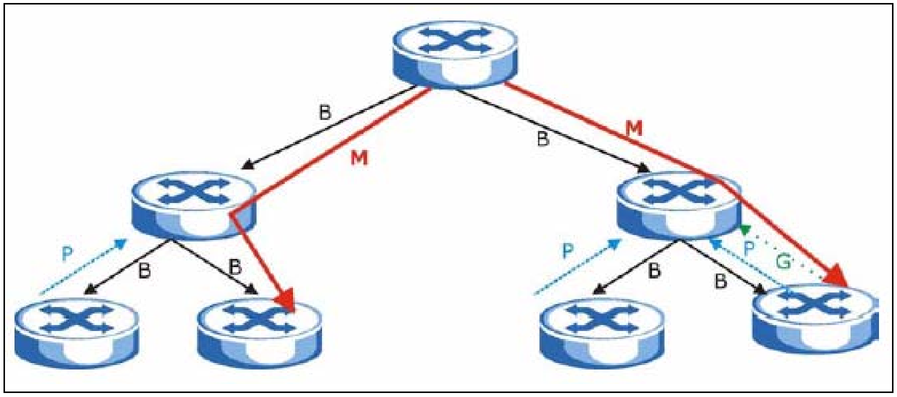
IGMP is a protocol used for joining or leaving a multicast group. You must have IGMP enabled when you enable DVMRP; otherwise you see the screen as in Figure 85 on page 191.

33.2 How DVMRP Works

DVMRP uses the Reverse Path Multicasting (RPM) algorithm to generate an IP Multicast delivery tree. Multicast packets are forwarded along these multicast tree branches. DVMRP dynamically learns host membership information using Internet Group Multicast Protocol (IGMP). The trees are updated dynamically to track the membership of individual groups.

1. Initially an advertisement multicast packet is broadcast ("B" in the following figure).
2. DVMRP-enabled Layer 3 devices that do not have any hosts in their networks that belong to this multicast group send back a prune message ("P").
3. If hosts later join the multicast group, a graft message ("G") to undo the prune is sent to the parent.
4. The final multicast ("M") after pruning and grafting is shown in the next figure.

Figure 83 How DVMRP Works



33.2.1 DVMRP Terminology

DVMRP probes are used to discover other DVMRP Neighbors on a network.

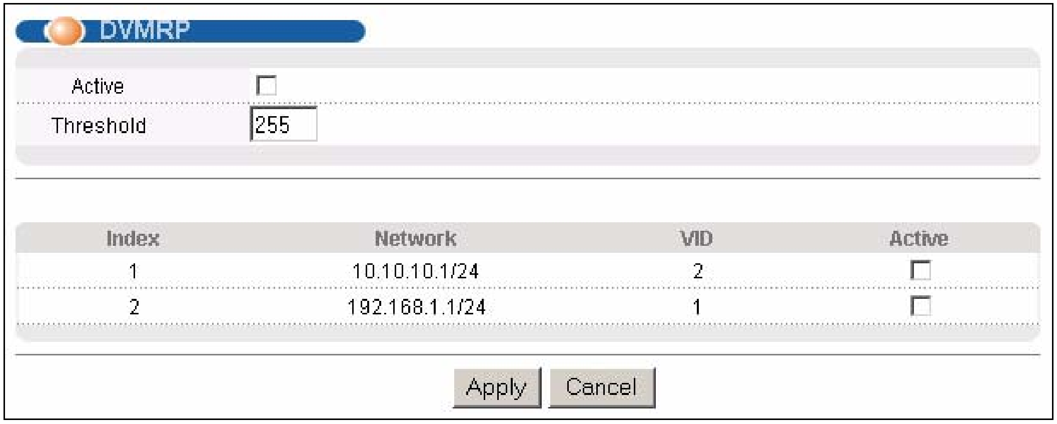
DVMRP reports are used to exchange DVMRP source routing information. These packets are used to build the DVMRP multicast routing table that is used to build source trees and also perform Reverse Path Forwarding (RPF) checks on incoming multicast packets. RPF checks prevent duplicate packets being filtered when loops exist in the network topology.

DVMRP prunes trim the multicast delivery tree(s). DVMRP grafts attach a branch back onto the multicast delivery tree.

33.3 DVMRP

Use this screen to configure DVMRP on the switch when you wish it to act as a multicast router ("mrouter"). To open this screen, click **IP Application > DVMRP**.

Figure 84 DVMRP



Active	□
Threshold	255

Index	Network	VID	Active
1	10.10.10.1/24	2	□
2	192.168.1.1/24	1	□

The following table describes the labels in this screen.

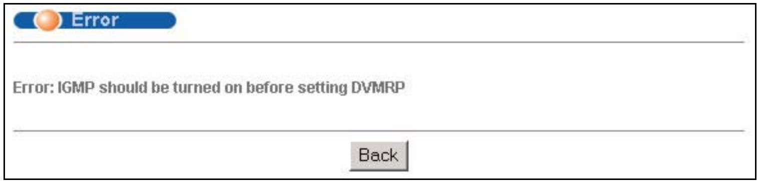
Table 70 DVMRP

LABEL	DESCRIPTION
Active	Select this to enable DVMRP on the switch. You should do this if you want the switch to act as a multicast router.
Threshold	Threshold is the maximum time to live (TTL) value. TTL is used to limit the scope of multicasting. You should reduce this value if you do not wish to flood Layer 3 devices many hops away with multicast traffic. This applies only to multicast traffic this switch sends out.
Index	Index is the DVMRP configuration for the IP routing domain defined under **Network**. The maximum number of DVMRP configurations allowed is the maximum number of IP routing domains allowed on the switch. See Section 10.2 on page 73 for more information on IP routing domains.
Network	This is the IP routing domain IP address and subnet mask you set up in **IP Setup.**
VID	DVMRP cannot be enabled on the same VLAN group across different IP routing domains, that is, you cannot have duplicate VIDs for different DVMRP configurations. See Figure 87 on page 192.
Active	Select **Active** to enable DVMRP on this IP routing domain.
Apply	Click **Apply** to save your changes to the switch's run-time memory. The switch loses these changes if it is turned off or loses power, so use the **Save** link on the top navigation panel to save your changes to the non-volatile memory when you are done configuring.
Cancel	Click **Cancel** to begin configuring this part of the screen afresh.

33.3.1 DVMRP Configuration Error Messages

You must have IGMP enabled when you enable DVMRP; otherwise you see the screen as in the next figure.

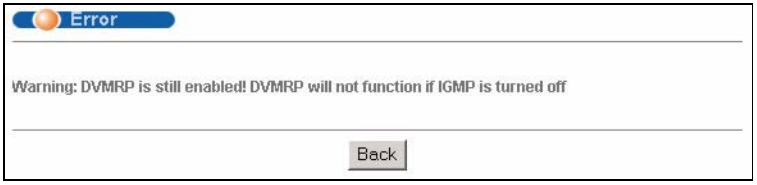
Figure 85 DVMRP: IGMP Not Set Error



Error: IGMP should be turned on before setting DVMRP

When you disable IGMP, but DVMRP is still active you also see another warning screen.

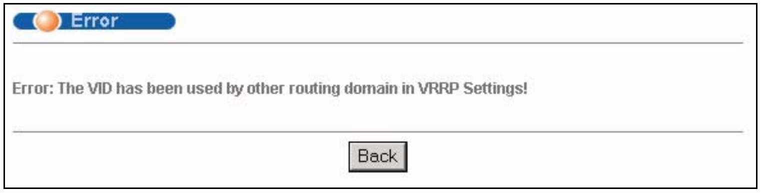
Figure 86 DVMRP: Unable to Disable IGMP Error



Warning: DVMRP is still enabled! DVMRP will not function if IGMP is turned off

Each IP routing domain DVMRP configuration must be in a different VLAN group; otherwise you see the following screen.

Figure 87 DVMRP: Duplicate VID Error Message



Error: The VID has been used by other routing domain in VRRP Settings!

33.4 Default DVMRP Timer Values

See Chapter 48 on page 269 for default DVMRP timer values. These may be changed using line commands. Please see the commands chapter later in this User's Guide for more information.

34

Differentiated Services

This chapter shows you how to configure Differentiated Services (DiffServ) on the switch.

34.1 DiffServ Overview

Quality of Service (QoS) is used to prioritize source-to-destination traffic flows. All packets in the flow are given the same priority. You can use CoS (class of service) to give different priorities to different packet types.

DiffServ is a class of service (CoS) model that marks packets so that they receive specific per-hop treatment at DiffServ-compliant network devices along the route based on the application types and traffic flow. Packets are marked with DiffServ Code Points (DSCPs) indicating the level of service desired. This allows the intermediary DiffServ-compliant network devices to handle the packets differently depending on the code points without the need to negotiate paths or remember state information for every flow. In addition, applications do not have to request a particular service or give advanced notice of where the traffic is going.

34.1.1 DSCP and Per-Hop Behavior

DiffServ defines a new DS (Differentiated Services) field to replace the Type of Service (ToS) field in the IP header. The DS field contains a 2-bit unused field and a 6-bit DSCP field which can define up to 64 service levels. The following figure illustrates the DS field.

DSCP is backward compatible with the three precedence bits in the ToS octet so that non-DiffServ compliant, ToS-enabled network device will not conflict with the DSCP mapping.

Figure 88 DiffServ: Differentiated Service Field

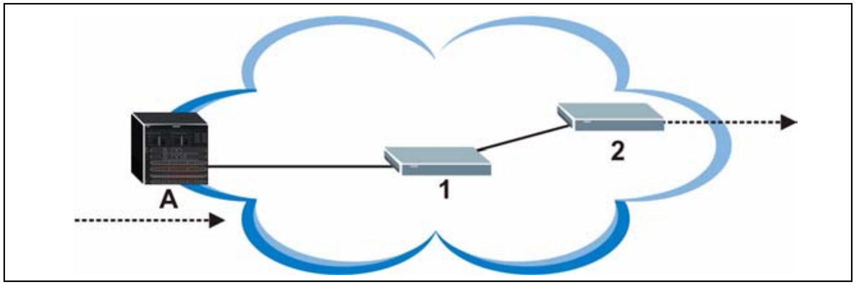
DSCP (6 bits)	DS (2 bits)

The DSCP value determines the forwarding behavior, the PHB (Per-Hop Behavior), that each packet gets across the DiffServ network. Based on the marking rule different kinds of traffic can be marked for different priorities of forwarding. Resources can then be allocated according to the DSCP values and the configured policies.

34.1.2 DiffServ Network Example

The following figure depicts a simple DiffServ network consisting of a group of contiguous DiffServ-compliant network devices.

Figure 89 DiffServ Network Example

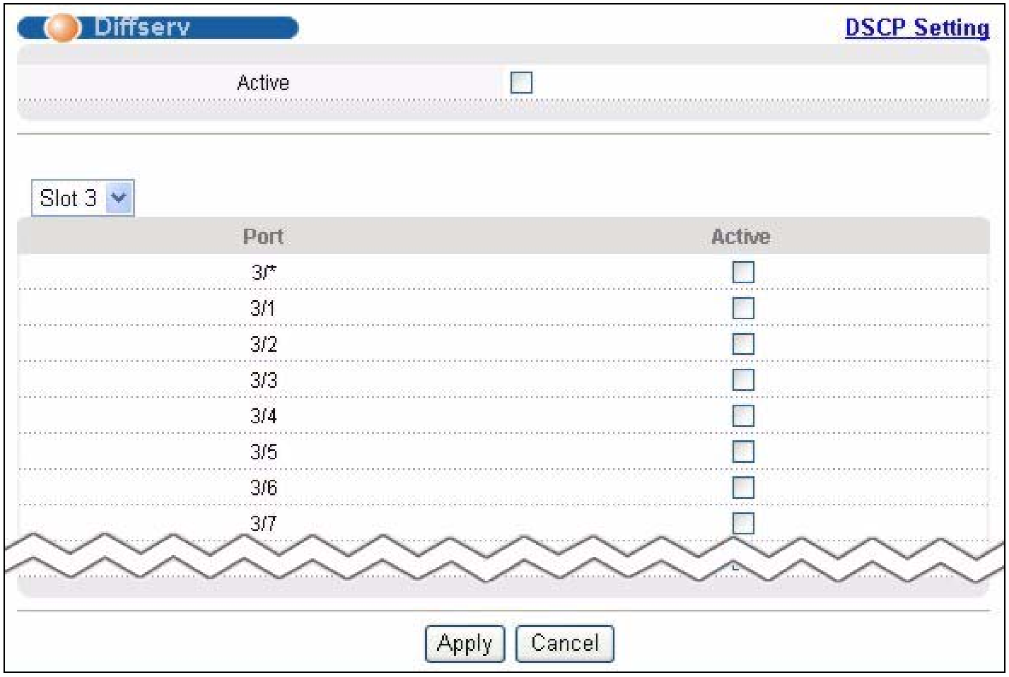


Switch **A** marks traffic flowing into the network based on the configured marking rules. Intermediary network devices **1** and **2** allocate network resources (such as bandwidth) by mapping the DSCP values and the associated policies.

34.2 DiffServ

Use this screen to activate DiffServ and to apply marking rules and IEEE 802.1p priority mapping on the selected port(s). To open this screen, click **IP Application** > **DiffServ**.

Figure 90 Diffserv



Active □

Slot 3

Port	Active
3/*	□
3/1	□
3/2	□
3/3	□
3/4	□
3/5	□
3/6	□
3/7	□

The following table describes the labels in this screen.

Table 71 Diffserv

LABEL	DESCRIPTION
Active	Select this option to enable DiffServ on the switch.
Slot	Select the slot at whose settings you want to look.
Port	This field displays the slot number and port number.

Table 71 Diffserv (continued)

LABEL	DESCRIPTION
*	Settings in this row apply to all ports. Use this row only if you want to make some settings the same for all ports. Use this row first to set the common settings and then make adjustments on a port-by-port basis. Note: Changes in this row are copied to all the ports as soon as you make them.
Active	Select this option to enable DiffServ on the port.
Apply	Click **Apply** to save your changes to the switch's run-time memory. The switch loses these changes if it is turned off or loses power, so use the **Save** link on the top navigation panel to save your changes to the non-volatile memory when you are done configuring.
Cancel	Click **Cancel** to start configuring this screen again.

34.3 DSCP Setting

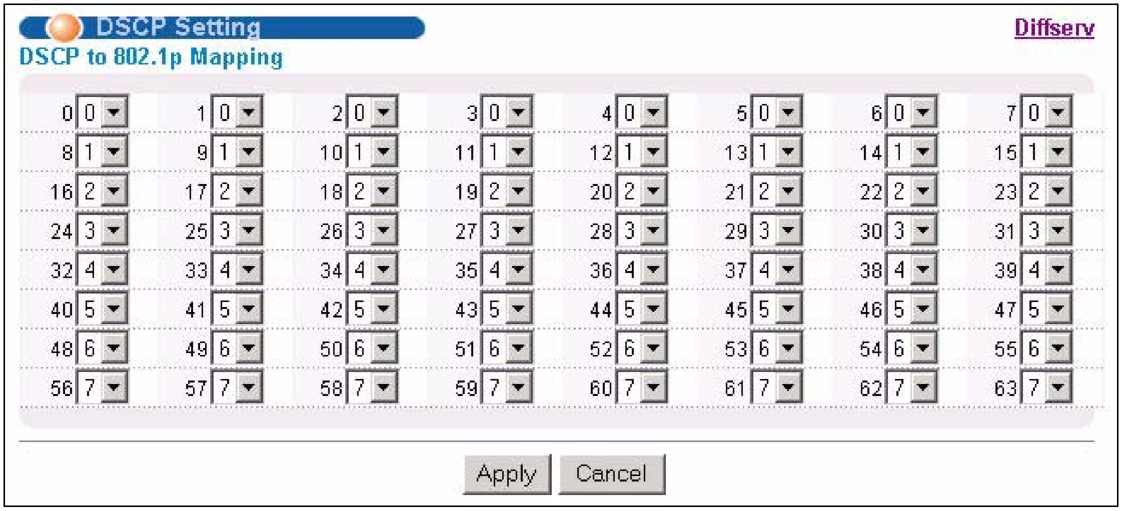
Use this screen to configure the DSCP to IEEE 802.1p mapping to allow the switch to prioritize all traffic based on the incoming DSCP value according to the DiffServ to IEEE 802.1p mapping table. The following table shows the default DSCP-to-IEEE-802.1p mapping.

Table 72 Default DSCP-IEEE-802.1p Mapping

DSCP Value	0 – 7	8 – 15	16 – 23	24 – 31	32 – 39	40 – 47	48 – 55	56 – 63
IEEE802.1p	0	1	2	3	4	5	6	7

To open this screen, **IP Application** > **DiffServ** > **DSCP Setting**.

Figure 91 DSCP Setting



0	0	1	0	2	0	3	0	4	0	5	0	6	0	7	0
8	1	9	1	10	1	11	1	12	1	13	1	14	1	15	1
16	2	17	2	18	2	19	2	20	2	21	2	22	2	23	2
24	3	25	3	26	3	27	3	28	3	29	3	30	3	31	3
32	4	33	4	34	4	35	4	36	4	37	4	38	4	39	4
40	5	41	5	42	5	43	5	44	5	45	5	46	5	47	5
48	6	49	6	50	6	51	6	52	6	53	6	54	6	55	6
56	7	57	7	58	7	59	7	60	7	61	7	62	7	63	7

The following table describes the labels in this screen.

Table 73 DSCP Setting

LABEL	DESCRIPTION
0 … 63	This is the DSCP classification identification number. To set the IEEE802.1p priority mapping, select the priority level from the drop-down list box.
Apply	Click **Apply** to save your changes to the switch’s run-time memory. The switch loses these changes if it is turned off or loses power, so use the **Save** link on the top navigation panel to save your changes to the non-volatile memory when you are done configuring.
Cancel	Click **Cancel** to discard all changes and start configuring the screen again.

35

DHCP

This chapter shows you how to configure the DHCP feature.

35.1 DHCP Overview

DHCP (Dynamic Host Configuration Protocol RFC 2131 and RFC 2132) allows individual computers to obtain TCP/IP configuration at start-up from a server. You can configure the switch as a DHCP server or disable it. When configured as a server, the switch provides the TCP/IP configuration for the clients. If you disable the DHCP service, you must have another DHCP server on your LAN, or else the computer must be manually configured.

35.1.1 DHCP modes

The switch can be configured as a DHCP server or DHCP relay agent.

- If you configure the switch as a DHCP server, it will maintain the pool of addresses and distribute them to your LAN computers.
- If there is an Ethernet device that performs the DHCP server function for your network, then you can configure the switch as a DHCP relay agent. When the switch receives a request from a computer on your network, it contacts the Ethernet device (the DHCP server) for the necessary IP information, and then relays the assigned information back to the computer.

35.1.2 DHCP Configuration Options

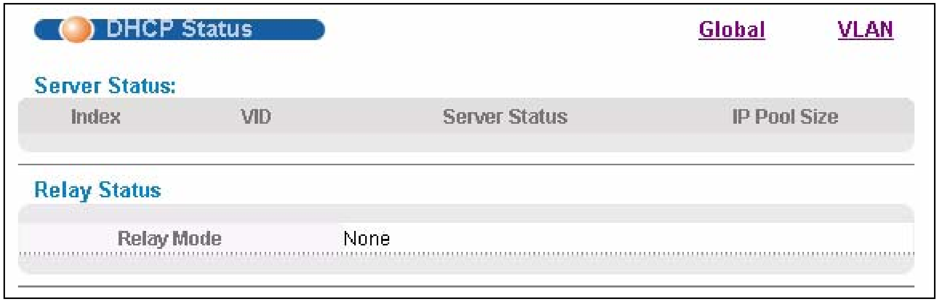
The DHCP configuration on the switch is divided into **Global** and **VLAN** screens. The screen you should use for configuration depends on the DHCP services you want to offer the DHCP clients on your network. Choose the configuration screen based on the following criteria:

- **Global** - The switch forwards all DHCP requests to the same DHCP server.
- **VLAN** - The switch is configured on a VLAN by VLAN basis. The switch can be configured as a DHCP server or to relay DHCP requests to different DHCP servers for clients in different VLAN.

35.2 DHCP Status

Use this screen to look at the status of DHCP servers on the switch. To open this screen, click **IP Application** > **DHCP**.

Figure 92 DHCP Status



Server Status:

Index	VID	Server Status	IP Pool Size

Relay Status

Relay Mode	None

The following table describes the labels in this screen.

Table 74 DHCP Status

LABEL	DESCRIPTION
Index	This is the index number.
VID	This field displays the ID number of the VLAN group to which this DHCP settings apply.
Server Status	This field displays the starting DHCP client IP address.
IP Pool Size	This field displays the size of the DHCP client IP address pool.
Relay Mode	This field displays: • **None** - if the switch is not configured as a DHCP relay agent. • **Global** - if the switch is configured as a DHCP relay agent only. • **VLAN** - followed by a VLAN ID if it is configured as a relay agent for specific VLAN(s).

35.3 DHCP Relay

Configure DHCP relay on the switch if the DHCP clients and the DHCP server are not in the same subnet. During the initial IP address leasing, the switch helps to relay network information (such as the IP address and subnet mask) between a DHCP client and a DHCP server. Once the DHCP client obtains an IP address and can connect to the network, network information renewal is done between the DHCP client and the DHCP server without the help of the switch.

The switch can be configured as a global DHCP relay. This means that the switch forwards all DHCP requests from all domains to the same DHCP server. You can also configure the switch to relay DHCP information based on the VLAN membership of the DHCP clients.

35.3.1 DHCP Relay Agent Information

The switch can add information about the source of client DHCP requests that it relays to a DHCP server by adding **Relay Agent Information**. This helps provide authentication about the source of the requests. The DHCP server can then provide an IP address based on this information. Please refer to RFC 3046 for more details.

The DHCP **Relay Agent Information** feature adds an Agent Information field to the **Option 82** field. The **Option 82** field is in the DHCP headers of client DHCP request frames that the switch relays to a DHCP server.

Relay Agent Information can include the **System Name** of the switch if you select this option. You can change the **System Name** in **Basic Settings** > **General Setup**.

The following describes the DHCP relay information that the switch sends to the DHCP server:

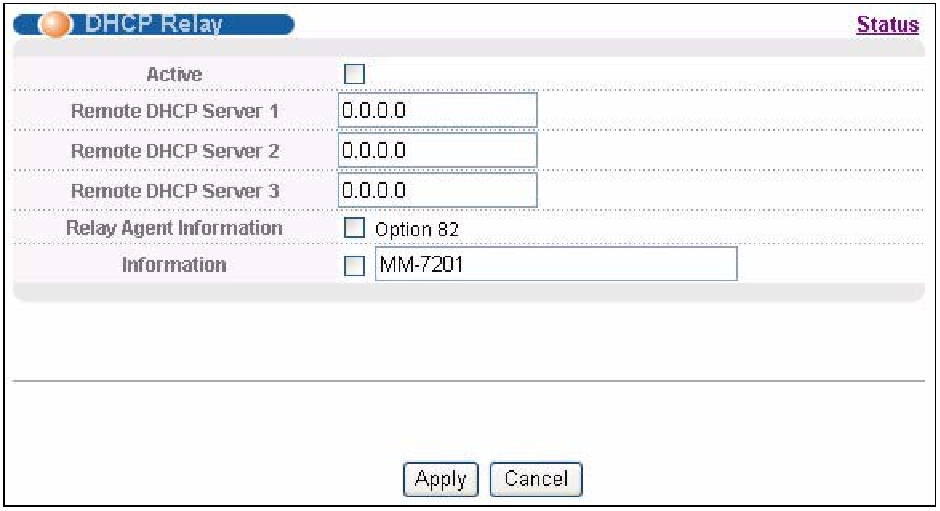
Table 75 Relay Agent Information

FIELD LABELS	DESCRIPTION
Slot ID	(1 byte) This value is always 0 for stand-alone switches.
Port ID	(1 byte) This is the port that the DHCP client is connected to.
VLAN ID	(2 bytes) This is the VLAN that the port belongs to.
Information	(up to 64 bytes) This optional, read-only field is set according to system name set in **Basic Settings > General Setup.**

35.3.2 Configuring DHCP Global Relay

Use this screen to configure the DHCP relay on the switch. To open this screen, click **IP Application** > **DHCP** in the navigation panel and click the **Global** link In the **DHCP Status** screen.

Figure 93 DHCP Relay



Active	□
Remote DHCP Server 1	0.0.0.0
Remote DHCP Server 2	0.0.0.0
Remote DHCP Server 3	0.0.0.0
Relay Agent Information	□ Option 82
Information	□ MM-7201

The following table describes the labels in this screen.

Table 76 DHCP Relay

LABEL	DESCRIPTION
Active	Select this check box to enable DHCP relay.
Remote DHCP Server 1 .. 3	Enter the IP address of a DHCP server in dotted decimal notation.
Relay Agent Information	Select the **Option 82** check box to have the switch add information (slot number, port number and VLAN ID) to client DHCP requests that it relays to a DHCP server.
Information	Select the check box for the switch to add the system name to the client DHCP requests that it relays to a DHCP server. The read-only field displays the system name you configure in the **General Setup** screen. See Chapter 8 on page 67.

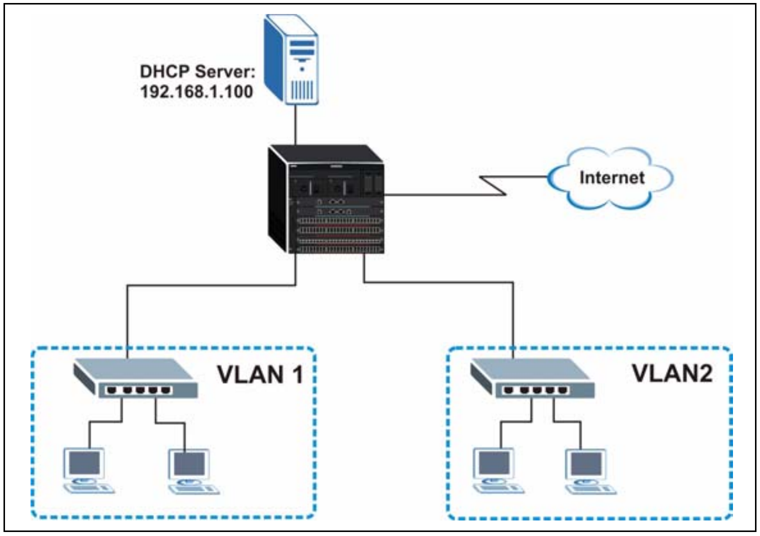
Table 76 DHCP Relay (continued)

LABEL	DESCRIPTION
Apply	Click **Apply** to save your changes to the switch's run-time memory. The switch loses these changes if it is turned off or loses power, so use the **Save** link on the top navigation panel to save your changes to the non-volatile memory when you are done configuring.
Cancel	Click **Cancel** to discard all changes and start configuring the screen again.

35.3.3 Global DHCP Relay Configuration Example

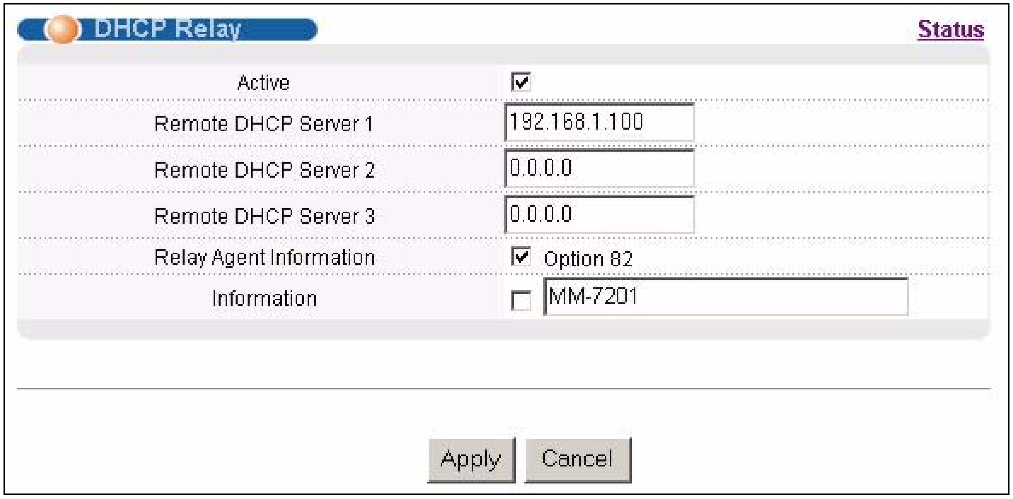
The follow figure shows a network example where the switch is used to relay DHCP requests for the **RD** (VLAN 1) and **Sales** (VLAN 2) network. There is only one DHCP server that services the DHCP clients in both networks.

Figure 94 Global DHCP Relay Network Example



Configure the **DHCP Relay** screen as shown. Make sure you select the **Option 82** check box to set the switch to send additional information (such as the VLAN ID) together with the DHCP requests to the DHCP server. This allows the DHCP server to assign the appropriate IP address according to the VLAN ID.

Figure 95 DHCP Relay Configuration Example



Active	☑
Remote DHCP Server 1	192.168.1.100
Remote DHCP Server 2	0.0.0.0
Remote DHCP Server 3	0.0.0.0
Relay Agent Information	☑ Option 82
Information	□ MM-7201

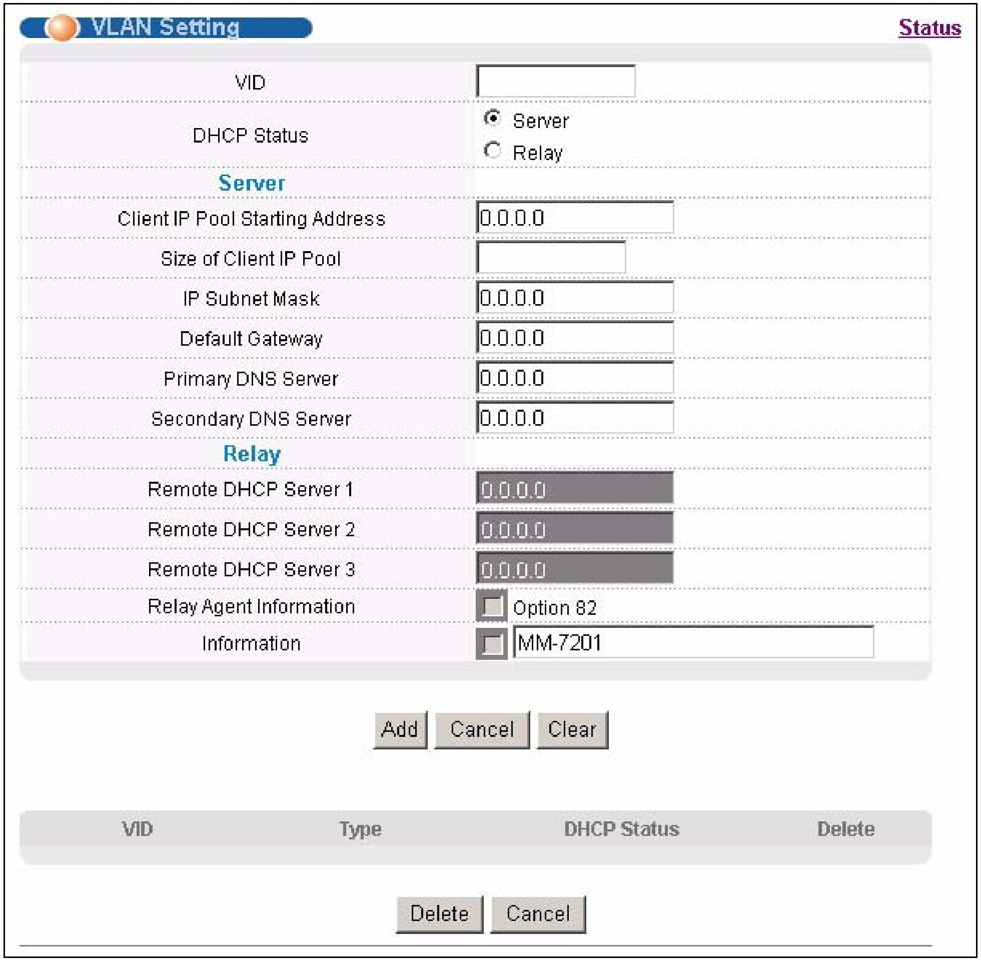
35.4 Configuring DHCP VLAN Settings

Use this screen to configure your DHCP settings based on the VLAN domain of the DHCP clients. Click **IP Application** > **DHCP** in the navigation panel, then click the **VLAN** link In the **DHCP Status** screen that displays.

You must set up a management IP address for each VLAN that you want to configure DHCP settings for on the switch.

See Section 10.1 on page 73 for information on how to set up management IP addresses for VLANs.

Figure 96 DHCP VLAN Setting



VID	
DHCP Status	● Server ○ Relay
Server	
Client IP Pool Starting Address	0.0.0.0
Size of Client IP Pool	
IP Subnet Mask	0.0.0.0
Default Gateway	0.0.0.0
Primary DNS Server	0.0.0.0
Secondary DNS Server	0.0.0.0
Relay	
Remote DHCP Server 1	0.0.0.0
Remote DHCP Server 2	0.0.0.0
Remote DHCP Server 3	0.0.0.0
Relay Agent Information	□ Option 82
Information	□ MM-7201

VID	Type	DHCP Status	Delete

The following table describes the labels in this screen.

Table 77 DHCP VLAN Setting

LABEL	DESCRIPTION
VID	Enter the ID number of the VLAN group to which this DHCP settings apply.
DHCP Status	Select **Sever** to set the switch to act as a DHCP server. Select **Relay** to set the switch to act as a DHCP relay. Then set the corresponding fields below.
Server The fields are editable when you select **Server** in the **DHCP Status** field.	
Client IP Pool Starting Address	Specify the first of the contiguous addresses in the IP address pool.
Size of Client IP Pool	Specify the size, or count of the IP address pool.
IP Subnet Mask	Enter the subnet mask for the client IP pool.
Default Gateway	Enter the IP address of the default gateway.

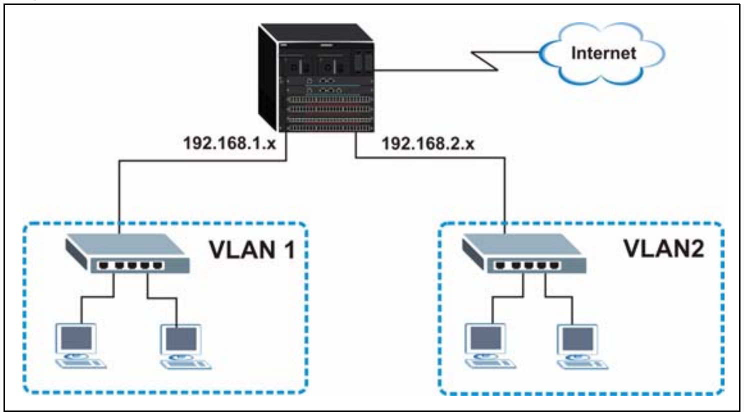
Table 77 DHCP VLAN Setting (continued)

LABEL	DESCRIPTION
Primary/ Secondary DNS Server	Enter the IP addresses of the DNS servers. The DNS servers are passed to the DHCP clients along with the IP address and the subnet mask.
Relay The fields are editable when you select **Relay** in the **DHCP Status** field.	
Remote DHCP Server 1.. 3	Enter the IP address(es) of the DHCP server(s).
Relay Agent Information	Select the **Option 82** check box to have the switch add information (slot number, port number and VLAN ID) to client DHCP requests that it relays to a DHCP server.
Information	Select the check box for the switch to add the system name to the client DHCP requests that it relays to a DHCP server. The read-only field displays the system name you configure in the **General Setup** screen. See Chapter 8 on page 67.
Add	Click **Add** to save your changes to the switch's run-time memory. The switch loses these changes if it is turned off or loses power, so use the **Save** link on the top navigation panel to save your changes to the non-volatile memory when you are done configuring.
Cancel	Click **Cancel** to reset the fields to your previous configurations.
Clear	Click **Clear** to reset the fields back to the factory defaults.
VID	This field displays the ID number of the VLAN group to which this DHCP settings apply.
Type	This field displays the DHCP mode (**Server** or **Relay**).
DHCP Status	For DHCP server configuration, this field displays the starting and the size of DHCP client IP address. For DHCP relay configuration, this field displays the first remote DHCP server IP address.
Delete	Click **Delete** to remove the selected entry.
Cancel	Click **Cancel** to clear the **Delete** check boxes.

35.4.1 DHCP VLAN Setting Example

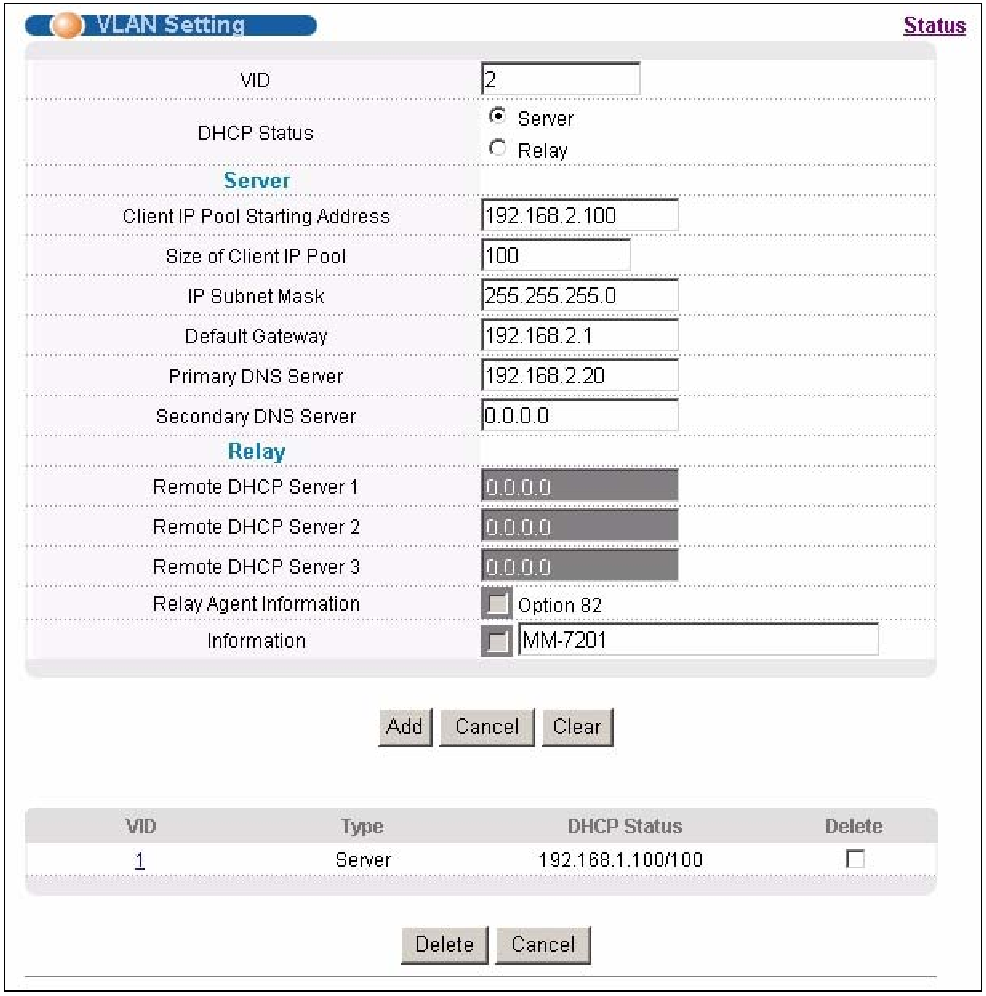
The follow figure shows a network example where the switch is used to assign network information to the DHCP clients in the **RD** (VLAN 1) and **Sales** (VLAN 2) network.

Figure 97 DHCP Server Network Example



In the **DHCP VLAN Setting** screen, set the **DHCP Status** to **Server** and configure two DHCP client IP address pools for the two networks. The following shows an example.

Figure 98 DHCP VLAN Setting Example



VID	2
DHCP Status	● Server ○ Relay
Server	
Client IP Pool Starting Address	192.168.2.100
Size of Client IP Pool	100
IP Subnet Mask	255.255.255.0
Default Gateway	192.168.2.1
Primary DNS Server	192.168.2.20
Secondary DNS Server	0.0.0.0
Relay	
Remote DHCP Server 1	0.0.0.0
Remote DHCP Server 2	0.0.0.0
Remote DHCP Server 3	0.0.0.0
Relay Agent Information	□ Option 82
Information	□ MM-7201

VID	Type	DHCP Status	Delete
1	Server	192.168.1.100/100	□

36

VRRP

This chapter shows you how to configure and monitor the Virtual Router Redundancy Protocol (VRRP) on the switch.

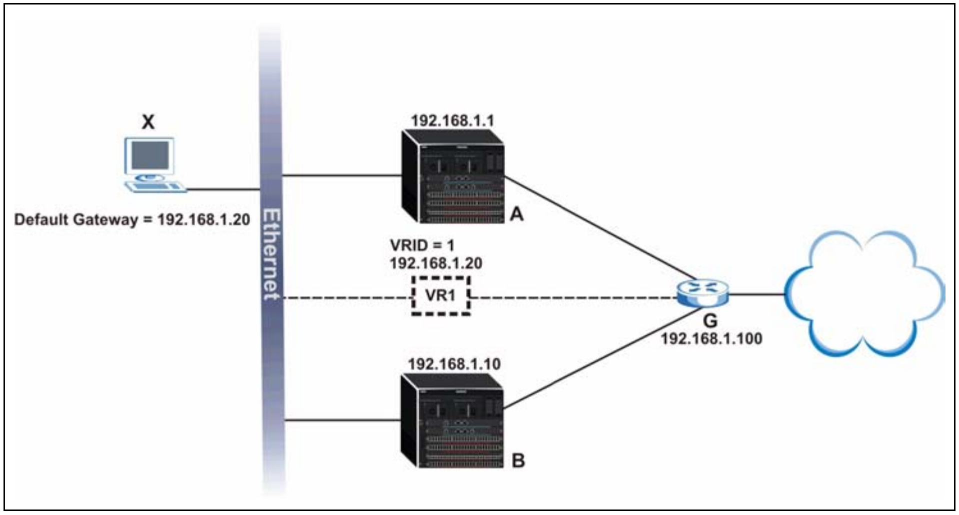
36.1 VRRP Overview

Each host on a network is configured to send packets to a statically configured default gateway (this switch). The default gateway can become a single point of failure. Virtual Router Redundancy Protocol (VRRP), defined in RFC 2338, allows you to create redundant backup gateways to ensure that the default gateway of a host is always available.

In VRRP, a virtual router (VR) represents a number of physical layer-3 devices. An IP address is associated with the virtual router. A layer-3 device having the same IP address is the preferred master router while the other Layer-3 devices are the backup routers. The master router forwards traffic for the virtual router. When the master router becomes unavailable, a backup router assumes the role of the master router until the master router comes back up and takes over.

The following figure shows a VRRP network example with the switches (**A** and **B**) implementing one virtual router **VR1** (VRID 1) to ensure the link between the host **X** and the uplink gateway **G**. Host **X** is configured to use **VR1** (192.168.1.20) as the default gateway. If switch **A** has a higher priority, it is the master router. Switch **B**, having a lower priority, is the backup router.

Figure 99 VRRP: Example 1



If switch **A** (the master router) is unavailable, switch **B** takes over. Traffic is then processed by switch **B**.

36.1.1 VRRP Parameters

This section describes some VRRP parameters.

36.1.1.1 Advertisement Interval

The master router sends out Hello messages to let the other backup routers know that it is still up and running. The time interval between sending the Hello messages is the advertisement interval. By default, a Hello message is sent out every second.

If the backup routers do not receive a Hello message from the master router after this interval expires, it is assumed that the master router is down. Then the backup router with the highest priority becomes the master router.

✍ All routers participating in the virtual router must use the same advertisement interval.

36.1.1.2 Priority

Configure the priority level (1 to 254) to set which backup router to take over in case the master router goes down. The backup router with the highest priority will take over. The priority of the VRRP router that owns the IP address(es) associated with the virtual router is 255.

36.1.1.3 Preempt Mode

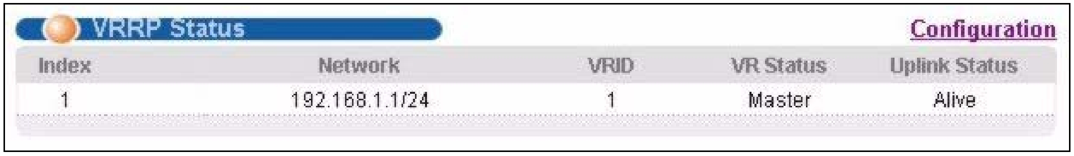
If the master router is unavailable, a backup router assumes the role of the master router. However, when another backup router with a higher priority joins the network, it will preempt the lower priority backup router that is the master. Disable preempt mode to prevent this from happening.

By default, a layer 3 device with the same IP address as the virtual router will become the master router regardless of the preempt mode.

36.2 VRRP Status

Use this screen to look at the virtual routers in which the switch is participating. To open this screen, click **IP Application > VRRP**.

Figure 100 VRRP Status



Index	Network	VRID	VR Status	Uplink Status
1	192.168.1.1/24	1	Master	Alive

The following table describes the labels in this screen.

Table 78 VRRP Status

LABEL	DESCRIPTION
Index	This field displays the index number of a rule.
Network	This field displays the IP address and the subnet mask bits of an IP routing domain that is associated to a virtual router.
VRID	This field displays the ID number of the virtual router.
VR Status	This field displays the status of the virtual router. This field is **Master** indicating that this switch functions as the master router. This field is **Backup** indicating that this switch functions as a backup router. This field displays **Init** when this switch is initiating the VRRP protocol or when the **Uplink Status** field displays **Dead**.
Uplink Status	This field displays the status of the link between this switch and the uplink gateway. This field is **Alive** indicating that the link between this switch and the uplink gateway is up. Otherwise, this field is **Dead**. This field displays **Probe** when this switch is check for the link state.

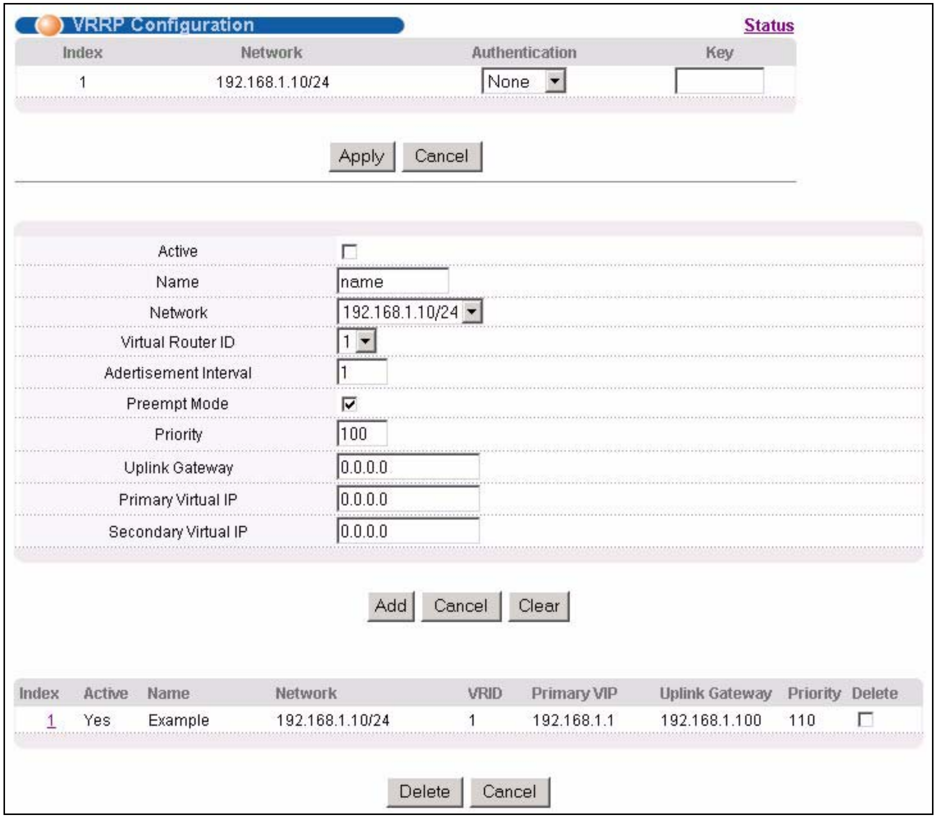
36.2.1 VRRP Configuration

Use this screen to specify the virtual routers in which the switch participates. Before configuring VRRP, first create an IP interface (or routing domain) in the **IP Setup** screen. See Section 10.2 on page 73 for more information.

You can only configure VRRP on interfaces with unique VLAN IDs.

Routing domains with the same VLAN ID are not displayed in the table indicated. To open this screen, click **IP Application** > **VRRP** > **Configuration**.

Figure 101 VRRP Configuration



Index	Network	Authentication	Key
1	192.168.1.10/24	None	

Active	□
Name	name
Network	192.168.1.10/24
Virtual Router ID	1
Adertisement Interval	1
Preempt Mode	☑
Priority	100
Uplink Gateway	0.0.0.0
Primary Virtual IP	0.0.0.0
Secondary Virtual IP	0.0.0.0

Index	Active	Name	Network	VRID	Primary VIP	Uplink Gateway	Priority	Delete
1	Yes	Example	192.168.1.10/24	1	192.168.1.1	192.168.1.100	110	□

The following table describes the labels in this screen.

Table 79 VRRP Configuration

LABEL	DESCRIPTION
Index	This field displays the index number of an entry.
Network	This field displays the IP address and number of subnet mask bit of an IP domain.
Authentication	Select **None** to disable authentication. This is the default setting. Select **Simple** to use a simple password to authenticate VRRP packet exchanges on this interface.
Key	When you select **Simple** in the **Authentication** field, enter a password key (up to eight printable English keyboard character long) in this field.
Apply	Click **Apply** to save your changes to the switch's run-time memory. The switch loses these changes if it is turned off or loses power, so use the **Save** link on the top navigation panel to save your changes to the non-volatile memory when you are done configuring.
Cancel	Click **Cancel** to discard all changes made in this table.
	Use this section to configure various VRRP parameters.
Active	Select this option to enable this VRRP entry.
Name	Enter a descriptive name (up to 32 printable English keyboard characters) for identification purposes.
Network	Select an IP domain to which this VRRP entry applies.
Virtual Router ID	Select a virtual router number (1 to 7) for which this VRRP entry is created. You can configure up to seven virtual routers for one network.

Table 79 VRRP Configuration (continued)

LABEL	DESCRIPTION
Advertisement Interval	Specify the number of seconds between Hello message transmissions.
Preempt Mode	Select this option to activate preempt mode.
Priority	Enter a number (between 1 and 254) to set the priority level. The bigger the number, the higher the priority.
Uplink Gateway	Enter the IP address of the uplink gateway in dotted decimal notation. The switch checks the link to the uplink gateway.
Primary Virtual IP	Enter the IP address of the primary virtual router in dotted decimal notation.
Secondary Virtual IP	This field is optional. Enter the IP address of a secondary virtual router in dotted decimal notation. This field is ignored when you enter **0.0.0.0**.
Add	Click **Add** to save your changes to the switch's run-time memory. The switch loses these changes if it is turned off or loses power, so use the **Save** link on the top navigation panel to save your changes to the non-volatile memory when you are done configuring.
Cancel	Click **Cancel** to discard all changes made in this table.
Clear	Click **Clear** to set the above fields back to the factory defaults.
	Use this section to look at a summary of VRRP configuration.
Index	This field displays the index number of an entry.
Active	This field shows whether a VRRP entry is enabled (**Yes**) or disabled (**No**).
Name	This field displays a descriptive name of an entry.
Network	This field displays the IP address and subnet mask of an interface.
VRID	This field displays the ID number of a virtual router.
Primary VIP	This field displays the IP address of the primary virtual router.
Uplink Gateway	This field displays the IP address of the uplink gateway.
Priority	This field displays the priority level (1 to 255) of the entry.
Delete	Click **Delete** to remove the selected entry from the summary table.
Cancel	Click **Cancel** to clear the **Delete** check boxes.

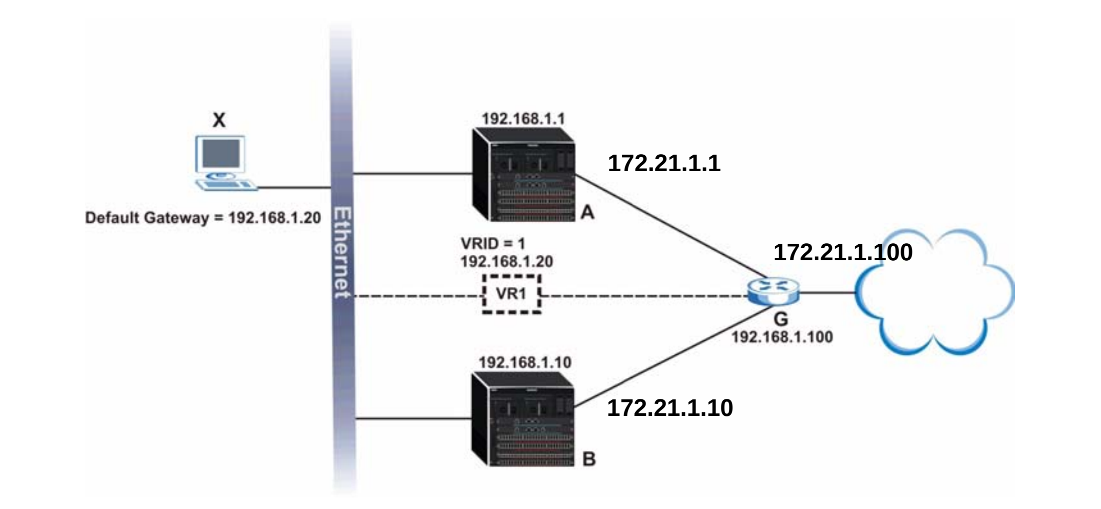
36.3 VRRP Configuration Examples

The following sections show two VRRP configuration examples on the switch.

36.3.1 One Subnet Network Example

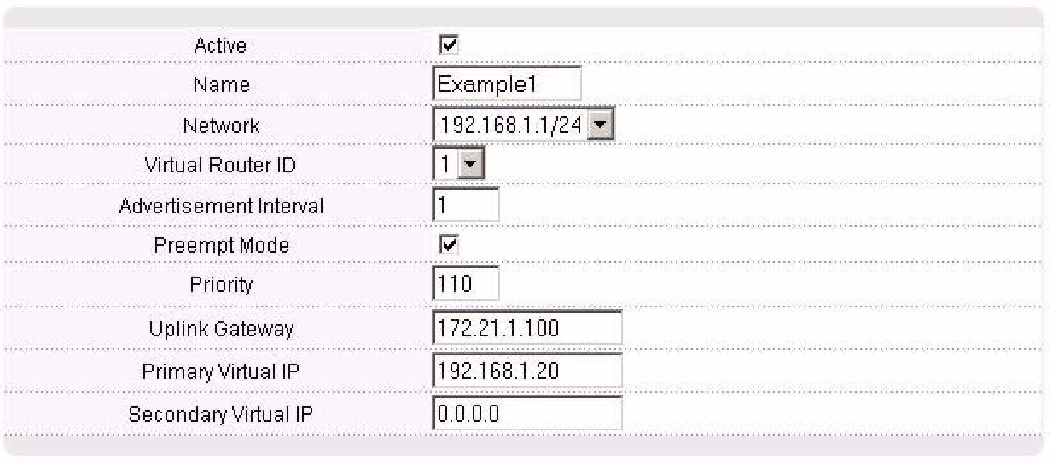
The figure below shows a simple VRRP network with only one virtual router **VR1** (VRID =1) and two switches. The network is connected to the WAN via an uplink gateway **G** (172.21.1.100). The host computer **X** is set to use **VR1** as the default gateway.

Figure 102 VRRP Configuration Example: One Virtual Router Network



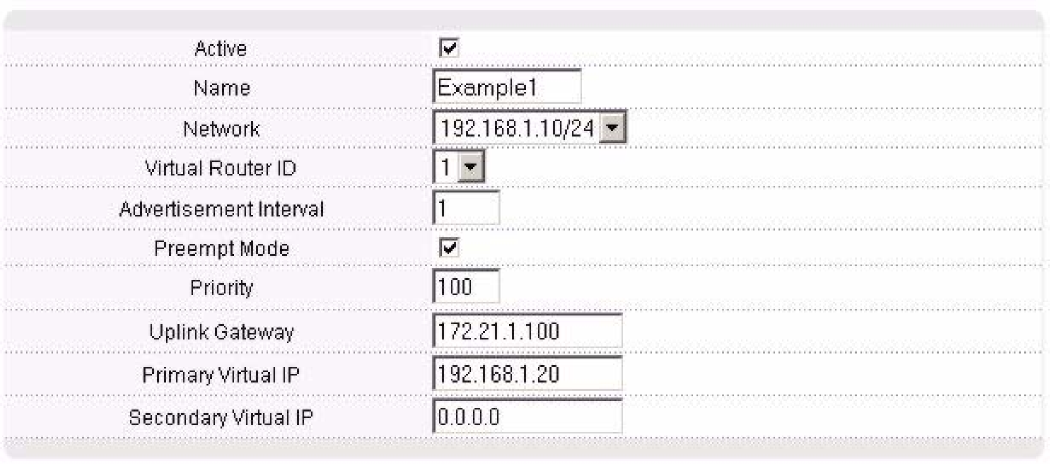
You want to set switch **A** as the master router. Configure the VRRP parameters in the **VRRP Configuration** screens on the switches as shown in the figures below.

Figure 103 VRRP Example 1: VRRP Parameter Settings on Switch A



Active	☑
Name	Example1
Network	192.168.1.1/24
Virtual Router ID	1
Advertisement Interval	1
Preempt Mode	☑
Priority	110
Uplink Gateway	172.21.1.100
Primary Virtual IP	192.168.1.20
Secondary Virtual IP	0.0.0.0

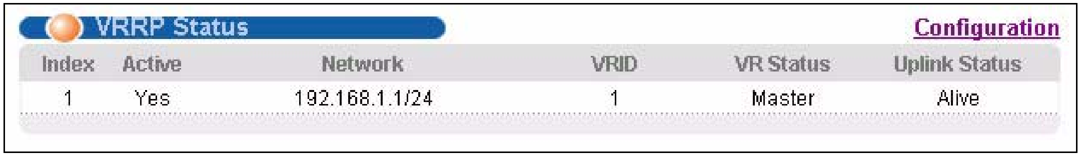
Figure 104 VRRP Example 1: VRRP Parameter Settings on Switch B



Active	☑
Name	Example1
Network	192.168.1.10/24
Virtual Router ID	1
Advertisement Interval	1
Preempt Mode	☑
Priority	100
Uplink Gateway	172.21.1.100
Primary Virtual IP	192.168.1.20
Secondary Virtual IP	0.0.0.0

After configuring and saving the VRRP configuration, the **VRRP Status** screens for both switches are shown next.

Figure 105 VRRP Example 1: VRRP Status on Switch A

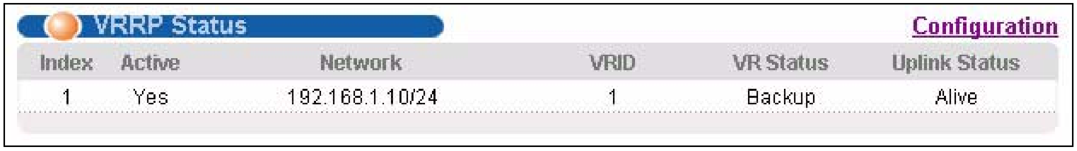


VRRP Status

Configuration

Index	Active	Network	VRID	VR Status	Uplink Status
1	Yes	192.168.1.1/24	1	Master	Alive

Figure 106 VRRP Example 1: VRRP Status on Switch B



VRRP Status

Configuration

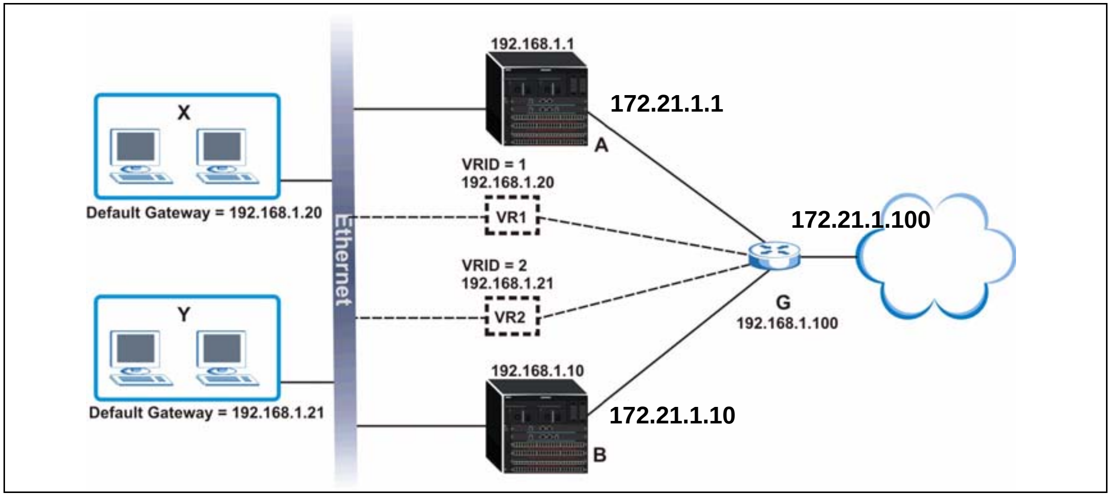
Index	Active	Network	VRID	VR Status	Uplink Status
1	Yes	192.168.1.10/24	1	Backup	Alive

36.3.2 Two Subnets Example

The following figure depicts an example in which two switches share the network traffic. Hosts in the two network groups use different default gateways. Each switch is configured to backup a virtual router using VRRP.

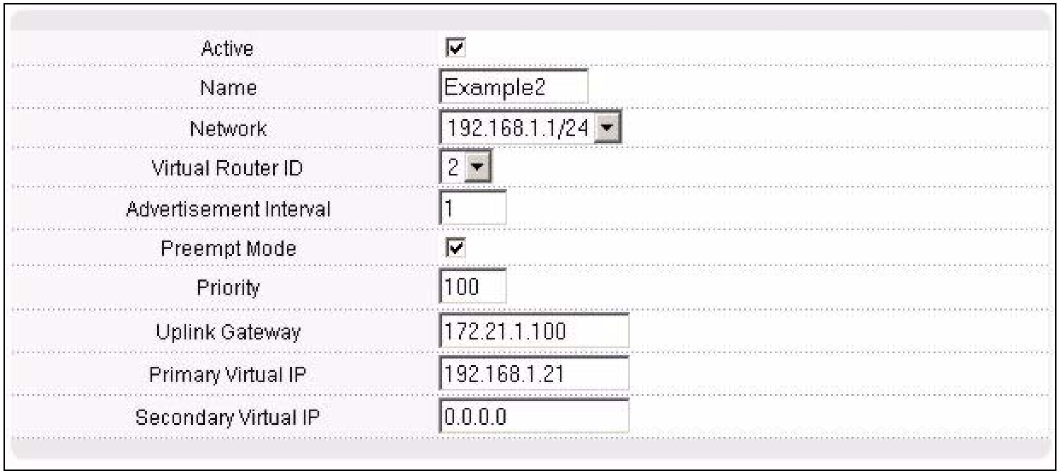
You wish to configure switch **A** as the master router for virtual router **VR1** and as a backup for virtual router **VR2**. On the other hand, switch **B** is the master for **VR2** and a backup for **VR1**.

Figure 107 VRRP Configuration Example: Two Virtual Router Network



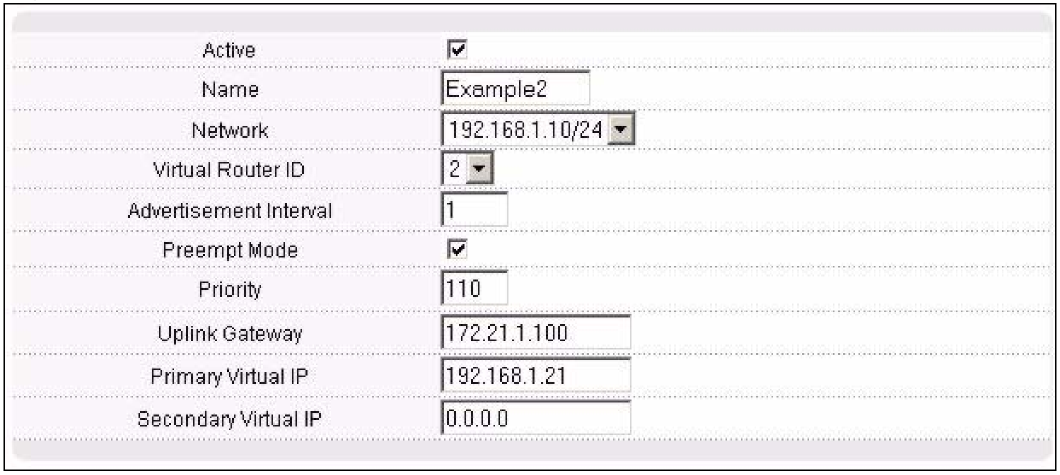
Keeping the VRRP configuration in example 1 for virtual router **VR1** (refer to Section 36.3.2 on page 211), you need to configure the **VRRP Configuration** screen for virtual router VR2 on each switch. Configure the VRRP parameters on the switches as shown in the figures below.

Figure 108 VRRP Example 2: VRRP Parameter Settings for VR2 on Switch A



Active	☑
Name	Example2
Network	192.168.1.1/24
Virtual Router ID	2
Advertisement Interval	1
Preempt Mode	☑
Priority	100
Uplink Gateway	172.21.1.100
Primary Virtual IP	192.168.1.21
Secondary Virtual IP	0.0.0.0

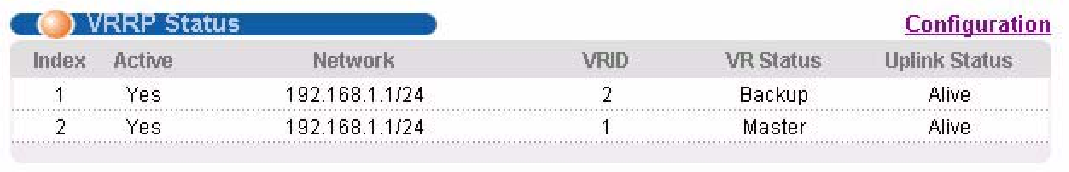
Figure 109 VRRP Example 2: VRRP Parameter Settings for VR2 on Switch B



Active	☑
Name	Example2
Network	192.168.1.10/24
Virtual Router ID	2
Advertisement Interval	1
Preempt Mode	☑
Priority	110
Uplink Gateway	172.21.1.100
Primary Virtual IP	192.168.1.21
Secondary Virtual IP	0.0.0.0

After configuring and saving the VRRP configuration, the **VRRP Status** screens for both switches are shown next.

Figure 110 VRRP Example 2: VRRP Status on Switch A

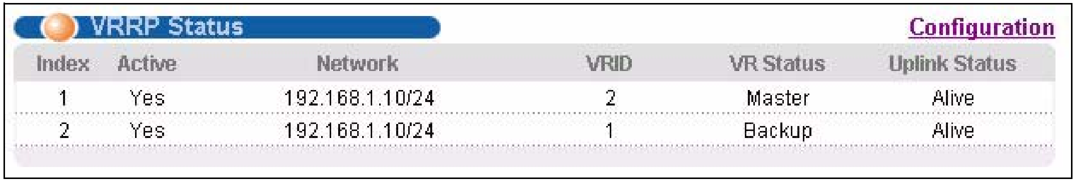


VRRP Status

Configuration

Index	Active	Network	VRID	VR Status	Uplink Status
1	Yes	192.168.1.1/24	2	Backup	Alive
2	Yes	192.168.1.1/24	1	Master	Alive

Figure 111 VRRP Example 2: VRRP Status on Switch B



VRRP Status

Configuration

Index	Active	Network	VRID	VR Status	Uplink Status
1	Yes	192.168.1.10/24	2	Master	Alive
2	Yes	192.168.1.10/24	1	Backup	Alive

PART VI
Manage

37

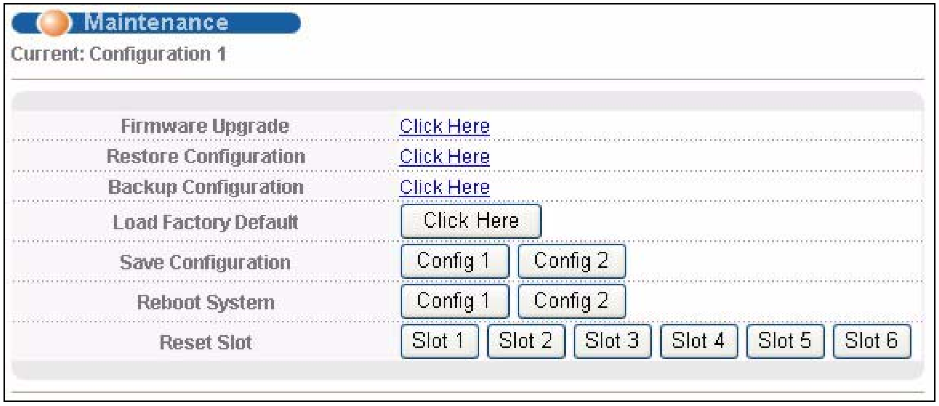
Maintenance

This chapter explains how to configure the maintenance screens that let you maintain the firmware and configuration files.

37.1 Maintenance

Use this screen to manage firmware and the configuration. To open this screen, click **Management** > **Maintenance**.

Figure 112 Maintenance



Maintenance

Current: Configuration 1

Firmware Upgrade	Click Here
Restore Configuration	Click Here
Backup Configuration	Click Here
Load Factory Default	Click Here
Save Configuration	Config 1 Config 2
Reboot System	Config 1 Config 2
Reset Slot	Slot 1 Slot 2 Slot 3 Slot 4 Slot 5 Slot 6

The following table describes the labels in this screen.

Table 80 Maintenance

LABEL	DESCRIPTION
Current	This field displays which configuration (**Configuration 1** or **Configuration 2**) is currently operating on the switch.
Firmware Upgrade	Click **Click Here** to go to the **Firmware Upgrade** screen. See Section 37.1.1 on page 216.
Restore Configuration	Click **Click Here** to go to the **Restore Configuration** screen. See Section 37.1.2 on page 218.
Backup Configuration	Click **Click Here** to go to the **Backup Configuration** screen. See Section 37.1.3 on page 218.
Load Factory Default	Follow these steps to reset the configuration to the factory default settings. 1. Click **Click Here**. The switch prompts you for confirmation. 2. Click **OK** to confirm. 3. In the main screen, click **Save** to make the changes take effect. If you want to access the switch web configurator again, you may need to change the IP address of your computer to be in the same subnet as that of the default IP address (192.168.0.1).

Table 80 Maintenance (continued)

LABEL	DESCRIPTION
Save Configuration	Click **Config 1** to save the current configuration settings permanently to **Configuration 1** on the switch. Click **Config 2** to save the current configuration settings permanently to **Configuration 2** on the switch. Alternatively, click **Save** on the top right-hand corner in any screen to save the configuration changes to the current configuration. Note: Clicking the **Apply** or **Add** button in a screen does NOT save the changes permanently. All unsaved changes are erased after you reboot the switch or card.
Reboot System	Use this to restart the switch without physically turning the power off. It also allows you to load configuration one (**Config 1**) or configuration two (**Config 2**) when you reboot. Click **Config 1** to reboot the system and load **Configuration 1** on the switch. Click **Config 2** to reboot the system and load **Configuration 2** on the switch. Note: Make sure to click the **Save** button to save your settings to the current configuration on the switch.
Reset Slot	Use this to restart the card in the selected slot. You might use this, for example, if you have just uploaded firmware to the card (Section 37.1.1 on page 216) and want the card to start running it. The card restarts using the last-saved configuration. Any unsaved changes are lost. Note: Make sure to click the **Save** button to save your settings to the current configuration on the switch.

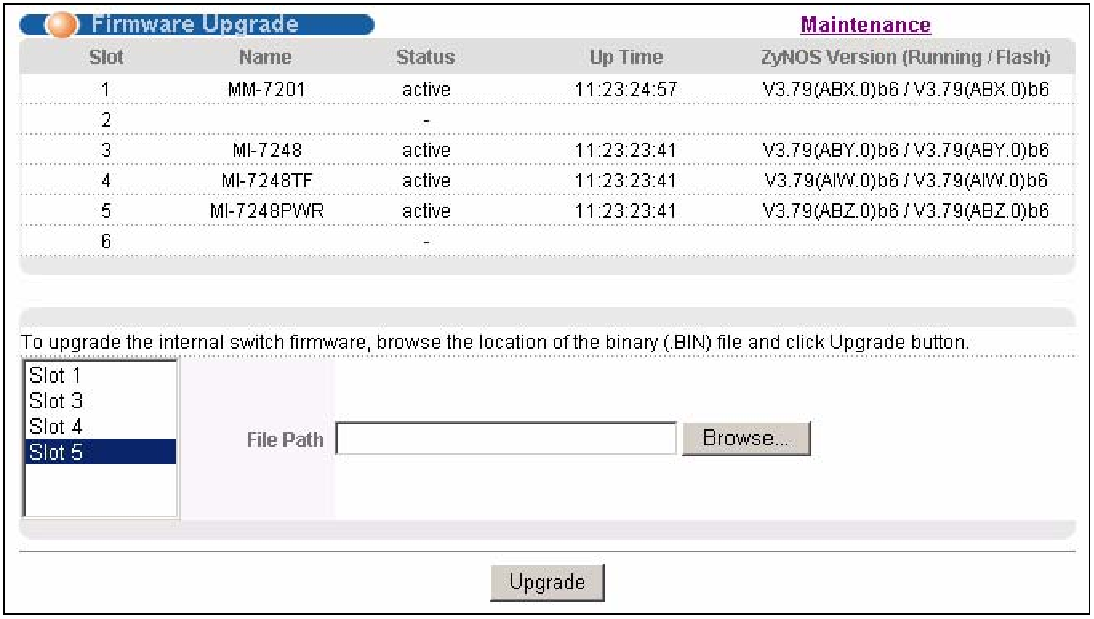
37.1.1 Firmware Upgrade

Make sure you have downloaded (and unzipped) the correct model firmware and version to your computer before uploading to the system.

Be sure to upload the correct model firmware as uploading the wrong model firmware may damage your system.

Use this screen to upload new firmware to the switch. You have to restart the switch (or slot for interface modules) before the new firmware starts running. To open this screen, click **Management** > **Maintenance** > **Firmware Upgrade**.

Figure 113 Firmware Upgrade



Firmware Upgrade

Maintenance

Slot	Name	Status	Up Time	ZyNOS Version (Running / Flash)
1	MM-7201	active	11:23:24:57	V3.79(ABX.0)b6 / V3.79(ABX.0)b6
2		-		
3	MI-7248	active	11:23:23:41	V3.79(ABY.0)b6 / V3.79(ABY.0)b6
4	MI-7248TF	active	11:23:23:41	V3.79(AIW.0)b6 / V3.79(AIW.0)b6
5	MI-7248PWR	active	11:23:23:41	V3.79(ABZ.0)b6 / V3.79(ABZ.0)b6
6		-		

To upgrade the internal switch firmware, browse the location of the binary (.BIN) file and click Upgrade button.

Slot 1
Slot 3
Slot 4
Slot 5

File Path

The following table describes the labels in this screen.

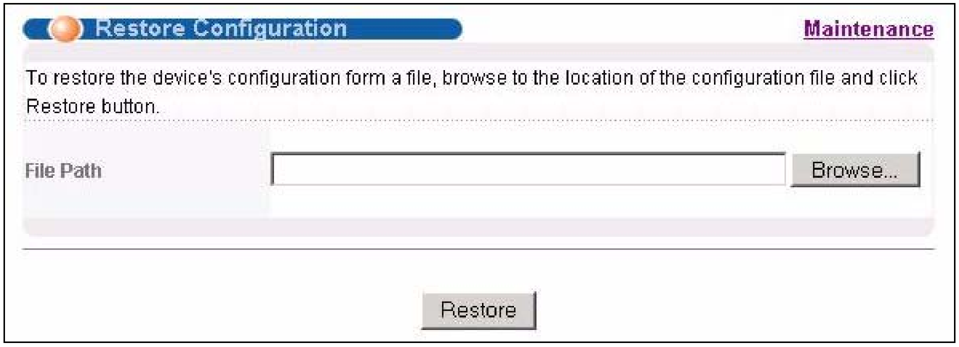
Table 81 Firmware Upgrade

LABEL	DESCRIPTION
Maintenance	Click this to return to the previous screen.
Slot	This field displays the slot number.
Name	This is the model name of the card in the slot. It is blank if there is no card in the slot.
Status	This field displays the status of the card in the slot. Possible values are: **active**: The card is ready. **standby**: The card is the backup management card. **-**: There is no card in this slot.
Up Time	This field shows the total amount of time in hours, minutes and seconds the card has been up.
ZyNOS Version (Running / Flash)	This field displays the version number of the firmware the card is currently running and of the firmware the card will run the next time it restarts.
Slot	Select the slot number of the card whose firmware you want to upgrade.
File Path	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.
Upgrade	Click this to upload the specified firmware to the specified card. Note: You have to restart the card before it starts using the firmware. You can restart the card in the **Maintenance** screen. See Section 37.1 on page 215. After the card has restarted, see the **System Info** screen to verify your current firmware version number. See Section 7.1 on page 63.

37.1.2 Restore Configuration

Use this screen to restore a previously saved configuration from your computer to the switch. To open this screen, click **Management** > **Maintenance** > **Restore Configuration**.

Figure 114 Restore Configuration



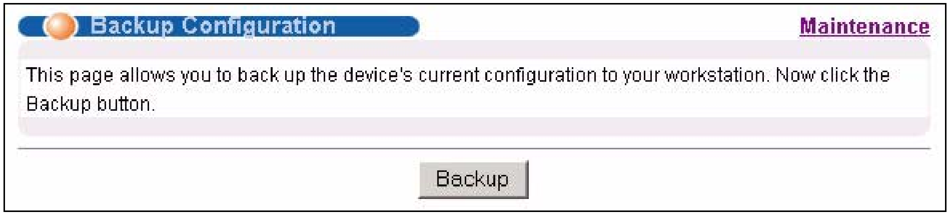
To restore the device's configuration form a file, browse to the location of the configuration file and click Restore button.

Type the path and file name of the configuration file you wish to restore in the **File Path** text box or click **Browse** to locate it. After you have specified the file, click **Restore**. "config" is the name of the configuration file on the switch, so your backup configuration file is automatically renamed when you restore using this screen.

37.1.3 Backup Configuration

Use this screen to back up your current switch configuration to a computer. Backing up your switch configurations allows you to create various “snap shots” of your system from which you may restore at a later date. To open this screen, click **Management** > **Maintenance** > **Backup Configuration**.

Figure 115 Backup Configuration



This page allows you to back up the device's current configuration to your workstation. Now click the Backup button.

Follow the steps below to back up the current switch configuration to your computer.

1 Click **Backup**.
2 Click **Save** to display the **Save As** screen.
3 Choose a location to save the file on your computer from the **Save in** drop-down list box and type a descriptive name for it in the **File name** list box. Click **Save** to save the configuration file to your computer.

37.2 FTP Command Line

This section explains the filename conventions and then shows some examples of uploading files to or downloading files from the system using FTP commands.

You can use FTP to upload firmware, but you have to restart the system (or card for interface modules) before the system (or card) starts running the new firmware.

37.2.1 Filename Conventions

The configuration file (also known as the romfile or ROM) contains the factory default settings in the screens such as password, switch setup, IP Setup, etc. Once you have customized the MM-7201's settings, they can be saved back to your computer under a filename of your choosing.

ZyNOS (ZyXEL Network Operating System sometimes referred to as the "ras" file) is the system firmware and has a "bin" filename extension.

Table 82 Filename Conventions

FILE TYPE	INTERNAL NAME	EXTERNAL NAME	DESCRIPTION
Configuration File	config		This is the configuration filename on the switch. Uploading the config file replaces the specified configuration file, including your switch configurations, system-related data (including the default password), the error log and the trace log.
Firmware			Firmware is loaded the next time the system (or card for interface modules) is restarted.
	ras	*.bin	This is the ZyNOS firmware for the active management card in the switch.
	ras-rddn	*.bin	This is the ZyNOS firmware for the standby management card in the switch. It should be the same as "ras".
	fw-3	*.bin	This is the ZyNOS firmware for the interface module in slot 3.
	fw-4	*.bin	This is the ZyNOS firmware for the interface module in slot 4.
	fw-5	*.bin	This is the ZyNOS firmware for the interface module in slot 5.
	fw-6	*.bin	This is the ZyNOS firmware for the interface module in slot 6.
	fw-MI-7248	*.bin	This is the ZyNOS firmware on any MI-7248 interface modules in the switch. This is overridden by ZyNOS firmware for a specific slot.
	fw-MI-7248PWR	*.bin	This is the generic name for the ZyNOS firmware on any MI-7248PWR interface modules in the switch. This is overridden by ZyNOS firmware for a specific slot.
	fw-MI-7248TF	*.bin	This is the generic name for the ZyNOS firmware on any MI-7248TF interface modules in the switch. This is overridden by ZyNOS firmware for a specific slot.

37.2.1.1 Example FTP Commands

```
ftp> put firmware.bin ras
```

This is a sample FTP session showing the transfer of the computer file "firmware.bin" to the switch.

```
ftp> get config config.cfg
```

This is a sample FTP session saving the current configuration to a file called “config.cfg” on your computer.

If your (T)FTP client does not allow you to have a destination filename different than the source, you will need to rename them first as the switch only recognizes the names in Table 82 on page 219. Be sure you keep unaltered copies of files for later use.

Be sure to upload the correct model firmware as uploading the wrong model firmware may damage your system.

37.2.2 FTP Command Line Procedure

1. Launch the FTP client on your computer.
2. Enter `open`, followed by a space and the IP address of your switch.
3. Enter your username as requested (the default is “admin”).
4. Enter your password as requested (the default is “1234”).
5. Enter `bin` to set transfer mode to binary.
6. Use `put` to transfer files from the computer to the switch, for example, `put firmware.bin ras` transfers the firmware on your computer (firmware.bin) to the switch and renames it to “ras”. Similarly, `put config.cfg config` transfers the configuration file on your computer (config.cfg) to the switch and renames it to “config”. Likewise `get config config.cfg` transfers the configuration file on the switch to your computer and renames it to “config.cfg”. See Table 82 on page 219 for more information on filename conventions.
7. Enter `quit` to exit the ftp prompt.

37.2.3 GUI-based FTP Clients

The following table describes some of the commands that you may see in GUI-based FTP clients.

Table 83 General Commands for GUI-based FTP Clients

COMMAND	DESCRIPTION
Host Address	Enter the address of the host server.
Login Type	Anonymous. This is when a user name and password is automatically supplied to the server for anonymous access. Anonymous logins will work only if your ISP or service administrator has enabled this option. Normal. The server requires a unique User ID and Password to login.

Table 83 General Commands for GUI-based FTP Clients (continued)

COMMAND	DESCRIPTION
Transfer Type	Transfer files in either plain text format (ASCII) or in binary mode. Configuration and firmware files should be transferred in binary mode.
Initial Remote Directory	Specify the default remote directory (path).
Initial Local Directory	Specify the default local directory (path).

37.2.4 FTP Restrictions

FTP will not work when:

- FTP service is disabled in the **Service Access Control** screen.
- The IP address(es) in the **Remote Management** screen does not match the client IP address. If it does not match, the switch will disconnect the Telnet session immediately.

38

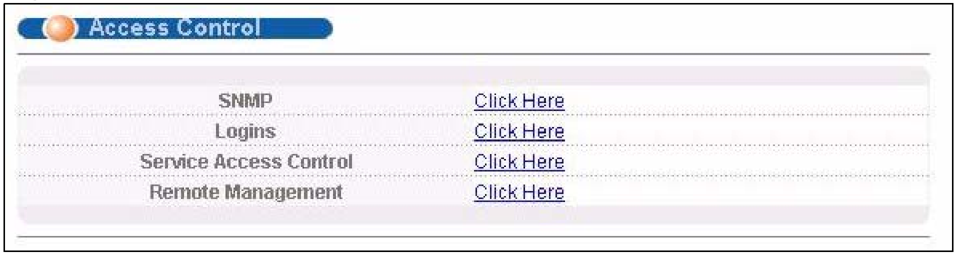
Access Control

This chapter describes how to control access to the switch.

38.1 Access Control

Use this screen to control access to the switch. A console port access control session and Telnet access control session cannot coexist when multi-login is disabled. See the CLI Reference Guide for more information on disabling multi-login. To open this screen, click **Management > Access Control**.

Figure 116 Access Control



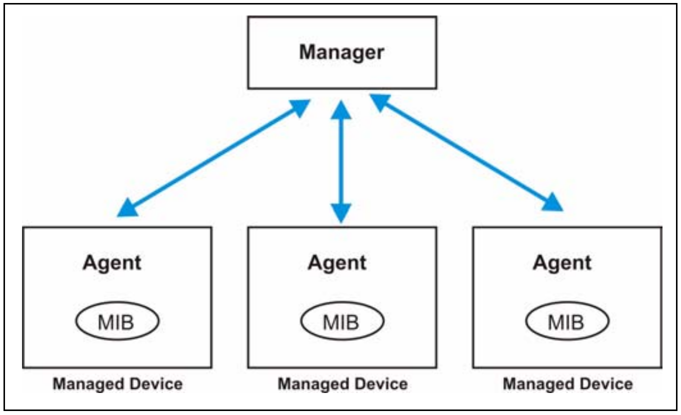
Access Control

SNMP	Click Here
Logins	Click Here
Service Access Control	Click Here
Remote Management	Click Here

38.2 SNMP Overview

Simple Network Management Protocol (SNMP) is an application layer protocol used to manage and monitor TCP/IP-based devices. SNMP is used to exchange management information between the network management system (NMS) and a network element (NE). A manager station can manage and monitor the switch through the network via SNMP version one (SNMPv1) and/or SNMP version 2c. The next figure illustrates an SNMP management operation. SNMP is only available if TCP/IP is configured.

Figure 117 SNMP Management Model



A SNMP managed network consists of two main components: agents and a manager.

An agent is a management software module that resides in a managed switch (the switch). An agent translates the local management information from the managed switch into a form compatible with SNMP. The manager is the console through which network administrators perform network management functions. It executes applications that control and monitor managed devices.

The managed devices contain object variables/managed objects that define each piece of information to be collected about a switch. Examples of variables include such as number of packets received, node port status etc. A Management Information Base (MIB) is a collection of managed objects. SNMP allows a manager and agents to communicate for the purpose of accessing these objects.

SNMP itself is a simple request/response protocol based on the manager/agent model. The manager issues a request and the agent returns responses using the following protocol operations:

Table 84 SNMP Commands

COMMAND	DESCRIPTION
Get	Allows the manager to retrieve an object variable from the agent.
GetNext	Allows the manager to retrieve the next object variable from a table or list within an agent. In SNMPv1, when a manager wants to retrieve all elements of a table from an agent, it initiates a Get operation, followed by a series of GetNext operations.
Set	Allows the manager to set values for object variables within an agent.
Trap	Used by the agent to inform the manager of some events.

38.2.1 SNMP v3 and Security

SNMP v3 enhances security for SNMP management. SNMP managers can be required to authenticate with agents before conducting SNMP management sessions.

Security can be further enhanced by encrypting the SNMP messages sent from the managers. Encryption protects the contents of the SNMP messages. When the contents of the SNMP messages are encrypted, only the intended recipients can read them.

38.2.2 Supported MIBs

MIBs let administrators collect statistics and monitor status and performance. The switch supports the following MIBs:

- SNMP MIB II (RFC 1213)
- RFC 1157 SNMP v1
- RFC 1493 Bridge MIBs
- RFC 1643 Ethernet MIBs
- RFC 1155 SMI
- RFC 2674 SNMPv2, SNMPv2c
- RFC 1757 RMON
- SNMPv2, SNMPv2c or later version, compliant with RFC 2011 SNMPv2 MIB for IP, RFC 2012 SNMPv2 MIB for TCP, RFC 2013 SNMPv2 MIB for UDP

38.2.3 SNMP Traps

The switch sends traps to an SNMP manager when an event occurs. The following tables outline the SNMP traps by category.

An OID (Object ID) that begins with "**1.3.6.1.4.1.890.1.5.8.34**" is defined in private MIBs. Otherwise, it is a standard MIB OID.

Table 85 SNMP System Traps

OPTION	OBJECT LABEL	OBJECT ID	DESCRIPTION
coldstart	coldStart	1.3.6.1.6.3.1.1.5.1	This trap is sent when the MM-7201 is turned on.
warmstart	warmStart	1.3.6.1.6.3.1.1.5.2	This trap is sent when the MM-7201 restarts.
fanspeed	FanSpeedEventOn	1.3.6.1.4.1.890.1.5.8.34.27.2.1	This trap is sent when the fan speed goes above or below the normal operating range.
	FanSpeedEventClear	1.3.6.1.4.1.890.1.5.8.34.27.2.2	This trap is sent when the fan speed returns to the normal operating range.
temperature	TemperatureEventOn	1.3.6.1.4.1.890.1.5.8.34.27.2.1	This trap is sent when the temperature goes above or below the normal operating range.
	TemperatureEventClear	1.3.6.1.4.1.890.1.5.8.34.27.2.2	This trap is sent when the temperature returns to the normal operating range.
voltage	VoltageEventOn	1.3.6.1.4.1.890.1.5.8.34.27.2.1	This trap is sent when the voltage goes above or below the normal operating range.
	VoltageEventClear	1.3.6.1.4.1.890.1.5.8.34.27.2.2	This trap is sent when the voltage returns to the normal operating range.

Table 85 SNMP System Traps (continued)

OPTION	OBJECT LABEL	OBJECT ID	DESCRIPTION
reset	UncontrolledResetEventOn	1.3.6.1.4.1.890.1.5.8.34.27.2.1	This trap is sent when the MM-7201 automatically resets.
	ControlledResetEventOn	1.3.6.1.4.1.890.1.5.8.34.27.2.1	This trap is sent when the MM-7201 resets by an administrator through a management interface.
	RebootEvent	1.3.6.1.4.1.890.1.5.0.1	This trap is sent when the MM-7201 reboots by an administrator through a management interface.
timesync	RTCNotUpdatedEventOn	1.3.6.1.4.1.890.1.5.8.34.27.2.1	This trap is sent when the MM-7201 fails to get the time and date from a time server.
	RTCNotUpdatedEventClear	1.3.6.1.4.1.890.1.5.8.34.27.2.2	This trap is sent when the MM-7201 gets the time and date from a time server.
intrusionlock	IntrusionLockEventOn	1.3.6.1.4.1.890.1.5.8.34.27.2.1	This trap is sent when intrusion lock occurs on a port.
externalarm	ExternalAlarmEventOn	1.3.6.1.4.1.890.1.5.8.34.27.2.1	This trap is sent when the external alarm is received.
	ExternalAlarmEventClear	1.3.6.1.4.1.890.1.5.8.34.27.2.2	This trap is sent when the external alarm stops sending an alert.

Table 86 SNMP Interface Traps

OPTION	OBJECT LABEL	OBJECT ID	DESCRIPTION
linkup	linkUp	1.3.6.1.6.3.1.1.5.4	This trap is sent when the Ethernet link is up.
	LinkDownEventClear	1.3.6.1.4.1.890.1.5.8.34.27.2.2	This trap is sent when the Ethernet link is up.
linkdown	linkDown	1.3.6.1.6.3.1.1.5.3	This trap is sent when the Ethernet link is down.
	LinkDownEventOn	1.3.6.1.4.1.890.1.5.8.34.27.2.1	This trap is sent when the Ethernet link is down.
autonegotiation	AutonegotiationFailedEventOn	1.3.6.1.4.1.890.1.5.8.34.27.2.1	This trap is sent when an Ethernet interface fails to auto-negotiate with the peer Ethernet interface.
	AutonegotiationFailedEventClear	1.3.6.1.4.1.890.1.5.8.34.27.2.2	This trap is sent when an Ethernet interface auto-negotiates with the peer Ethernet interface.

Table 87 AAA Traps

OPTION	OBJECT LABEL	OBJECT ID	DESCRIPTION
authentication	authenticationFailure	1.3.6.1.6.3.1.1.5.5	This trap is sent when authentication fails due to incorrect user name and/or password.
	AuthenticationFailureEventOn	1.3.6.1.4.1.890.1.5.8.34.27.2.1	This trap is sent when authentication fails due to incorrect user name and/or password.
	RADIUSNotReachableEventOn	1.3.6.1.4.1.890.1.5.8.34.27.2.1	This trap is sent when there is no response message from the RADIUS server.
	RADIUSNotReachableEventClear	1.3.6.1.4.1.890.1.5.8.34.27.2.2	This trap is sent when the RADIUS server can be reached.
accounting	RADIUSNotReachableEventOn	1.3.6.1.4.1.890.1.5.8.34.27.2.1	This trap is sent when there is no response message from the RADIUS accounting server.
	RADIUSNotReachableEventClear	1.3.6.1.4.1.890.1.5.8.34.27.2.2	This trap is sent when the RADIUS accounting server can be reached.

Table 88 SNMP IP Traps

OPTION	OBJECT LABEL	OBJECT ID	DESCRIPTION
ping	pingProbeFailed	1.3.6.1.2.1.80.0.1	This trap is sent when a single ping probe fails.
	pingTestFailed	1.3.6.1.2.1.80.0.2	This trap is sent when a ping test (consisting of a series of ping probes) fails.
	pingTestCompleted	1.3.6.1.2.1.80.0.3	This trap is sent when a ping test is completed.
traceroute	traceRoutePathChange	1.3.6.1.2.1.81.0.1	This trap is sent when a path to a target changes.
	traceRouteTestFailed	1.3.6.1.2.1.81.0.2	This trap is sent when a traceroute test fails.
	traceRouteTestCompleted	1.3.6.1.2.1.81.0.3	This trap is sent when a traceroute test is completed.

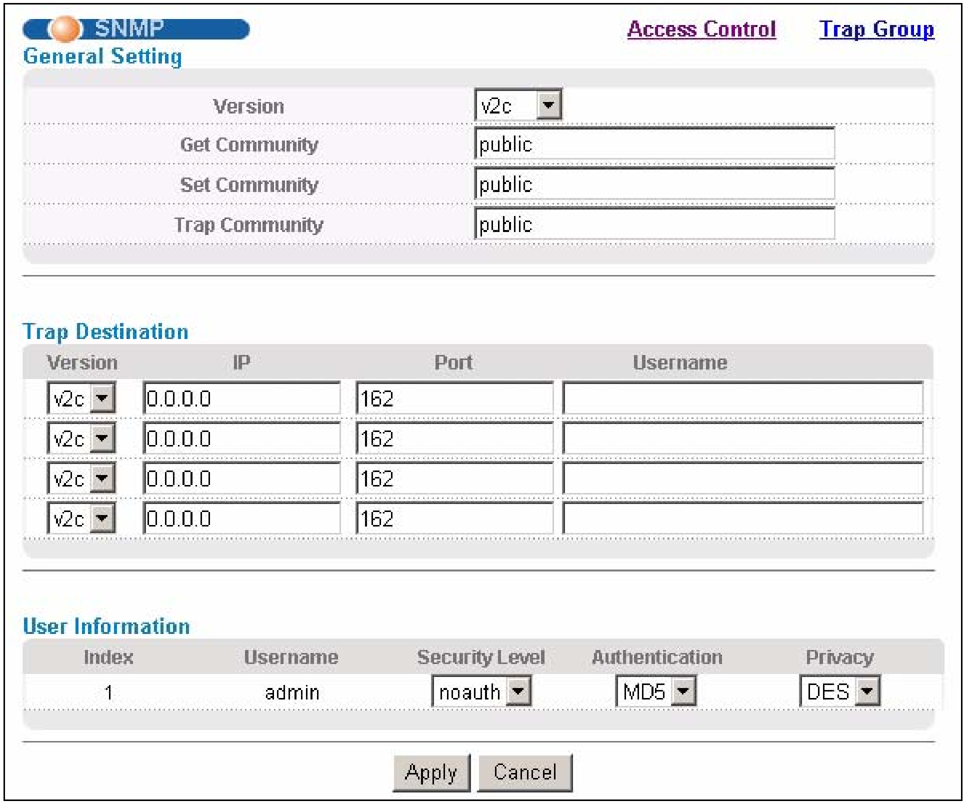
Table 89 SNMP Switch Traps

OPTION	OBJECT LABEL	OBJECT ID	DESCRIPTION
stp	STPNewRoot	1.3.6.1.2.1.17.0.1	This trap is sent when the STP root switch changes.
	MRSTPNewRoot	1.3.6.1.4.1.890.1.5.8.34.36.2.1	This trap is sent when the MRSTP root switch changes.
	MSTPNewRoot	1.3.6.1.4.1.890.1.5.8.34.107.70.1	This trap is sent when the MSTP root switch changes.
	STPTopologyChange	1.3.6.1.2.1.17.0.2	This trap is sent when the STP topology changes.
	MRSTPTopologyChange	1.3.6.1.4.1.890.1.5.8.34.36.2.2	This trap is sent when the MRSTP topology changes.
	MSTPTopologyChange	1.3.6.1.4.1.890.1.5.8.34.107.70.2	This trap is sent when the MSTP root switch changes.
mactable	MacTableFullEventOn	1.3.6.1.4.1.890.1.5.8.34.27.2.1	This trap is sent when more than 99% of the MAC table is used.
	MacTableFullEventClear	1.3.6.1.4.1.890.1.5.8.34.27.2.2	This trap is sent when less than 95% of the MAC table is used.
rmon	RmonRisingAlarm	1.3.6.1.2.1.16.0.1	This trap is sent when a variable goes over the RMON "rising" threshold.
	RmonFallingAlarm	1.3.6.1.2.1.16.0.2	This trap is sent when the variable falls below the RMON "falling" threshold.

38.2.4 SNMP

Use this screen to configure SNMP on the switch. To open this screen, click **Management** > **Access Control** > **SNMP**.

Figure 118 SNMP



Version	v2c
Get Community	public
Set Community	public
Trap Community	public

Version	IP	Port	Username
v2c	0.0.0.0	162	
v2c	0.0.0.0	162	
v2c	0.0.0.0	162	
v2c	0.0.0.0	162	

Index	Username	Security Level	Authentication	Privacy
1	admin	noauth	MD5	DES

The following table describes the labels in this screen.

Table 90 SNMP

LABEL	DESCRIPTION
General Setting	Use this section to specify the SNMP version and community (password) values.
Version	Select the SNMP version for the switch. The SNMP version on the MM-7201 must match the version on the SNMP manager. Choose SNMP version 2c (**v2c**), SNMP version 3 (**v3**) or both (**v3v2c**). Note: SNMP version 2c is backwards compatible with SNMP version 1.
Get Community	Enter the **Get Community** string, which is the password for the incoming Get- and GetNext- requests from the management station. The **Get Community** string is only used by SNMP managers using SNMP version 2c or lower.
Set Community	Enter the **Set Community**, which is the password for incoming Set- requests from the management station. The **Set Community** string is only used by SNMP managers using SNMP version 2c or lower.
Trap Community	Enter the **Trap Community** string, which is the password sent with each trap to the SNMP manager. The **Trap Community** string is only used by SNMP managers using SNMP version 2c or lower.
Trap Destination	Use this section to configure where to send SNMP traps from the switch.
Version	Specify the version of the SNMP trap messages.
IP	Enter the IP addresses of up to four managers to send your SNMP traps to.

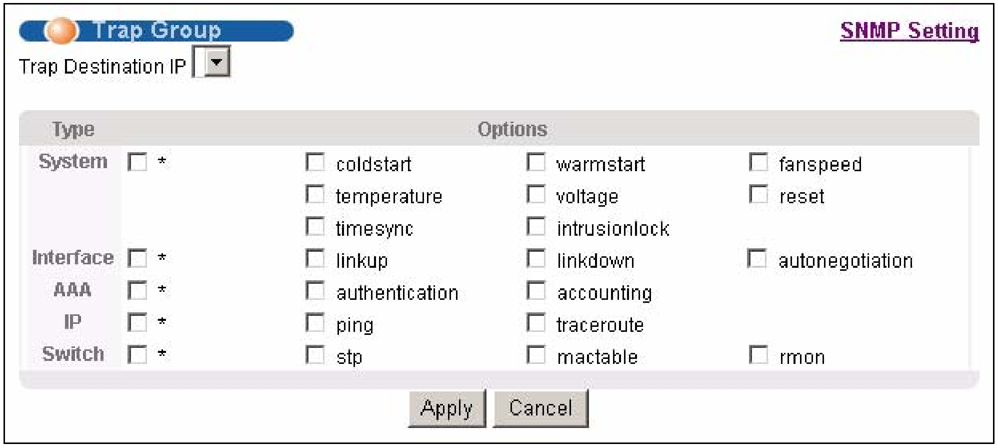
Table 90 SNMP (continued)

LABEL	DESCRIPTION
Port	Enter the port number upon which the manager listens for SNMP traps.
Username	Enter the username to be sent to the SNMP manager along with the SNMP v3 trap. Note: This username must match an existing account on the switch (configured in **Management** > **Access Control** > **Logins** screen).
User Information	Use this section to configure users for authentication with managers using SNMP v3. Note: Use the username and password of the login accounts you specify in this section to create accounts on the SNMP v3 manager.
Index	This is a read-only number identifying a login account on the switch.
Username	This field displays the username of a login account on the switch.
Security Level	Select whether you want to implement authentication and/or encryption for SNMP communication from this user. Choose: • **noauth** -to use the username as the password string to send to the SNMP manager. This is equivalent to the Get, Set and Trap Community in SNMP v2c. This is the lowest security level. • **auth** - to implement an authentication algorithm for SNMP messages sent by this user. • **priv** - to implement authentication and encryption for SNMP messages sent by this user. This is the highest security level. Note: The settings on the SNMP manager must be set at the same security level or higher than the security level settings on the switch.
Authentication	Select an authentication algorithm. **MD5** (Message Digest 5) and **SHA** (Secure Hash Algorithm) are hash algorithms used to authenticate SNMP data. **SHA** authentication is generally considered stronger than **MD5**, but is slower.
Privacy	Specify the encryption method for SNMP communication from this user. You can choose one of the following: • **DES** - Data Encryption Standard is a widely used (but breakable) method of data encryption. It applies a 56-bit key to each 64-bit block of data. • **AES** - Advanced Encryption Standard is another method for data encryption that also uses a secret key. AES applies a 128-bit key to 128-bit blocks of data.
Apply	Click **Apply** to save your changes to the switch's run-time memory. The switch loses these changes if it is turned off or loses power, so use the **Save** link on the top navigation panel to save your changes to the non-volatile memory when you are done configuring.
Cancel	Click **Cancel** to begin configuring this screen afresh.

38.2.5 Configuring SNMP Trap Group

Click **Management** > **Access Control** > **SNMP** > **Trap Group** to view the screen as shown. Use the **Trap Group** screen to specify the types of SNMP traps that should be sent to each SNMP manager.

Figure 119 SNMP Trap Group


Trap Group
SNMP Setting
Trap Destination IP
Type
Options
System □ * □ coldstart □ warmstart □ fanspeed
□ temperature □ voltage □ reset
□ timesync □ intrusionlock
Interface □ * □ linkup □ linkdown □ autonegotiation
AAA □ * □ authentication □ accounting
IP □ * □ ping □ traceroute
Switch □ * □ stp □ mactable □ rmon
Apply
Cancel

The following table describes the labels in this screen.

Table 91 SNMP Trap Group

LABEL	DESCRIPTION
Trap Destination IP	Select one of your configured trap destination IP addresses. These are the IP addresses of the SNMP managers. You must first configure a trap destination IP address in the **SNMP Setting** screen. Use the rest of the screen to select which traps the switch sends to that SNMP manager.
Type	Select the categories of SNMP traps that the switch is to send to the SNMP manager.
Options	Select the individual SNMP traps that the switch is to send to the SNMP station. See Section 38.2.3 on page 225 for individual trap descriptions. The traps are grouped by category. Selecting a category automatically selects all of the category's traps. Clear the check boxes for individual traps that you do not want the switch to send to the SNMP station. Clearing a category's check box automatically clears all of the category's trap check boxes (the switch only sends traps from selected categories).
Apply	Click **Apply** to save your changes to the switch's run-time memory. The switch loses these changes if it is turned off or loses power, so use the **Save** link on the top navigation panel to save your changes to the non-volatile memory when you are done configuring.
Cancel	Click **Cancel** to begin configuring this screen afresh.

38.3 Logins

Up to five people (one administrator and four non-administrators) may access the switch via the web configurator at any one time.

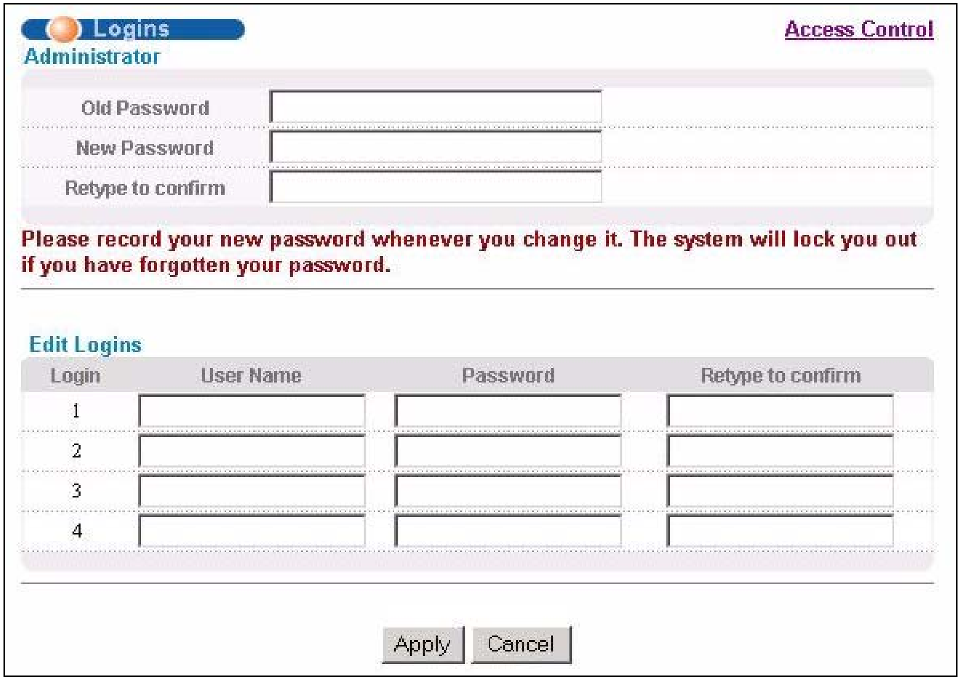
- An administrator is someone who can both view and configure switch changes. The username for the Administrator is always **admin**. The default administrator password is **1234**.

It is highly recommended that you change the default administrator password.

- A non-administrator (username is something other than **admin**) is someone who can view but not configure switch settings.

Use this screen to change the administrator password and to manage non-administrator accounts. To open this screen, click **Management** > **Access Control** > **Logins**.

Figure 120 Logins



Please record your new password whenever you change it. The system will lock you out if you have forgotten your password.

The following table describes the labels in this screen.

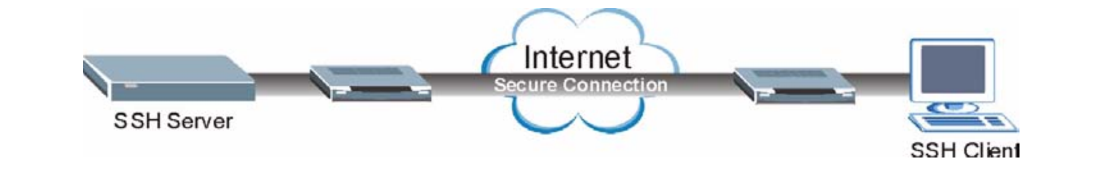
Table 92 Logins

LABEL	DESCRIPTION
Administrator	This is the default administrator account with the “admin” user name. Only the administrator has read/write access. You cannot change the default administrator user name.
Old Password	Type the existing administrator password (**1234** is the default password when shipped).
New Password	Enter your new administrator password.
Retype to confirm	Retype your new administrator password for confirmation
Edit Logins	You may configure passwords for up to four users. These users have read-only access. You can give users higher privileges via the CLI. For more information on assigning privileges see the CLI Reference Guide.
User Name	Set a user name (up to 32 English keyboard characters long).
Password	Enter your new user password.
Retype to confirm	Retype your new user password for confirmation
Apply	Click **Apply** to save your changes to the switch’s run-time memory. The switch loses these changes if it is turned off or loses power, so use the **Save** link on the top navigation panel to save your changes to the non-volatile memory when you are done configuring.
Cancel	Click **Cancel** to reset the fields.

38.4 SSH Overview

Unlike Telnet or FTP, which transmit data in clear text, SSH (Secure Shell) is a secure communication protocol that combines authentication and data encryption to provide secure encrypted communication between two hosts over an unsecured network.

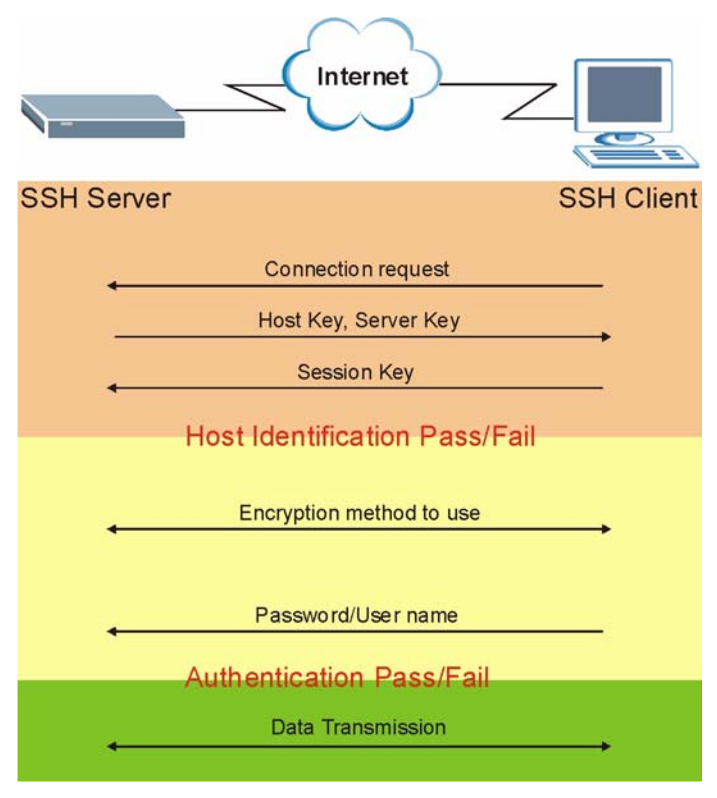
Figure 121 SSH Communication Example



38.4.1 How SSH works

The following table summarizes how a secure connection is established between two remote hosts.

Figure 122 How SSH Works



1 Host Identification

The SSH client sends a connection request to the SSH server. The server identifies itself with a host key. The client encrypts a randomly generated session key with the host key and server key and sends the result back to the server.

The client automatically saves any new server public keys. In subsequent connections, the server public key is checked against the saved version on the client computer.

2 Encryption Method

Once the identification is verified, both the client and server must agree on the type of encryption method to use.

3 Authentication and Data Transmission

After the identification is verified and data encryption activated, a secure tunnel is established between the client and the server. The client then sends its authentication information (user name and password) to the server to log in to the server.

38.4.2 SSH Implementation on the Switch

Your switch supports SSH version 2 using RSA authentication and three encryption methods (DES, 3DES and Blowfish). The SSH server is implemented on the switch for remote management and file transfer on port 22. Only one SSH connection is allowed at a time.

38.4.2.1 Requirements for Using SSH

You must install an SSH client program on a client computer (Windows or Linux operating system) that is used to connect to the switch over SSH.

38.5 Introduction to HTTPS

HTTPS (HyperText Transfer Protocol over Secure Socket Layer, or HTTP over SSL) is a web protocol that encrypts and decrypts web pages. Secure Socket Layer (SSL) is an application-level protocol that enables secure transactions of data by ensuring confidentiality (an unauthorized party cannot read the transferred data), authentication (one party can identify the other party) and data integrity (you know if data has been changed).

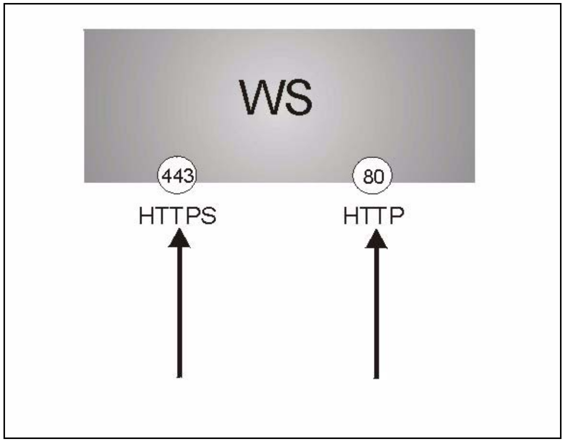
It relies upon certificates, public keys, and private keys.

HTTPS on the switch is used so that you may securely access the switch using the web configurator. The SSL protocol specifies that the SSL server (the switch) must always authenticate itself to the SSL client (the computer which requests the HTTPS connection with the switch), whereas the SSL client only should authenticate itself when the SSL server requires it to do so. Authenticating client certificates is optional and if selected means the SSL-client must send the switch a certificate. You must apply for a certificate for the browser from a CA that is a trusted CA on the switch.

Please refer to the following figure.

1. HTTPS connection requests from an SSL-aware web browser go to port 443 (by default) on the switch’s WS (web server).
2. HTTP connection requests from a web browser go to port 80 (by default) on the switch’s WS (web server).

Figure 123   HTTPS Implementation



If you disable **HTTP** in the **Service Access Control** screen, then the switch blocks all HTTP connection attempts.

38.5.1 HTTPS Example

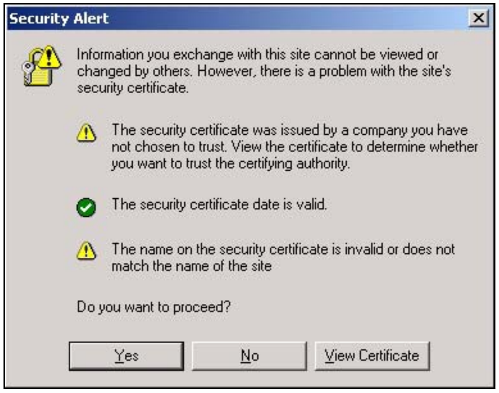
If you haven’t changed the default HTTPS port on the switch, then in your browser enter “https://switch IP Address/” as the web site address where “switch IP Address” is the IP address or domain name of the switch you wish to access.

38.5.1.1 Internet Explorer Warning Messages

When you attempt to access the switch HTTPS server, a Windows dialog box pops up asking if you trust the server certificate. Click **View Certificate** if you want to verify that the certificate is from the switch.

You see the following **Security Alert** screen in Internet Explorer. Select **Yes** to proceed to the web configurator login screen; if you select **No**, then web configurator access is blocked.

Figure 124   Security Alert Dialog Box (Internet Explorer)



Information you exchange with this site cannot be viewed or changed by others. However, there is a problem with the site's security certificate.

⚠ The security certificate was issued by a company you have not chosen to trust. View the certificate to determine whether you want to trust the certifying authority.

✓ The security certificate date is valid.

⚠ The name on the security certificate is invalid or does not match the name of the site

Do you want to proceed?

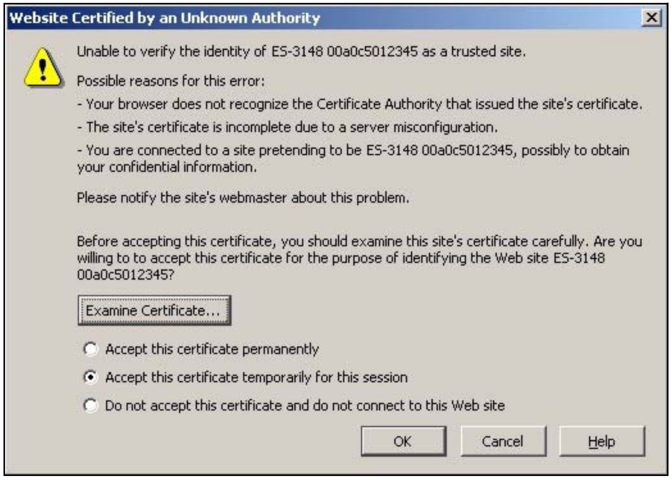
38.5.1.2 Netscape Navigator Warning Messages

When you attempt to access the switch HTTPS server, a **Website Certified by an Unknown Authority** screen pops up asking if you trust the server certificate. Click **Examine Certificate** if you want to verify that the certificate is from the switch.

If **Accept this certificate temporarily for this session** is selected, then click **OK** to continue in Netscape.

Select **Accept this certificate permanently** to import the switch's certificate into the SSL client.

Figure 125 Security Certificate 1 (Netscape)



Website Certified by an Unknown Authority

Unable to verify the identity of ES-3148 00a0c5012345 as a trusted site.

Possible reasons for this error:

- Your browser does not recognize the Certificate Authority that issued the site's certificate.
- The site's certificate is incomplete due to a server misconfiguration.
- You are connected to a site pretending to be ES-3148 00a0c5012345, possibly to obtain your confidential information.

Please notify the site's webmaster about this problem.

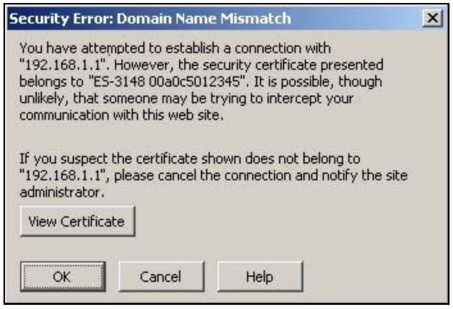
Before accepting this certificate, you should examine this site's certificate carefully. Are you willing to to accept this certificate for the purpose of identifying the Web site ES-3148 00a0c5012345?

○ Accept this certificate permanently

● Accept this certificate temporarily for this session

○ Do not accept this certificate and do not connect to this Web site

Figure 126 Security Certificate 2 (Netscape)



Security Error: Domain Name Mismatch

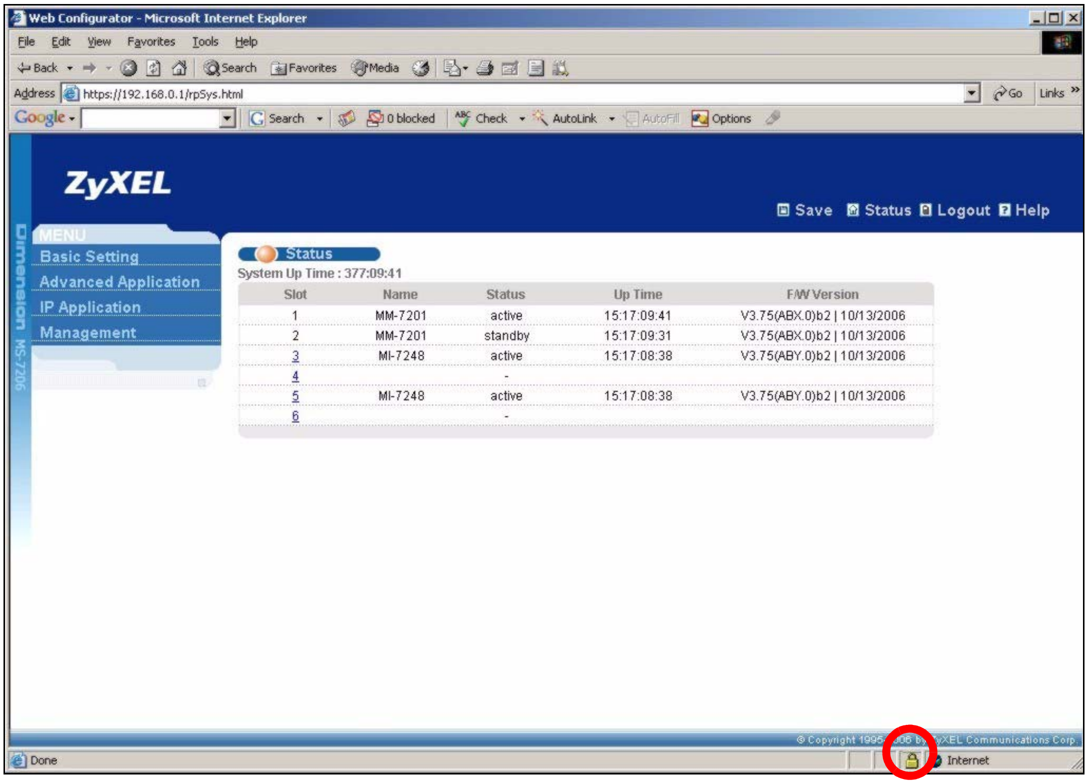
You have attempted to establish a connection with "192.168.1.1". However, the security certificate presented belongs to "ES-3148 00a0c5012345". It is possible, though unlikely, that someone may be trying to intercept your communication with this web site.

If you suspect the certificate shown does not belong to "192.168.1.1", please cancel the connection and notify the site administrator.

38.5.1.3 The Main Screen

After you accept the certificate and enter the login username and password, the switch main screen appears. The lock displayed in the bottom right of the browser status bar denotes a secure connection.

Figure 127 Example: Lock Denoting a Secure Connection



Web Configurator - Microsoft Internet Explorer
File Edit View Favorites Tools Help
Back Search Favorites Media
Address https://192.168.0.1/rpSys.html
Go Links
Google Search 0 blocked Check AutoLink AutoFill Options
ZyXEL
Save Status Logout Help
Dimension MS-7206
MENU
Basic Setting
Advanced Application
IP Application
Management
Status
© Copyright 1995-2006 by ZyXEL Communications Corp.
Done
Internet

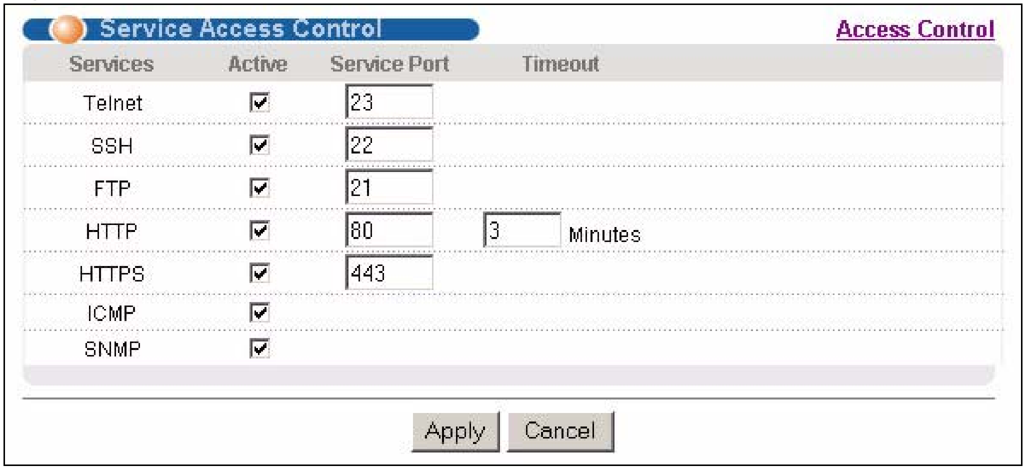
System Up Time : 377:09:41

Slot	Name	Status	Up Time	F/W Version
1	MM-7201	active	15:17:09:41	V3.75(ABX.0)b2 | 10/13/2006
2	MM-7201	standby	15:17:09:31	V3.75(ABX.0)b2 | 10/13/2006
3	MI-7248	active	15:17:08:38	V3.75(ABY.0)b2 | 10/13/2006
4		-		
5	MI-7248	active	15:17:08:38	V3.75(ABY.0)b2 | 10/13/2006
6		-		

38.6 Service Access Control

Use this screen to decide what services can be used to access the switch. You may also change the default service port. To open this screen, click **Management** > **Access Control** > **Service Access Control**.

Figure 128 Service Access Control



Services	Active	Service Port	Timeout
Telnet	☑	23	
SSH	☑	22	
FTP	☑	21	
HTTP	☑	80	3 Minutes
HTTPS	☑	443	
ICMP	☑		
SNMP	☑		

The following table describes the fields in this screen.

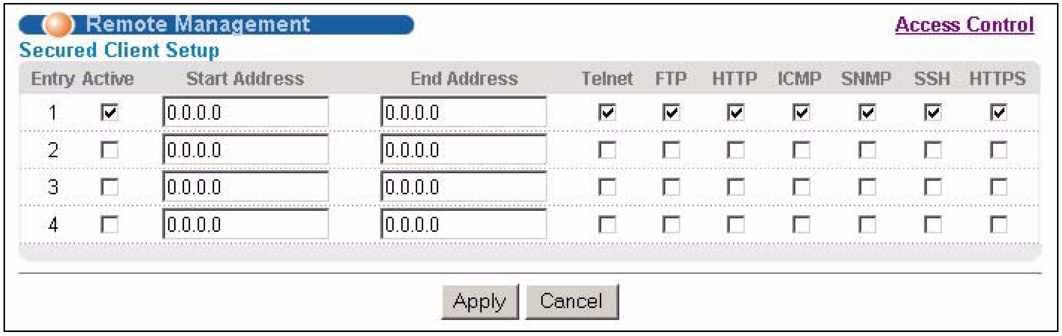
Table 93 Service Access Control

LABEL	DESCRIPTION
Services	Services you may use to access the switch are listed here.
Active	Select this option for the corresponding services that you want to allow to access the switch.
Service Port	For Telnet, SSH, FTP, HTTP or HTTPS services, you may change the default service port by typing the new port number in the **Server Port** field. If you change the default port number then you will have to let people (who wish to use the service) know the new port number for that service.
Timeout	Type how many minutes a management session (via the web configurator) can be left idle before the session times out. After it times out you have to log in with your password again. Very long idle timeouts may have security risks.
Apply	Click **Apply** to save your changes to the switch's run-time memory. The switch loses these changes if it is turned off or loses power, so use the **Save** link on the top navigation panel to save your changes to the non-volatile memory when you are done configuring.
Cancel	Click **Cancel** to reset the fields.

38.7 Remote Management

Use this screen to specify groups of one or more "trusted computers" from which an administrator may use one or more service to manage the switch. To open this screen, click **Management** > **Access Control** > **Remote Management**.

Figure 129 Remote Management



Remote Management

Access Control

Secured Client Setup

Entry	Active	Start Address	End Address	Telnet	FTP	HTTP	ICMP	SNMP	SSH	HTTPS
1	☑	0.0.0.0	0.0.0.0	☑	☑	☑	☑	☑	☑	☑
2	□	0.0.0.0	0.0.0.0	□	□	□	□	□	□	□
3	□	0.0.0.0	0.0.0.0	□	□	□	□	□	□	□
4	□	0.0.0.0	0.0.0.0	□	□	□	□	□	□	□

The following table describes the labels in this screen.

Table 94 Remote Management

LABEL	DESCRIPTION
Entry	This is the client set index number. A "client set" is a group of one or more "trusted computers" from which an administrator may use a service to manage the switch.
Active	Select this check box to activate this secured client set. Clear the check box if you wish to temporarily disable the set without deleting it.
Start Address End Address	Configure the IP address range of trusted computers from which you can manage this switch. The switch checks if the client IP address of a computer requesting a service or protocol matches the range set here. The switch immediately disconnects the session if it does not match.

Table 94 Remote Management (continued)

LABEL	DESCRIPTION
Telnet/FTP/ HTTP/ICMP/ SNMP/SSH/ HTTPS	Select services that may be used for managing the switch from the specified trusted computers.
Apply	Click **Apply** to save your changes to the switch’s run-time memory. The switch loses these changes if it is turned off or loses power, so use the **Save** link on the top navigation panel to save your changes to the non-volatile memory when you are done configuring.
Cancel	Click **Cancel** to reset the fields.

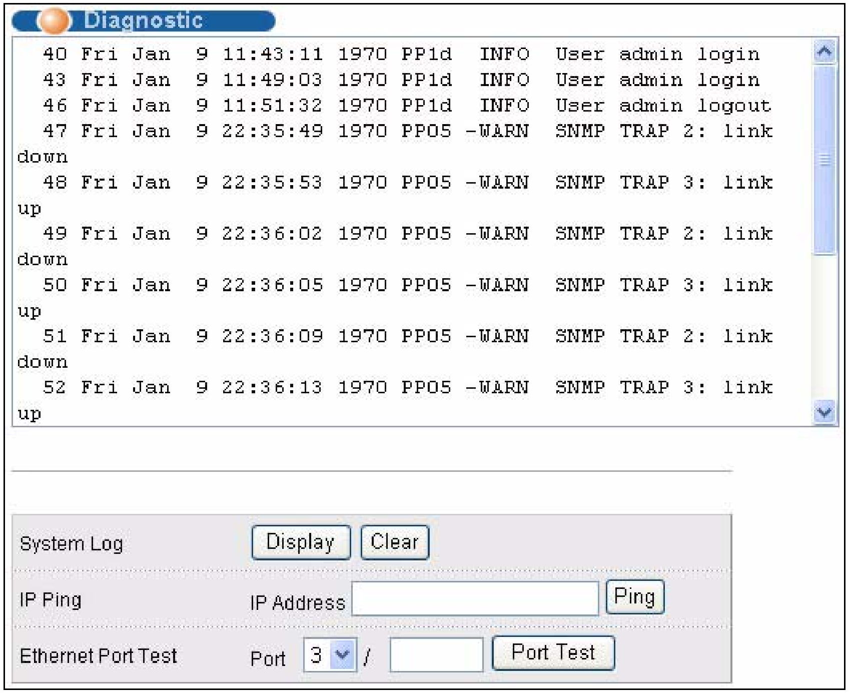
Diagnostic

This chapter explains the **Diagnostic** screen.

39.1 Diagnostic

Use this screen to check system logs, ping IP addresses or perform port tests. To open this screen, click **Management** > **Diagnostic**.

Figure 130   Diagnostic



```
  40 Fri Jan  9 11:43:11 1970 PP1d  INFO  User admin login
  43 Fri Jan  9 11:49:03 1970 PP1d  INFO  User admin login
  46 Fri Jan  9 11:51:32 1970 PP1d  INFO  User admin logout
  47 Fri Jan  9 22:35:49 1970 PP05 -WARN  SNMP TRAP 2: link
down
  48 Fri Jan  9 22:35:53 1970 PP05 -WARN  SNMP TRAP 3: link
up
  49 Fri Jan  9 22:36:02 1970 PP05 -WARN  SNMP TRAP 2: link
down
  50 Fri Jan  9 22:36:05 1970 PP05 -WARN  SNMP TRAP 3: link
up
  51 Fri Jan  9 22:36:09 1970 PP05 -WARN  SNMP TRAP 2: link
down
  52 Fri Jan  9 22:36:13 1970 PP05 -WARN  SNMP TRAP 3: link
up
```

The following table describes the labels in this screen.

Table 95   Diagnostic

LABEL	DESCRIPTION
System Log	Click **Display** to display a log of events in the multi-line text box. Click **Clear** to empty the text box and reset the syslog entry.
IP Ping	Type the IP address of a device that you want to ping in order to test a connection. Click **Ping** to have the switch ping the IP address (in the field to the left).
Ethernet Port Test	Select a slot number, enter a port number, and click **Port Test** to perform an internal loopback test.

40

Syslog

This chapter explains the syslog screens.

40.1 Syslog Overview

The syslog protocol allows devices to send event notification messages across an IP network to syslog servers that collect the event messages. A syslog-enabled device can generate a syslog message and send it to a syslog server.

Syslog is defined in RFC 3164. The RFC defines the packet format, content and system log related information of syslog messages. Each syslog message has a facility and severity level. The syslog facility identifies a file in the syslog server. Refer to the documentation of your syslog program for details. The following table describes the syslog severity levels.

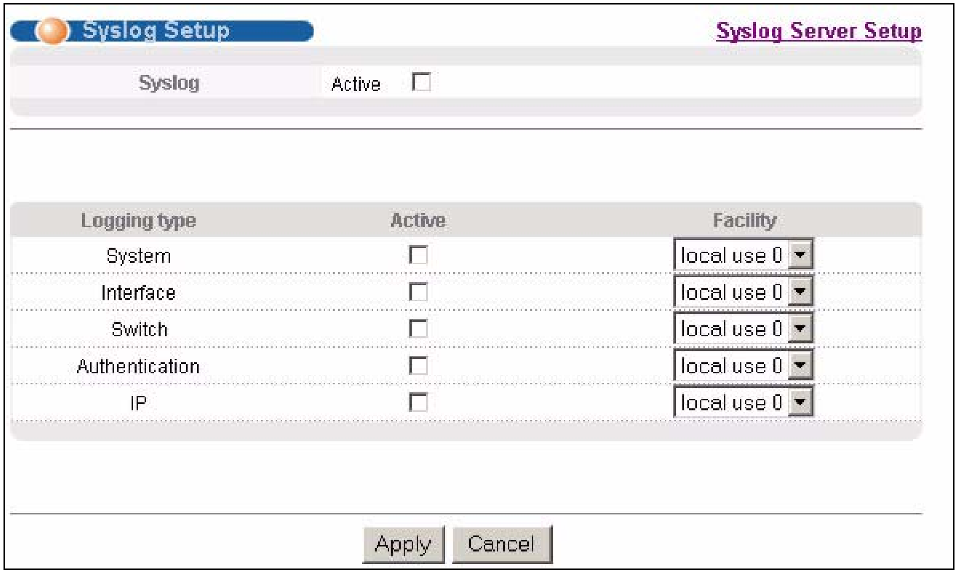
Table 96 Syslog Severity Levels

CODE	SEVERITY
0	Emergency: The system is unusable.
1	Alert: Action must be taken immediately.
2	Critical: The system condition is critical.
3	Error: There is an error condition on the system.
4	Warning: There is a warning condition on the system.
5	Notice: There is a normal but significant condition on the system.
6	Informational: The syslog contains an informational message.
7	Debug: The message is intended for debug-level purposes.

40.2 Syslog Setup

Use this screen to configure the system logging settings. The syslog feature sends logs to an external syslog server. To open this screen, click **Management** > **Syslog**.

Figure 131 Syslog Setup



Syslog Setup

Syslog Server Setup

Syslog Active □

Logging type	Active	Facility
System	□	local use 0
Interface	□	local use 0
Switch	□	local use 0
Authentication	□	local use 0
IP	□	local use 0

The following table describes the labels in this screen.

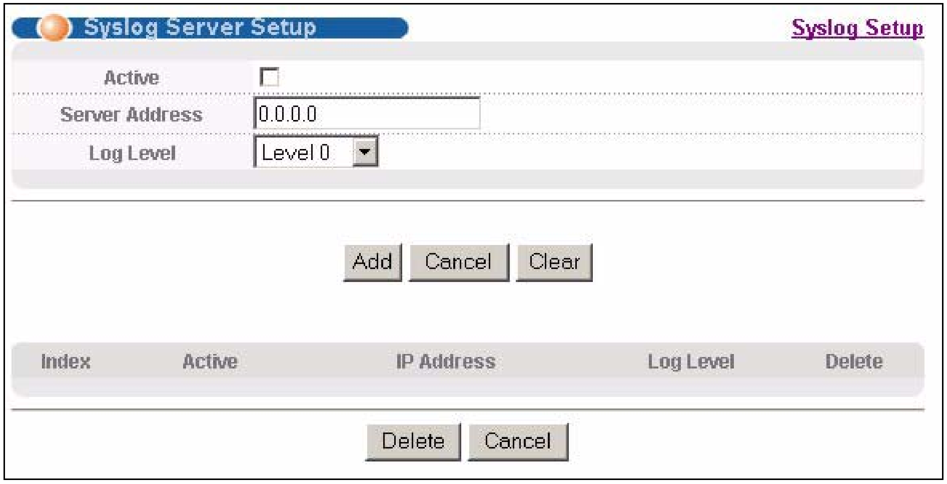
Table 97 Syslog Setup

LABEL	DESCRIPTION
Syslog	Select **Active** to turn on syslog (system logging) and then configure the syslog setting
Logging Type	This column displays the names of the categories of logs that the system can generate.
Active	Select this option to set the system to generate logs for the corresponding category.
Facility	The log facility allows you to send logs to different files in the syslog server. Refer to the documentation of your syslog program for more details.
Apply	Click **Apply** to save your changes to the switch's run-time memory. The switch loses these changes if it is turned off or loses power, so use the **Save** link on the top navigation panel to save your changes to the non-volatile memory when you are done configuring.
Cancel	Click **Cancel** to reset the fields.

40.2.1 Syslog Server Setup

Use this screen to configure a list of external syslog servers. To open this screen, click **Management** > **Syslog** > **Syslog Server Setup**.

Figure 132 Syslog Server Setup



Active □
Server Address 0.0.0.0
Log Level Level 0

The following table describes the labels in this screen.

Table 98 Syslog Server Setup

LABEL	DESCRIPTION
Active	Select this check box to have the system send logs to this syslog server. Clear the check box if you want to create a syslog server entry but not have the system send logs to it (you can edit the entry later).
Server Address	Enter the IP address of the syslog server.
Log Level	Select the severity level(s) of the logs that you want the system to send to this syslog server. The lower the number, the more critical the logs are.
Add	Click **Add** to save your changes to the switch's run-time memory. The switch loses these changes if it is turned off or loses power, so use the **Save** link on the top navigation panel to save your changes to the non-volatile memory when you are done configuring.
Cancel	Click **Cancel** to reset the fields.
Clear	Click **Clear** to return the fields to the factory defaults.
Index	This is the index number of a syslog server entry. Click this number to edit the entry.
Active	This field displays **Yes** if the system is to send logs to the syslog server. **No** displays if the system is not to send logs to the syslog server.
IP Address	This field displays the IP address of the syslog server.
Log Level	This field displays the severity level of the logs that the system is to send to this syslog server.
Delete	Select an entry's **Delete** check box and click **Delete** to remove the entry.
Cancel	Click **Cancel** to reset the fields.

41

Cluster Management

This chapter introduces cluster management.

41.1 Cluster Management Status Overview

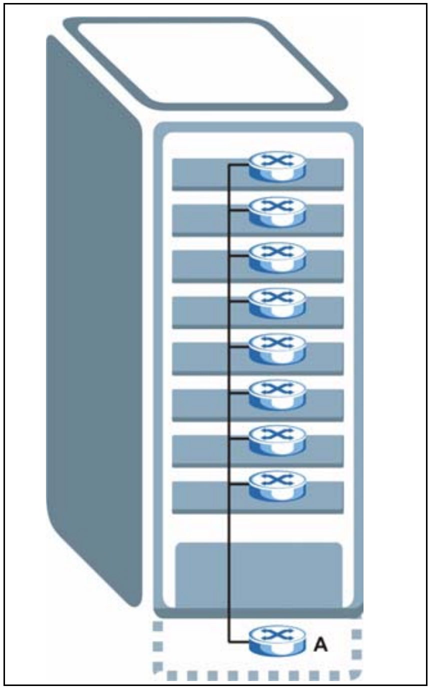
Cluster Management allows you to manage switches through one switch, called the cluster manager. The switches must be directly connected and be in the same VLAN group so as to be able to communicate with one another.

Table 99 Cluster Management Specifications

Cluster Member Models	Must be compatible with ZyXEL cluster management implementation.
Cluster Manager	The switch through which you manage the cluster member switches.
Cluster Members	The switches being managed by the cluster manager switch.

In the following example, switch **A** in the basement is the cluster manager and the other switches on the upper floors of the building are cluster members.

Figure 133 Clustering Application Example

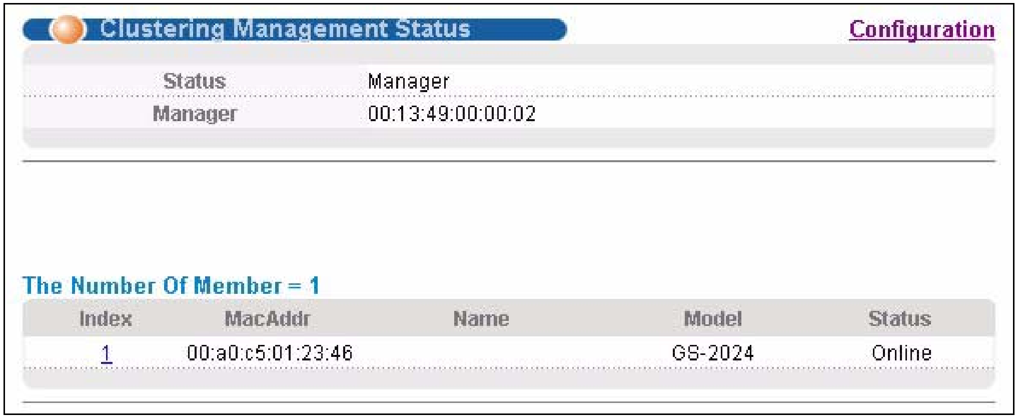


41.2 Clustering Management Status

Use this screen to manage switches through one switch, called the cluster manager. The switches must be directly connected and be in the same VLAN group so as to be able to communicate with one another. To open this screen, click **Management** > **Cluster Management**.

A cluster can only have one manager.

Figure 134 Clustering Management Status



Status Manager
Manager 00:13:49:00:00:02

The Number Of Member = 1

Index	MacAddr	Name	Model	Status
1	00:a0:c5:01:23:46		GS-2024	Online

The following table describes the labels in this screen.

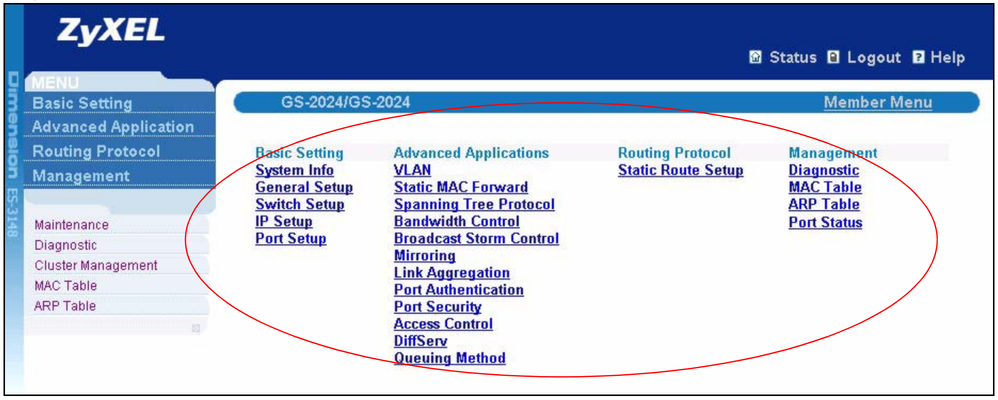
Table 100 Clustering Management Status

LABEL	DESCRIPTION
Status	This field displays the role of this switch within the cluster. **Manager** **Member** (you see this if you access this screen in the cluster member switch directly and not via the cluster manager) **None** (neither a manager nor a member of a cluster)
Manager	This field displays the cluster manager switch’s hardware MAC address.
The Number of Member	This field displays the number of switches that make up this cluster. The following fields describe the cluster member switches.
Index	You can manage cluster member switches via the cluster manager switch. Each number in the **Index** column is a hyperlink leading to the cluster member switch’s web configurator (see Figure 135 on page 249).
MacAddr	This is the cluster member switch’s hardware MAC address.
Name	This is the cluster member switch’s system name.
Model	This field displays the model name.
Status	This field displays: **Online** (the cluster member switch is accessible) **Error** (for example the cluster member switch password was changed or the switch was set as the manager and so left the member list, etc.) **Offline** (the switch is disconnected - **Offline** shows approximately 1.5 minutes after the link between cluster member and manager goes down)

41.2.1 Cluster Member Switch Management

Use this screen to open the web configurator of a cluster member. The web configurator that you access through cluster management and the web configurator you access using regular HTTP/HTTPS are different. To open this screen, click **Management > Cluster Management**, and click the index number of the cluster member.

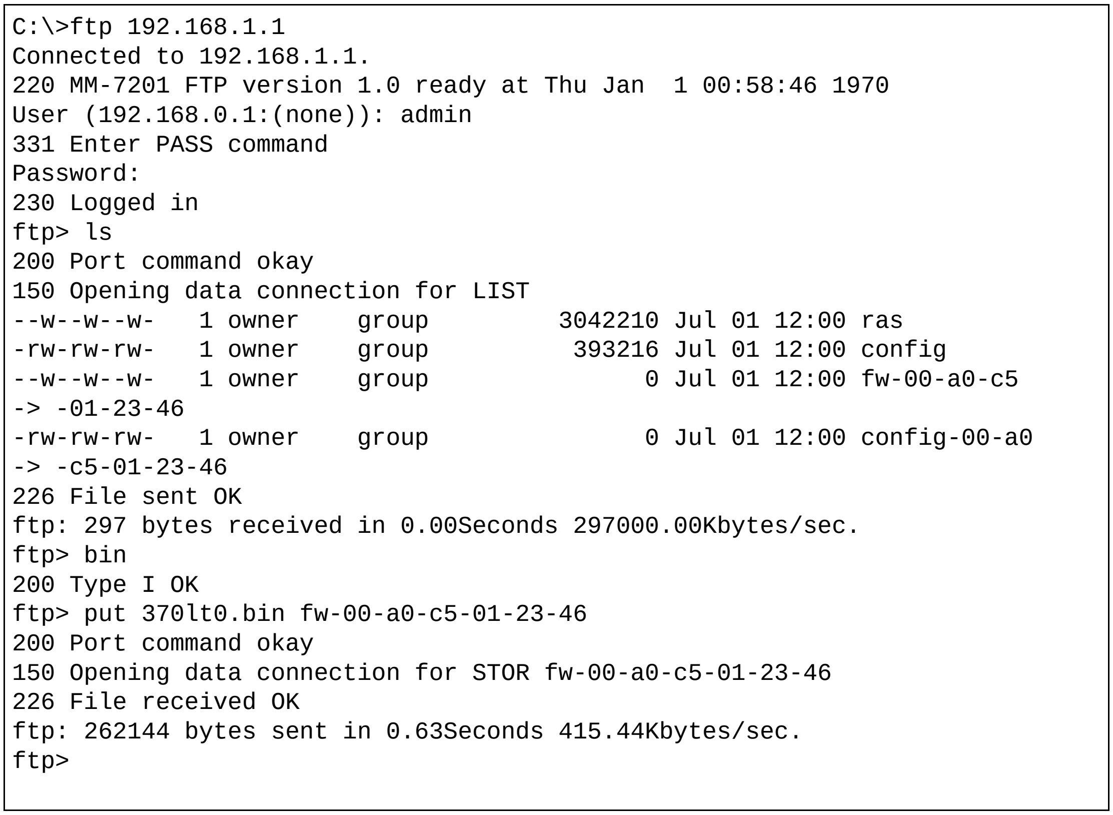
Figure 135 Cluster Management: Cluster Member Web Configurator Screen



41.2.2 Uploading Firmware to a Cluster Member Switch

You can use FTP to upload firmware to a cluster member switch through the cluster manager switch as shown in the following example.

Figure 136 Example: Uploading Firmware to a Cluster Member Switch



```
C:\>ftp 192.168.1.1
Connected to 192.168.1.1.
220 MM-7201 FTP version 1.0 ready at Thu Jan  1 00:58:46 1970
User (192.168.0.1:(none)): admin
331 Enter PASS command
Password:
230 Logged in
ftp> ls
200 Port command okay
150 Opening data connection for LIST
--w--w--w-   1 owner    group         3042210 Jul 01 12:00 ras
-rw-rw-rw-   1 owner    group          393216 Jul 01 12:00 config
--w--w--w-   1 owner    group               0 Jul 01 12:00 fw-00-a0-c5
-> -01-23-46
-rw-rw-rw-   1 owner    group               0 Jul 01 12:00 config-00-a0
-> -c5-01-23-46
226 File sent OK
ftp: 297 bytes received in 0.00Seconds 297000.00Kbytes/sec.
ftp> bin
200 Type I OK
ftp> put 370lt0.bin fw-00-a0-c5-01-23-46
200 Port command okay
150 Opening data connection for STOR fw-00-a0-c5-01-23-46
226 File received OK
ftp: 262144 bytes sent in 0.63Seconds 415.44Kbytes/sec.
ftp>
```

The following table explains some of the FTP parameters.

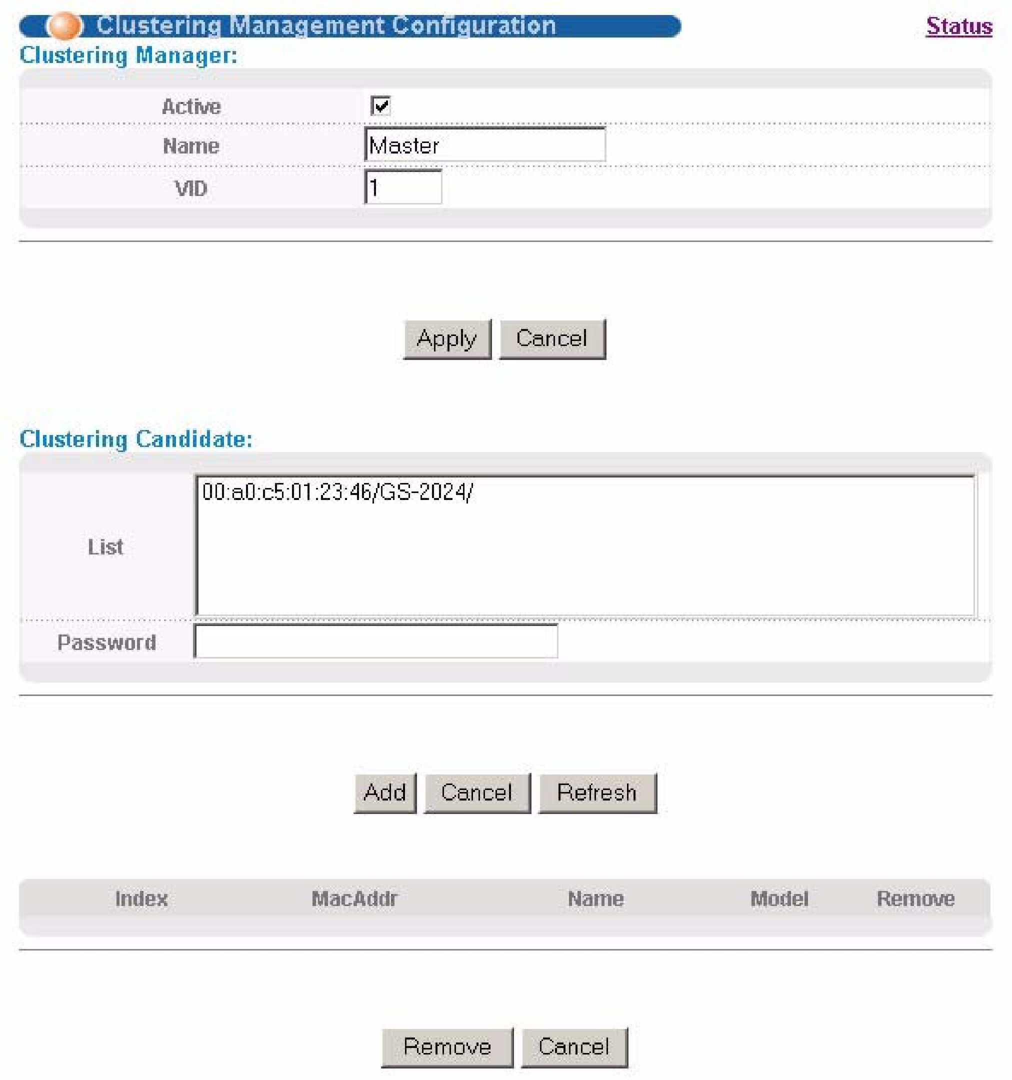
Table 101 FTP Upload to Cluster Member Example

FTP PARAMETER	DESCRIPTION
`User`	Enter “admin”.
`Password`	The web configurator password default is 1234.
`ls`	Enter this command to list the name of cluster member switch’s firmware and configuration file.
`360lt0.bin`	This is the name of the firmware file you want to upload to the cluster member switch.
`fw-00-a0-c5-01-23-46`	This is the cluster member switch’s firmware name as seen in the cluster manager switch.
`config-00-a0-c5-01-23-46`	This is the cluster member switch’s configuration file name as seen in the cluster manager switch.

41.3 Clustering Management Configuration

Use this screen to configure cluster management. To open this screen, click **Management** > **Cluster Management** > **Configuration**.

Figure 137 Clustering Management Configuration



Clustering Manager:

Active ☑

Name: Master

VID: 1

Clustering Candidate:

List: 00:a0:c5:01:23:46/GS-2024/

Password:

The following table describes the labels in this screen.

Table 102 Clustering Management Configuration

LABEL	DESCRIPTION
Clustering Manager	
Active	Select **Active** to have this switch become the cluster manager switch. A cluster can only have one manager. Other (directly connected) switches that are set to be cluster managers will not be visible in the **Clustering Candidates** list. If a switch that was previously a cluster member is later set to become a cluster manager, then its **Status** is displayed as **Error** in the **Cluster Management Status** screen and a warning icon (⚠) appears in the member summary list below.
Name	Type a name to identify the **Clustering Manager.** You may use up to 32 printable characters (spaces are allowed).
VID	This is the VLAN ID and is only applicable if the switch is set to **802.1Q** VLAN. All switches must be directly connected and in the same VLAN group to belong to the same cluster. Switches that are not in the same VLAN group are not visible in the **Clustering Candidates** list. This field is ignored if the **Clustering Manager** is using **Port-based** VLAN.

Table 102 Clustering Management Configuration (continued)

LABEL	DESCRIPTION
Apply	Click **Apply** to save your changes to the switch's run-time memory. The switch loses these changes if it is turned off or loses power, so use the **Save** link on the top navigation panel to save your changes to the non-volatile memory when you are done configuring.
Cancel	Click **Cancel** to reset the fields.
Clustering Candidate	The following fields relate to the switches that are potential cluster members.
List	A list of suitable candidates found by auto-discovery is shown here. The switches must be directly connected. Directly connected switches that are set to be cluster managers will not be visible in the **Clustering Candidate** list. Switches that are not in the same management VLAN group will not be visible in the **Clustering Candidate** list.
Password	Each cluster member's password is its web configurator password. Select a member in the **Clustering Candidate** list and then enter its web configurator password. If that switch administrator changes the web configurator password afterwards, then it cannot be managed from the **Cluster Manager**. Its **Status** is displayed as **Error** in the **Cluster Management Status** screen and a warning icon (⚠) appears in the member summary list below. If multiple devices have the same password then hold [SHIFT] and click those switches to select them. Then enter their common web configurator password.
Add	Click **Add** to save your changes to the switch's run-time memory. The switch loses these changes if it is turned off or loses power, so use the **Save** link on the top navigation panel to save your changes to the non-volatile memory when you are done configuring.
Cancel	Click **Cancel** to reset the fields.
Refresh	Click **Refresh** to perform auto-discovery again to list potential cluster members.
	The next summary table shows the information for the clustering members configured.
Index	This is the index number of a cluster member switch.
MacAddr	This is the cluster member switch's hardware MAC address.
Name	This is the cluster member switch's system name.
Model	This is the cluster member switch's model name.
Remove	Select this check box and then click the **Remove** button to remove a cluster member switch from the cluster.
Cancel	Click **Cancel** to reset the fields.

42

MAC Table

This chapter introduces the MAC table in the switch and then explains the MAC table screen.

42.1 MAC Table Overview

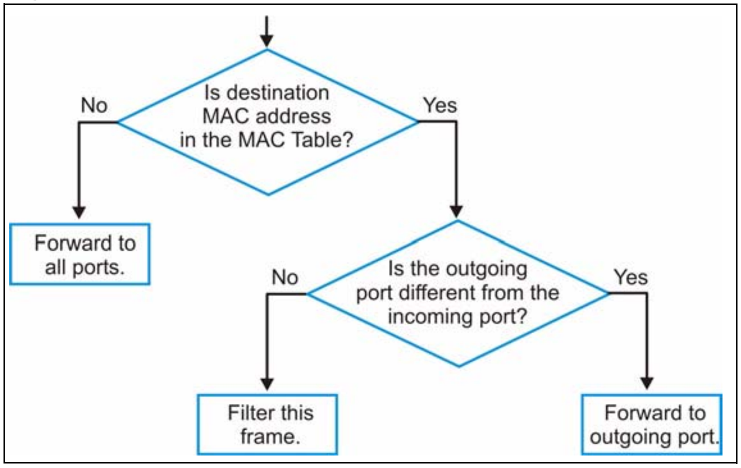
The **MAC Table** screen (a MAC table is also known as a filtering database) shows how frames are forwarded or filtered across the switch's ports. It shows what device MAC address, belonging to what VLAN group (if any) is forwarded to which port(s) and whether the MAC address is dynamic (learned by the switch) or static (manually entered in the **Static MAC Forwarding** screen, see Chapter 14 on page 91).

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 on 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 learned in the MAC table.

- If the switch has already learned the port for this MAC address, then it forwards the frame to that port.
- If the switch has not already learned 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 learned 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.

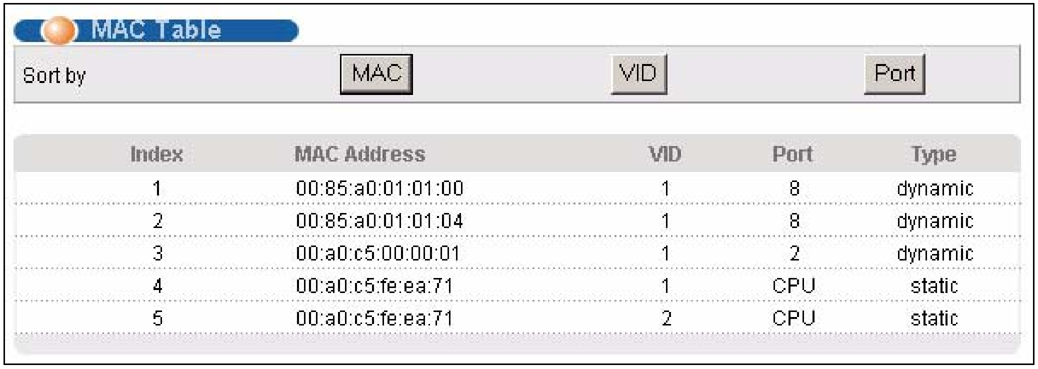
Figure 138 MAC Table Flowchart


Is destination MAC address in the MAC Table?
No
Yes
Forward to all ports.
Is the outgoing port different from the incoming port?
No
Yes
Filter this frame.
Forward to outgoing port.

42.2 MAC Table

Use this screen to look at the MAC table in the switch. To open this screen, click **Management** > **MAC Table**.

Figure 139 MAC Table



Index	MAC Address	VID	Port	Type
1	00:85:a0:01:01:00	1	8	dynamic
2	00:85:a0:01:01:04	1	8	dynamic
3	00:a0:c5:00:00:01	1	2	dynamic
4	00:a0:c5:fe:ea:71	1	CPU	static
5	00:a0:c5:fe:ea:71	2	CPU	static

The following table describes the labels in this screen.

Table 103 MAC Table

LABEL	DESCRIPTION
Sort by	Click one of the following buttons to display and arrange the data according to that button type. The information is then displayed in the summary table below.
MAC	Click this button to display and arrange the data according to MAC address.
VID	Click this button to display and arrange the data according to VLAN group.
Port	Click this button to display and arrange the data according to port number.
Index	This is the incoming frame index number.
MAC Address	This is the MAC address of the device from which this incoming frame came.
VID	This is the VLAN group to which this frame belongs.
Port	This is the port from which the above MAC address was learned.
Type	This shows whether the MAC address is **dynamic** (learned by the switch) or **static** (manually entered in the **Static MAC Forwarding** screen, Chapter 14 on page 91).

43

IP Table

This chapter introduces the IP table in the switch and then explains the IP table screen.

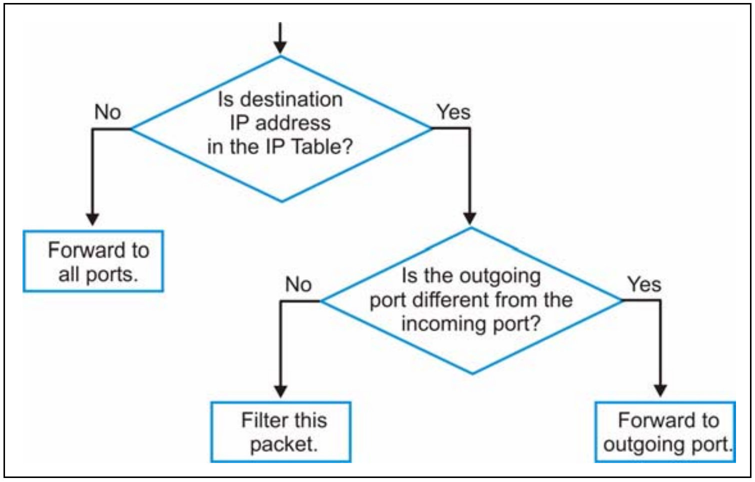
43.1 IP Table Overview

The **IP Table** screen shows how packets are forwarded or filtered across the switch's ports. It shows what device IP address, belonging to what VLAN group (if any) is forwarded to which port(s) and whether the IP address is dynamic (learned by the switch) or static (belonging to the switch).

The switch uses the IP table to determine how to forward packets. See the following figure.

1. The switch examines a received packet and learns the port on which this source IP address came.
2. The switch checks to see if the packet's destination IP address matches a source IP address already learned in the IP table.
    - If the switch has already learned the port for this IP address, then it forwards the packet to that port.
    - If the switch has not already learned the port for this IP address, then the packet is flooded to all ports. Too much port flooding leads to network congestion.
    - If the switch has already learned the port for this IP address, but the destination port is the same as the port it came in on, then it filters the packet.

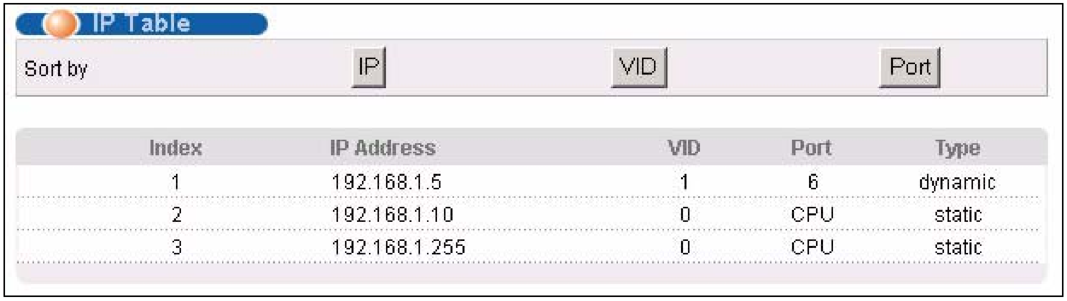
Figure 140 IP Table Flowchart


Is destination IP address in the IP Table?
No
Yes
Forward to all ports.
Is the outgoing port different from the incoming port?
No
Yes
Filter this packet.
Forward to outgoing port.

43.2 IP Table

Use this screen to look at the IP table in the switch. To open this screen, click **Management** > **IP Table**.

Figure 141 IP Table



Index	IP Address	VID	Port	Type
1	192.168.1.5	1	6	dynamic
2	192.168.1.10	0	CPU	static
3	192.168.1.255	0	CPU	static

The following table describes the labels in this screen.

Table 104 IP Table

LABEL	DESCRIPTION
Sort by	Click one of the following buttons to display and arrange the data according to that button type. The information is then displayed in the summary table below.
IP	Click this button to display and arrange the data according to IP address.
VID	Click this button to display and arrange the data according to VLAN group.
Port	Click this button to display and arrange the data according to port number.
Index	This field displays the index number.
IP Address	This is the IP address of the device from which the incoming packets came.
VID	This is the VLAN group to which the packet belongs.
Port	This is the port from which the above IP address was learned. This field displays **CPU** to indicate the IP address belongs to the switch.
Type	This shows whether the IP address is **dynamic** (learned by the switch) or **static** (belonging to the switch).

44

ARP Table

This chapter introduces the ARP table in the switch and then explains the ARP table screen.

44.1 ARP Table Overview

Address Resolution Protocol (ARP) is a protocol for mapping an Internet Protocol address (IP address) to a physical machine address, also known as a Media Access Control or MAC address, on the local area network.

An IP (version 4) address is 32 bits long. In an Ethernet LAN, MAC addresses are 48 bits long. The ARP Table maintains an association between each MAC address and its corresponding IP address.

44.1.1 How ARP Works

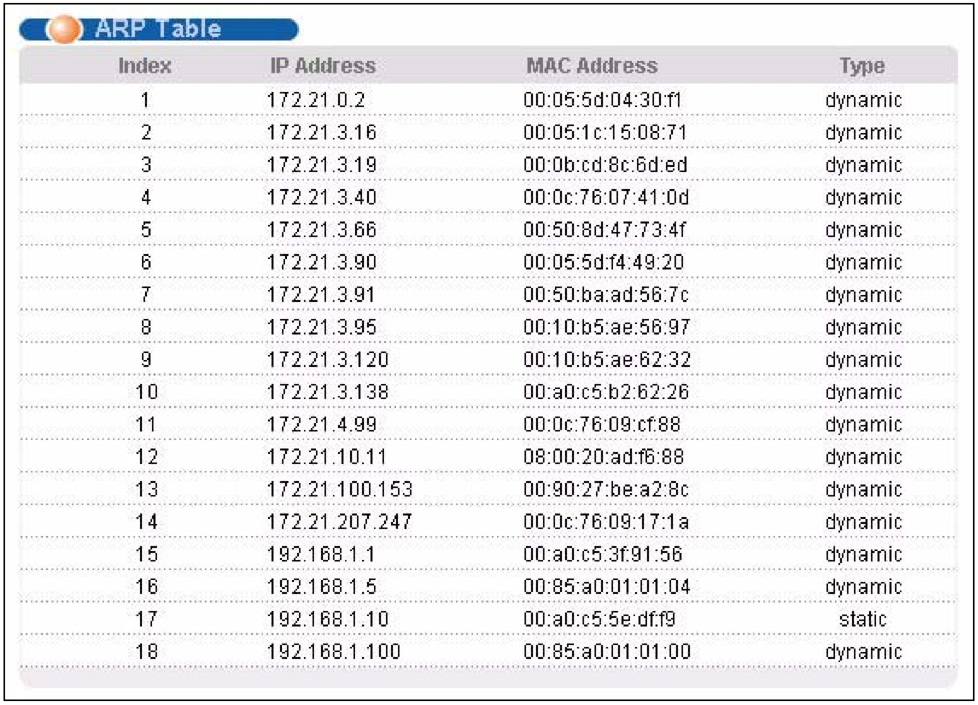
When an incoming packet destined for a host device on a local area network arrives at the switch, the switch's ARP program looks in the ARP Table and, if it finds the address, sends it to the device.

If no entry is found for the IP address, ARP broadcasts the request to all the devices on the LAN. The switch fills in its own MAC and IP address in the sender address fields, and puts the known IP address of the target in the target IP address field. In addition, the switch puts all ones in the target MAC field (FF.FF.FF.FF.FF.FF is the Ethernet broadcast address). The replying device (which is either the IP address of the device being sought or the router that knows the way) replaces the broadcast address with the target's MAC address, swaps the sender and target pairs, and unicasts the answer directly back to the requesting machine. ARP updates the ARP Table for future reference and then sends the packet to the MAC address that replied.

44.2 ARP Table

Use this screen to view IP-to-MAC address mapping(s). To open this screen, click **Management > ARP Table**.

Figure 142 ARP Table



ARP Table

Index	IP Address	MAC Address	Type
1	172.21.0.2	00:05:5d:04:30:f1	dynamic
2	172.21.3.16	00:05:1c:15:08:71	dynamic
3	172.21.3.19	00:0b:cd:8c:6d:ed	dynamic
4	172.21.3.40	00:0c:76:07:41:0d	dynamic
5	172.21.3.66	00:50:8d:47:73:4f	dynamic
6	172.21.3.90	00:05:5d:f4:49:20	dynamic
7	172.21.3.91	00:50:ba:ad:56:7c	dynamic
8	172.21.3.95	00:10:b5:ae:56:97	dynamic
9	172.21.3.120	00:10:b5:ae:62:32	dynamic
10	172.21.3.138	00:a0:c5:b2:62:26	dynamic
11	172.21.4.99	00:0c:76:09:cf:88	dynamic
12	172.21.10.11	08:00:20:ad:f6:88	dynamic
13	172.21.100.153	00:90:27:be:a2:8c	dynamic
14	172.21.207.247	00:0c:76:09:17:1a	dynamic
15	192.168.1.1	00:a0:c5:3f:91:56	dynamic
16	192.168.1.5	00:85:a0:01:01:04	dynamic
17	192.168.1.10	00:a0:c5:5e:df:f9	static
18	192.168.1.100	00:85:a0:01:01:00	dynamic

The following table describes the labels in this screen.

Table 105 ARP Table

LABEL	DESCRIPTION
Index	This is the ARP Table entry number.
IP Address	This is the learned IP address of a device connected to a switch port with corresponding MAC address below.
MAC Address	This is the MAC address of the device with corresponding IP address above.
Type	This shows whether the MAC address is dynamic (learned by the switch) or static (manually entered in the **Static MAC Forwarding** screen).

45

Routing Table

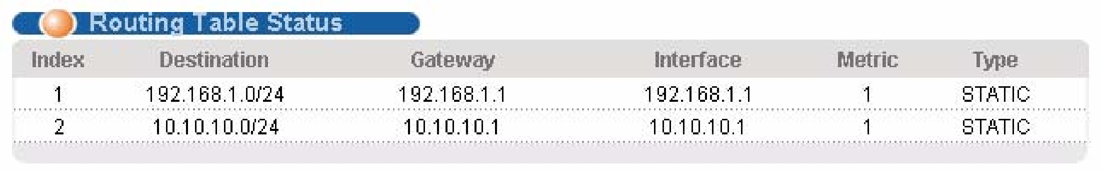
This chapter introduces the routing table.

45.1 Routing Table Status

Use this screen to view routing table information. The routing table contains the route information to the network(s) that the switch can reach. The switch automatically updates the routing table with the RIP/OSPF information received from other Ethernet devices.

To open this screen, click **Management** > **Routing Table**.

Figure 143 Routing Table Status



Routing Table Status

Index	Destination	Gateway	Interface	Metric	Type
1	192.168.1.0/24	192.168.1.1	192.168.1.1	1	STATIC
2	10.10.10.0/24	10.10.10.1	10.10.10.1	1	STATIC

The following table describes the labels in this screen.

Table 106 Routing Table Status

LABEL	DESCRIPTION
Index	This field displays the index number.
Destination	This field displays the destination IP routing domain.
Gateway	This field displays the IP address of the gateway device.
Interface	This field displays the IP address of the Interface.
Metric	This field displays the cost of the route.
Type	This field displays the method used to learn the route.

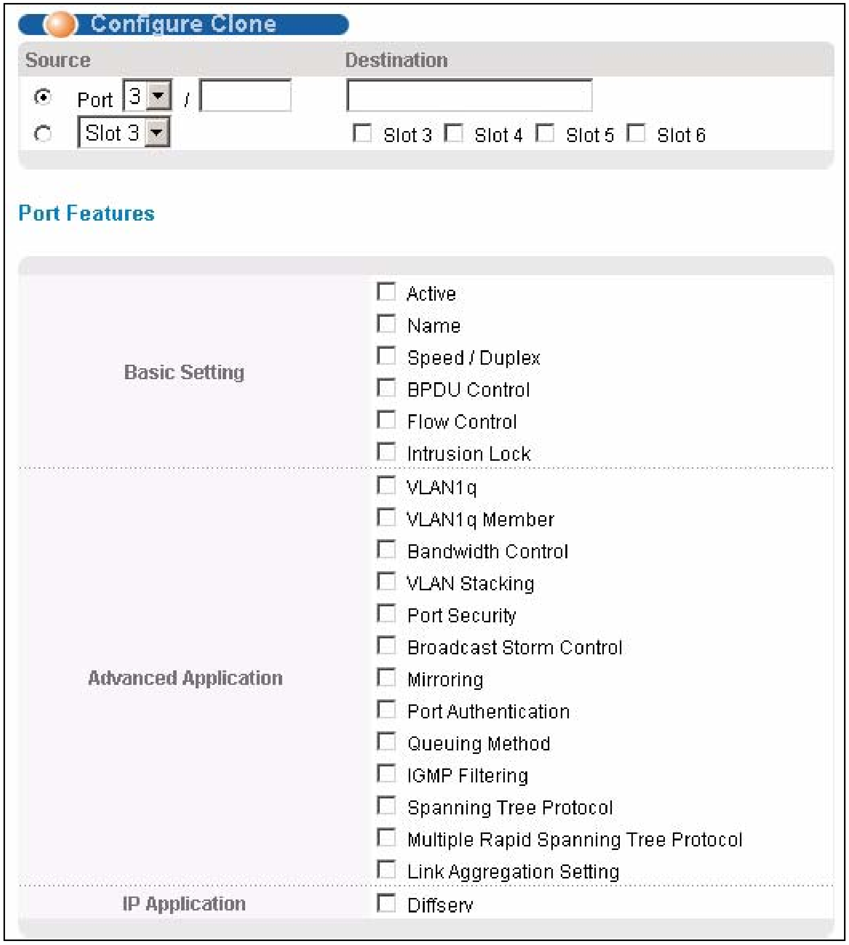
Configure Clone

This chapter shows you how to copy settings from one port or card to other ports or cards.

46.1 Configure Clone

Use this screen to copy basic or advanced settings from a source port or source card to one or more destination ports or cards. To open this screen, click **Management > Configure Clone**.

Figure 144 Configure Clone



Source	Destination
● Port 3 /	
○ Slot 3	□ Slot 3 □ Slot 4 □ Slot 5 □ Slot 6

Port Features

Basic Setting	□ Active □ Name □ Speed / Duplex □ BPDU Control □ Flow Control □ Intrusion Lock
Advanced Application	□ VLAN1q □ VLAN1q Member □ Bandwidth Control □ VLAN Stacking □ Port Security □ Broadcast Storm Control □ Mirroring □ Port Authentication □ Queuing Method □ IGMP Filtering □ Spanning Tree Protocol □ Multiple Rapid Spanning Tree Protocol □ Link Aggregation Setting
IP Application	□ Diffserv

The following table describes the labels in this screen.

Table 107 Configure Clone

LABEL	DESCRIPTION
Source/ Destination Port	You can copy attributes from one port to one or more ports (first radio button) or from one card to one or more cards (second radio button). Select the appropriate radio button. Under **Source**, specify the port or card whose attributes you want to copy. Under **Destination**, specify the port(s) or card(s) to which you want to copy these attributes. You can enter individual ports separated by a comma or a range of ports by using a dash. Examples: • **2, 4, 6** indicates that ports 2, 4 and 6 are the destination ports. • **2-6** indicates that ports 2 through 6 are the destination ports.
Basic Setting	Select which port settings (you configured in the **Basic Setting** menus) should be copied to the destination port(s).
Advanced Application	Select which port settings (you configured in the **Advanced Application** menus) should be copied to the destination ports.
IP Application	Select which port settings (you configured in the **IP Application** menus) should be copied to the destination ports.
Apply	Click **Apply** to save your changes to the switch's run-time memory. The switch loses these changes if it is turned off or loses power, so use the **Save** link on the top navigation panel to save your changes to the non-volatile memory when you are done configuring.
Cancel	Click **Cancel** to reset the fields.

PART VII

Troubleshooting and Product Specifications

47

Troubleshooting

This chapter offers some suggestions to solve problems you might encounter. The potential problems are divided into the following categories.

- Power, Hardware Connections, and LEDs
- MM-7201 Access and Login

47.1 Power, Hardware Connections, and LEDs

The MM-7201 does not turn on. None of the LEDs turn on.

1. Make sure the MM-7201 is inserted correctly.
2. Make sure the MS-7206 system is receiving power. If it is not, see the appropriate User’s Guide.
3. Inspect your cables for damage. Contact the vendor to replace any damaged cables.
4. Remove and re-insert the MM-7201 into the MS-7206 chassis.
5. If the problem continues, contact the vendor.

The **ALM** LED is on.

1. Make sure the fans in the MS-7206 chassis are working. If they are not, see the appropriate User’s Guide.
2. Make sure the MM-7201 is operating within its operating temperature and humidity. If it is not, move the MS-7206 system to a more suitable environment.
3. If the problem continues, contact the vendor.

47.2 MM-7201 Access and Login

I forgot the IP address for the MM-7201.

1 The default IP address is **192.168.0.1**.

2 Use the console port to log in to the MM-7201.

I forgot the password.

1 The default password is **1234**.

2 If this does not work, you have to reset the device to its factory defaults. See Section 4.6 on page 51.

I cannot see or access the **Login** screen in the web configurator.

1 Make sure you are using the correct IP address.

- The default IP address is 192.168.0.1.
- If you changed the IP address (Section 10.2 on page 73), use the new IP address.
- If you changed the IP address and have forgotten it, see the troubleshooting suggestions for I forgot the IP address for the MM-7201.

2 Make sure the MM-7201 is inserted correctly, and make sure the LEDs are behaving as expected. See Section 1.4 on page 33.

3 Make sure your Internet browser does not block pop-up windows and has JavaScripts and Java enabled. See Appendix B on page 287.

4 Make sure your computer is in the same subnet as the MM-7201. (If you know that there are routers between your computer and the MM-7201, skip this step.)

5 If you have configured more than one IP interface, make sure another administrator is NOT logged into the web configurator on a different IP interface using the same account.

6 Try to access the MM-7201 using the console port. If you can access the MM-7201, check the settings to find out why the MM-7201 does not respond to HTTP. Make sure you have enabled web service access. If you have configured a secured client IP address, your computer's IP address must match it. Refer to the chapter on access control for details.

7 Reset the device to its factory defaults, and try to access the MM-7201 with the default IP address. See Section 4.6 on page 51.

8 If the problem continues, contact the network administrator or vendor.

I can see the **Login** screen, but I cannot log in to the MM-7201.

1. Make sure you have entered the user name and password correctly. These fields are case-sensitive, so make sure [Caps Lock] is not on.
2. You cannot log in to the web configurator while someone is using the console port to access the MM-7201. Log out of the MM-7201 in the other session, or ask the person who is logged in to log out.
3. If this does not work, you have to reset the device to its factory defaults. See Section 4.6 on page 51.

I cannot Telnet to the MM-7201.

See the troubleshooting suggestions for I cannot see or access the Login screen in the web configurator. Ignore the suggestions about your browser. You can also try the following suggestions.

- You may have exceeded the maximum number of concurrent Telnet sessions. Close other Telnet session(s) or try connecting again later.
- Check that you have enabled Telnet service access. If you have configured a secured client IP address, your computer’s IP address must match it. Refer to the chapter on access control for details.

I cannot use FTP to upload / download the configuration file. / I cannot use FTP to upload new firmware.

See the troubleshooting suggestions for I cannot see or access the Login screen in the web configurator. Ignore the suggestions about your browser.

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Product Specifications

The following tables summarize the MM-7201's hardware and firmware features.

Table 108 Hardware Specifications

HARDWARE	SPECIFICATION
Dimensions (L x W x H)	276 x 396.6 x 42.5 mm
Device Weight	1.7 kg
Power Specification	Dual AC power supply (100-240 V, 50-60 Hz) into 24 VDC Dual 48 V DC power supply (36-72 V) into 24 VDC
Power Consumption	21 W
Console Port	D-Sub 9 pin Female (DCE)
Ethernet Port (for WAN or out-of-band management)	RJ-45
Core Switching Capability	Non-blocking, wire-speed, 96 Gbps, full duplex
Ethernet Ports (for out-of-band management of interface modules)	100 Mbps x 6 (layer 2 only)
System Monitoring	Voltage: • 48 V POE (power good only) • 24 V (two +24 V power modules and power for Fan Tray [24 V]) • 5 V • 3.3 V • 2.5 V • 1.8 V • 1.3 V • 1.25 V Temperature: • MAC: • CPU: • PHY: Fan: • 2250-4950 rpm for 8 fans in the fan tray.
Temperature	Operating: 0~45 ºC (32~113 ºF) Storage: -25~70 ºC (13~158 ºF)
Humidity	10-90% (non-condensing)

Table 109 Feature Descriptions

FEATURE	DESCRIPTION
IP Routing Domain	An IP interface (also known as an IP routing domain) is not bound to a physical port. Configure an IP routing domain to allow the switch to route traffic between different networks.
VLAN	A VLAN (Virtual Local Area Network) allows a physical network to be partitioned into multiple logical networks. Devices on a logical network belong to one group. A device can belong to more than one group. With VLAN, a device cannot directly talk to or hear from devices that are not in the same group(s); the traffic must first go through a router.
VLAN Stacking	Use VLAN stacking to add an outer VLAN tag to the inner IEEE 802.1Q tagged frames that enter the network. By tagging the tagged frames ("double-tagged" frames), the service provider can manage up to 4,094 VLAN groups with each group containing up to 4,094 customer VLANs. This allows a service provider to provide different service, based on specific VLANs, for many different customers.
MAC Address Filter	Filter traffic based on the source and/or destination MAC address and VLAN group (ID).
DHCP (Dynamic Host Configuration Protocol)	Use this feature to have the MM-7201 assign IP addresses, an IP default gateway and DNS servers to computers on your network.
IGMP Snooping	The switch supports IGMP snooping enabling group multicast traffic to be only forwarded to ports that are members of that group; thus allowing you to significantly reduce multicast traffic passing through your switch.
Differentiated Services (DiffServ)	With DiffServ, the switch marks packets so that they receive specific per-hop treatment at DiffServ-compliant network devices along the route based on the application types and traffic flow.
Classifier and Policy	You can create a policy to define actions to be performed on a traffic flow grouped by a classifier according to specific criteria such as the IP address, port number or protocol type, etc.
Queuing	Queuing is used to help solve performance degradation when there is network congestion. Two scheduling services are supported: Strict Priority Queuing (SPQ) and Weighted Round Robin (WRR). This allows the switch to maintain separate queues for packets from each individual source or flow and prevent a source from monopolizing the bandwidth.
Port Mirroring	Port mirroring allows you to copy traffic going from one or all ports to another or all ports in order that you can examine the traffic from the mirror port (the port you copy the traffic to) without interference.
Static Route	Static routes tell the switch how to forward IP traffic when you configure the TCP/IP parameters manually.
Port Cloning	Port cloning allows you to copy attributes from one port to another port or ports.
Multicast VLAN Registration (MVR)	Multicast VLAN Registration (MVR) is designed for applications (such as Media-on-Demand (MoD)) using multicast traffic across a network. MVR allows one single multicast VLAN to be shared among different subscriber VLANs on the network. This improves bandwidth utilization by reducing multicast traffic in the subscriber VLANs and simplifies multicast group management.
IP Multicast	With IP multicast, the switch delivers IP packets to a group of hosts on the network - not everybody. In addition, the switch can send packets to Ethernet devices that are not VLAN-aware by untagging (removing the VLAN tags) IP multicast packets.
RIP	RIP (Routing Information Protocol) allows a routing device to exchange routing information with other routers.

Table 109 Feature Descriptions (continued)

FEATURE	DESCRIPTION
OSPF	OSPF (Open Shortest Path First) is a link-state protocol designed to distribute routing information within an autonomous system (AS). An autonomous system is a collection of networks using a common routing protocol to exchange routing information. OSPF is best suited for large networks.
DVMRP	DVMRP (Distance Vector Multicast Routing Protocol) is a protocol used for routing multicast data within an autonomous system (AS). DVMRP provides multicast forwarding capability to a layer 3 switch that runs both the IPv4 protocol (with IP Multicast support) and the IGMP protocol.
VRRP	Virtual Router Redundancy Protocol (VRRP), defined in RFC 2338, allows you to create redundant backup gateways to ensure that the default gateway of a host is always available.
RSTP (Rapid Spanning Tree Protocol) / MRSTP (Multiple RSTP)	RSTP detects and breaks network loops and provides backup links between switches, bridges or routers. It allows a switch to interact with other RSTP -compliant switches in your network to ensure that only one path exists between any two stations on the network. MRSTP allows you to configure multiple RSTP configurations and assign ports to each tree.
Link Aggregation	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.
Port Authentication and Security	For security, the switch allows authentication using IEEE 802.1x with an external RADIUS server and port security that allows only packets with dynamically learned MAC addresses and/or configured static MAC addresses to pass through a port on the switch. For redundancy, multiple RADIUS servers can be configured.
Device Management	Use the web configurator to easily configure the rich range of features on the MM-7201.
Firmware Upgrade	Download new firmware (when available) from the ZyXEL web site and use the web configurator, CLI or an FTP/TFTP tool to put it on the MM-7201. Note: Only upload firmware for your specific model!
Configuration Backup & Restoration	Make a copy of the MM-7201's configuration and put it back on the MM-7201 later if you decide you want to revert back to an earlier configuration.
Cluster Management	Cluster management (also known as iStacking) allows you to manage switches through one switch, called the cluster manager. The switches must be directly connected and be in the same VLAN group so as to be able to communicate with one another.

Table 110 General Specifications

CHARACTERISTIC	SPECIFICATION
Default IP Address	192.168.1.1 (in-band management) 192.168.0.1 (out-of-band management)
Default Subnet Mask	255.255.255.0 (24 bits)
Default User Name	admin
Default Password	1234

Table 110 General Specifications (continued)

CHARACTERISTIC	SPECIFICATION
Bridging	16K MAC addresses Static MAC address filtering by source/destination Broadcast storm control Static MAC address forwarding
Switching	Max. Frame size: 1522 bytes Forwarding frame: IEEE 802.3, IEEE 802.1q, Ethernet II, PPPoE Prevent the forwarding of corrupted packets
STP	IEEE 802.1w Rapid Spanning Tree Protocol (RSTP) Multiple Rapid Spanning Tree capability (4 configurable trees)
QoS	IEEE 802.1p Eight priority queues per port Port-based egress traffic shaping Rule-based traffic mirroring Supports IGMP snooping
VLAN	Port-based VLAN setting Tag-based (IEEE 802.1Q) VLAN Number of VLAN: 4K, 4K static maximum Supports GVRP Double tagging for VLAN stacking
Port Aggregation	Supports IEEE 802.3ad; static and dynamic (LACP) port trunking Six groups (up to 8 ports each) (per interface module)
Port Mirroring	All ports support port mirroring Support port mirroring per IP/TCP/UDP
IP Capability	IPV4 support 256 IP routing domains 8K IP address table Wire speed IP forwarding
Routing Protocols	Unicast: RIP-V1/V2, OSPF V2 Multicast: DVMRP, IGMP V1/V2 Static Routing VRRP
IP Services	DHCP server/relay
Multicast	3 multicast VLANs 256 multicast rules
Authentication ans Accounting	Support RADIUS and TACACS+
DVMRP	Default Timer Values Probe interval: 10 sec Report interval: 35 sec Route expiration time: 140 sec Prune lifetime: Variable (less than two hours) Prune retransmission time: 3 sec with exponential back off Graft retransmission time: 5 sec with exponential back off

Table 111 Management Specifications

FEATURE	SPECIFICATION
System Control	Alarm/Status surveillance LED indication for alarm and system status Performance monitoring Line speed Four RMON groups (history, statistics, alarms, and events) Throughput monitoring Port mirroring and aggregation Spanning Tree Protocol IGMP snooping Firmware upgrade and download through FTP/TFTP DHCP server/relay Login authorization and security levels (Privileges assigned via CLI or via RADIUS server) Self diagnostics FLASH memory
Network Management	CLI through console port (limit: one session) CLI through SSH and Telnet (limit: nine sessions total) Web-based management (limit: five sessions) SNMP (no limit on sessions) FTP for firmware and configuration files (limit: one session) Clustering: up to 24 switches can be managed by one IP address RMON groups (history, statistics, alarms and events)
MIB	RFC 1213 MIB II RFC 1493 Bridge MIB RFC 1643 Ethernet MIB RFC 1757 Four groups of RMON RFC 2011 IP MIP RFC 2012 TCP MIB RFC 2014 UDP MIB RFC 2233 RFC 2674 Bridge MIB extension RFC 2925 ZyXEL Private MIB
Cluster Management	Maximum number of cluster members: 24

Table 112 Supported Standards

STANDARD	DESCRIPTION
RFC 867 RFC 868 RFC 1305	Daytime protocol Time protocol Network Time Protocol (NTP)
RFC 894	IP Datagrams over Ethernet Networks
RFC 1112 RFC 2236	Internet Group Multicast Protocol (IGMP)

Table 112 Supported Standards (continued)

STANDARD	DESCRIPTION
RFC 1155 RFC 1157 RFC 1213 RFC 1493 RFC 1643 RFC 1757 RFC 2011 RFC 2012 RFC 2013 RFC 2674	Simple Network Management Protocol (SNMP)
RFC 2131 RFC 2132 RFC 3046	Dynamic Host Configuration Protocol (DHCP)
RFC 2138 RFC 2139 RFC 3580	Remote Authentication Dial In User Service (RADIUS)
RFC 2338	Virtual Router Redundancy Protocol (VRRP)
RFC 3164	BSD Syslog Protocol
IEEE 802.1D IEEE 802.1w	Spanning Tree Protocol (STP) Rapid Spanning Tree Protocol (STP)
IEEE 802.1d IEEE 802.1p	Layer 2 Traffic Prioritization
IEEE 802.1Q	Virtual Local Area Network (VLAN)
IEEE 802.1x	Network Authentication
IEEE 802.3	Standards for Carrier Sense Multiple Access / Collision Detection (CSMA/CD) Ethernet-based LANs
IEEE 802.3ad	Link Aggregate Control Protocol (LACP)
IEEE 802.3x	Flow Control

Cable Pin Assignments

In a serial communications connection, generally a computer is DTE (Data Terminal Equipment) and a modem is DCE (Data Circuit-terminating Equipment). The MM-7201 is DCE when you connect a computer to the console port.

Figure 145 Console/Dial Backup Port Pin Layout

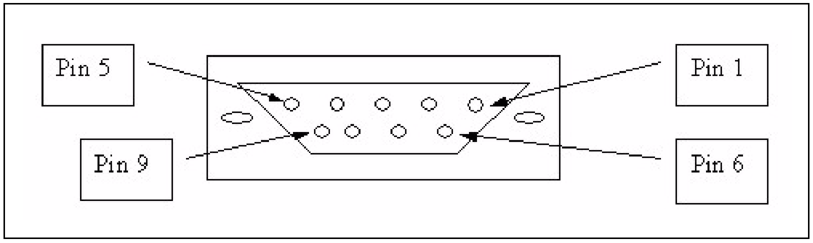
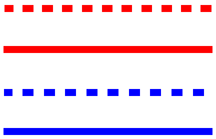
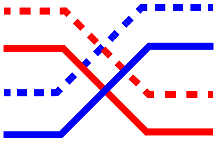


Table 113 Console Port Pin Assignments

PIN	ASSIGNMENT
1	NON
2	DCE-TXD
3	DCE –RXD
4	DCE –DSR
5	GND
6	DCE –DTR
7	DCE –CTS
8	DCE –RTS
9	NON

Table 114 Ethernet Cable Pin Assignments

ETHERNET CABLE PIN LAYOUT					
Straight-through			**Crossover**		
(Switch)		(Adapter)	(Switch)		(Switch)
1 IRD +		1 OTD +	1 IRD +		1 IRD +
2 IRD -		2 OTD -	2 IRD -		2 IRD -
3 OTD +		3 IRD +	3 OTD +		3 OTD +
6 OTD -		6 IRD -	6 OTD -		6 OTD -

PART VIII

Appendices and Index

A

IP Addresses and Subnetting

This appendix introduces IP addresses, IP address classes and subnet masks. You use subnet masks to subdivide a network into smaller logical networks.

Introduction to IP Addresses

An IP address has two parts: the network number and the host ID. Routers use the network number to send packets to the correct network, while the host ID identifies a single device on the network.

An IP address is made up of four octets, written in dotted decimal notation, for example, 192.168.1.1. (An octet is an 8-digit binary number. Therefore, each octet has a possible range of 00000000 to 11111111 in binary, or 0 to 255 in decimal.)

There are several classes of IP addresses. The first network number (192 in the above example) defines the class of IP address. These are defined as follows:

- Class A: 0 to 127
- Class B: 128 to 191
- Class C: 192 to 223
- Class D: 224 to 239
- Class E: 240 to 255

IP Address Classes and Hosts

The class of an IP address determines the number of hosts you can have on your network.

- In a class A address the first octet is the network number, and the remaining three octets are the host ID.
- In a class B address the first two octets make up the network number, and the two remaining octets make up the host ID.
- In a class C address the first three octets make up the network number, and the last octet is the host ID.

The following table shows the network number and host ID arrangement for classes A, B and C.

Table 115 Classes of IP Addresses

IP ADDRESS	OCTET 1	OCTET 2	OCTET 3	OCTET 4
Class A	**Network number**	Host ID	Host ID	Host ID

Table 115 Classes of IP Addresses (continued)

IP ADDRESS	OCTET 1	OCTET 2	OCTET 3	OCTET 4
Class B	**Network number**	**Network number**	Host ID	Host ID
Class C	**Network number**	**Network number**	**Network number**	Host ID

An IP address with host IDs of all zeros is the IP address of the network (192.168.1.0 for example). An IP address with host IDs of all ones is the broadcast address for that network (192.168.1.255 for example). Therefore, to determine the total number of hosts allowed in a network, deduct two as shown next:

- A class C address (1 host octet: 8 host bits) can have 2^8 – 2, or 254 hosts.
- A class B address (2 host octets: 16 host bits) can have 2^{16} – 2, or 65534 hosts.

A class A address (3 host octets: 24 host bits) can have 2^{24} – 2 hosts, or approximately 16 million hosts.

IP Address Classes and Network ID

The value of the first octet of an IP address determines the class of an address.

- Class A addresses have a **0** in the leftmost bit.
- Class B addresses have a **1** in the leftmost bit and a **0** in the next leftmost bit.
- Class C addresses start with **1 1 0** in the first three leftmost bits.
- Class D addresses begin with **1 1 1 0**. Class D addresses are used for multicasting, which is used to send information to groups of computers.
- There is also a class E. It is reserved for future use.

The following table shows the allowed ranges for the first octet of each class. This range determines the number of subnets you can have in a network.

Table 116 Allowed IP Address Range By Class

CLASS	ALLOWED RANGE OF FIRST OCTET (BINARY)	ALLOWED RANGE OF FIRST OCTET (DECIMAL)
Class A	**0**0000000 to **0**1111111	0 to 127
Class B	**10**000000 to **10**111111	128 to 191
Class C	**110**00000 to **110**11111	192 to 223
Class D	**1110**0000 to **1110**1111	224 to 239
Class E (reserved)	**1111**0000 to **1111**1111	240 to 255

Subnet Masks

A subnet mask is used to determine which bits are part of the network number, and which bits are part of the host ID (using a logical AND operation).

A subnet mask has 32 bits. If a bit in the subnet mask is a “1” then the corresponding bit in the IP address is part of the network number. If a bit in the subnet mask is “0” then the corresponding bit in the IP address is part of the host ID.

Subnet masks are expressed in dotted decimal notation just like IP addresses. The “natural” masks for class A, B and C IP addresses are as follows.

Table 117 “Natural” Masks

CLASS	NATURAL MASK
A	255.0.0.0
B	255.255.0.0
C	255.255.255.0

Subnetting

With subnetting, the class arrangement of an IP address is ignored. For example, a class C address no longer has to have 24 bits of network number and 8 bits of host ID. With subnetting, some of the host ID bits are converted into network number bits.

By convention, subnet masks always consist of a continuous sequence of ones beginning from the leftmost bit of the mask, followed by a continuous sequence of zeros, for a total number of 32 bits.

Since the mask is always a continuous number of ones beginning from the left, followed by a continuous number of zeros for the remainder of the 32 bit mask, you can simply specify the number of ones instead of writing the value of each octet. This is usually specified by writing a “/” followed by the number of bits in the mask after the address.

For example, 192.1.1.0 /25 is equivalent to saying 192.1.1.0 with mask 255.255.255.128.

The following table shows all possible subnet masks for a class “C” address using both notations.

Table 118 Alternative Subnet Mask Notation

SUBNET MASK	SUBNET MASK “1” BITS	LAST OCTET BIT VALUE	DECIMAL
255.255.255.0	/24	0000 0000	0
255.255.255.128	/25	1000 0000	128
255.255.255.192	/26	1100 0000	192
255.255.255.224	/27	1110 0000	224
255.255.255.240	/28	1111 0000	240
255.255.255.248	/29	1111 1000	248
255.255.255.252	/30	1111 1100	252

The first mask shown is the class “C” natural mask. Normally if no mask is specified it is understood that the natural mask is being used.

Example: Two Subnets

As an example, you have a class “C” address 192.168.1.0 with subnet mask of 255.255.255.0.

Table 119 Two Subnets Example

IP/SUBNET MASK	NETWORK NUMBER	HOST ID
IP Address	192.168.1.	0
IP Address (Binary)	11000000.10101000.00000001.	00000000
Subnet Mask	255.255.255.	0
Subnet Mask (Binary)	11111111.11111111.11111111.	00000000

The first three octets of the address make up the network number (class “C”).

To make two networks, divide the network 192.168.1.0 into two separate subnets by converting one of the host ID bits of the IP address to a network number bit. The “borrowed” host ID bit can be either “0” or “1” thus giving two subnets; 192.168.1.0 with mask 255.255.255.128 and 192.168.1.128 with mask 255.255.255.128.

In the following charts, shaded/bolded last octet bit values indicate host ID bits “borrowed” to make network ID bits. The number of “borrowed” host ID bits determines the number of subnets you can have. The remaining number of host ID bits (after “borrowing”) determines the number of hosts you can have on each subnet.

Table 120 Subnet 1

IP/SUBNET MASK	NETWORK NUMBER	LAST OCTET BIT VALUE
IP Address	192.168.1.	0
IP Address (Binary)	11000000.10101000.00000001.	**0**0000000
Subnet Mask	255.255.255.	128
Subnet Mask (Binary)	11111111.11111111.11111111.	**1**0000000
Subnet Address: 192.168.1.0	Lowest Host ID: 192.168.1.1	
Broadcast Address: 192.168.1.127	Highest Host ID: 192.168.1.126	

Table 121 Subnet 2

IP/SUBNET MASK	NETWORK NUMBER	LAST OCTET BIT VALUE
IP Address	192.168.1.	128
IP Address (Binary)	11000000.10101000.00000001.	**1**0000000
Subnet Mask	255.255.255.	128
Subnet Mask (Binary)	11111111.11111111.11111111.	**1**0000000

Table 121 Subnet 2 (continued)

IP/SUBNET MASK	NETWORK NUMBER	LAST OCTET BIT VALUE
Subnet Address: 192.168.1.128	Lowest Host ID: 192.168.1.129	
Broadcast Address: 192.168.1.255	Highest Host ID: 192.168.1.254	

Host IDs of all zeros represent the subnet itself and host IDs of all ones are the broadcast address for that subnet, so the actual number of hosts available on each subnet in the example above is $2^7 – 2$ or 126 hosts for each subnet.

192.168.1.0 with mask 255.255.255.128 is the subnet itself, and 192.168.1.127 with mask 255.255.255.128 is the directed broadcast address for the first subnet. Therefore, the lowest IP address that can be assigned to an actual host for the first subnet is 192.168.1.1 and the highest is 192.168.1.126. Similarly the host ID range for the second subnet is 192.168.1.129 to 192.168.1.254.

Example: Four Subnets

The above example illustrated using a 25-bit subnet mask to divide a class “C” address space into two subnets. Similarly to divide a class “C” address into four subnets, you need to “borrow” two host ID bits to give four possible combinations (00, 01, 10 and 11). The subnet mask is 26 bits (11111111.11111111.11111111.**11**000000) or 255.255.255.192. Each subnet contains 6 host ID bits, giving 2^6-2 or 62 hosts for each subnet (all zeroes is the subnet itself, all ones is the broadcast address on the subnet).

Table 122 Subnet 1

IP/SUBNET MASK	NETWORK NUMBER	LAST OCTET BIT VALUE
IP Address	192.168.1.	0
IP Address (Binary)	11000000.10101000.00000001.	**00**000000
Subnet Mask (Binary)	11111111.11111111.11111111.	**11**000000
Subnet Address: 192.168.1.0	Lowest Host ID: 192.168.1.1	
Broadcast Address: 192.168.1.63	Highest Host ID: 192.168.1.62	

Table 123 Subnet 2

IP/SUBNET MASK	NETWORK NUMBER	LAST OCTET BIT VALUE
IP Address	192.168.1.	64
IP Address (Binary)	11000000.10101000.00000001.	**01**000000
Subnet Mask (Binary)	11111111.11111111.11111111.	**11**000000
Subnet Address: 192.168.1.64	Lowest Host ID: 192.168.1.65	
Broadcast Address: 192.168.1.127	Highest Host ID: 192.168.1.126	

Table 124 Subnet 3

IP/SUBNET MASK	NETWORK NUMBER	LAST OCTET BIT VALUE
IP Address	192.168.1.	128
IP Address (Binary)	11000000.10101000.00000001.	**10**000000
Subnet Mask (Binary)	11111111.11111111.11111111.	**11**000000
Subnet Address: 192.168.1.128	Lowest Host ID: 192.168.1.129	
Broadcast Address: 192.168.1.191	Highest Host ID: 192.168.1.190	

Table 125 Subnet 4

IP/SUBNET MASK	NETWORK NUMBER	LAST OCTET BIT VALUE
IP Address	192.168.1.	192
IP Address (Binary)	11000000.10101000.00000001.	**11**000000
Subnet Mask (Binary)	11111111.11111111.11111111.	**11**000000
Subnet Address: 192.168.1.192	Lowest Host ID: 192.168.1.193	
Broadcast Address: 192.168.1.255	Highest Host ID: 192.168.1.254	

Example Eight Subnets

Similarly use a 27-bit mask to create eight subnets (000, 001, 010, 011, 100, 101, 110 and 111).

The following table shows class C IP address last octet values for each subnet.

Table 126 Eight Subnets

SUBNET	SUBNET ADDRESS	FIRST ADDRESS	LAST ADDRESS	BROADCAST ADDRESS
1	0	1	30	31
2	32	33	62	63
3	64	65	94	95
4	96	97	126	127
5	128	129	158	159
6	160	161	190	191
7	192	193	222	223
8	224	225	254	255

The following table is a summary for class “C” subnet planning.

Table 127 Class C Subnet Planning

NO. “BORROWED” HOST BITS	SUBNET MASK	NO. SUBNETS	NO. HOSTS PER SUBNET
1	255.255.255.128 (/25)	2	126
2	255.255.255.192 (/26)	4	62

Table 127 Class C Subnet Planning (continued)

NO. “BORROWED” HOST BITS	SUBNET MASK	NO. SUBNETS	NO. HOSTS PER SUBNET
3	255.255.255.224 (/27)	8	30
4	255.255.255.240 (/28)	16	14
5	255.255.255.248 (/29)	32	6
6	255.255.255.252 (/30)	64	2
7	255.255.255.254 (/31)	128	1

Subnetting With Class A and Class B Networks.

For class “A” and class “B” addresses the subnet mask also determines which bits are part of the network number and which are part of the host ID.

A class “B” address has two host ID octets available for subnetting and a class “A” address has three host ID octets (see Table 115 on page 279) available for subnetting.

The following table is a summary for class “B” subnet planning.

Table 128 Class B Subnet Planning

NO. “BORROWED” HOST BITS	SUBNET MASK	NO. SUBNETS	NO. HOSTS PER SUBNET
1	255.255.128.0 (/17)	2	32766
2	255.255.192.0 (/18)	4	16382
3	255.255.224.0 (/19)	8	8190
4	255.255.240.0 (/20)	16	4094
5	255.255.248.0 (/21)	32	2046
6	255.255.252.0 (/22)	64	1022
7	255.255.254.0 (/23)	128	510
8	255.255.255.0 (/24)	256	254
9	255.255.255.128 (/25)	512	126
10	255.255.255.192 (/26)	1024	62
11	255.255.255.224 (/27)	2048	30
12	255.255.255.240 (/28)	4096	14
13	255.255.255.248 (/29)	8192	6
14	255.255.255.252 (/30)	16384	2
15	255.255.255.254 (/31)	32768	1

B

Pop-up Windows, JavaScripts and Java Permissions

In order to use the web configurator you need to allow:

- Web browser pop-up windows from your device.
- JavaScripts (enabled by default).
- Java permissions (enabled by default).

Internet Explorer 6 screens are used here. Screens for other Internet Explorer versions may vary.

48.0.0.1 Internet Explorer Pop-up Blockers

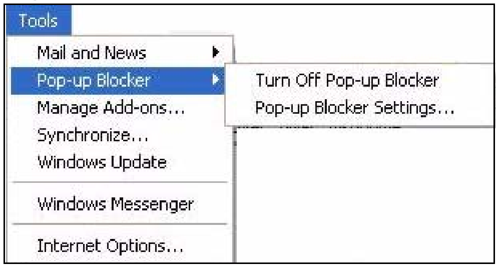
You may have to disable pop-up blocking to log into your device.

Either disable pop-up blocking (enabled by default in Windows XP SP (Service Pack) 2) or allow pop-up blocking and create an exception for your device's IP address.

48.0.0.1.1 Disable pop-up Blockers

1 In Internet Explorer, select **Tools**, **Pop-up Blocker** and then select **Turn Off Pop-up Blocker**.

Figure 146 Pop-up Blocker

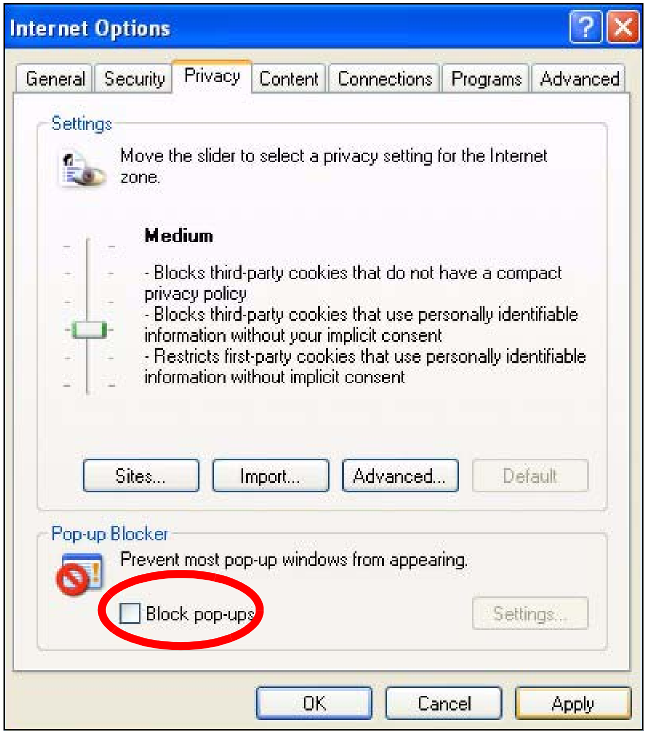


You can also check if pop-up blocking is disabled in the **Pop-up Blocker** section in the **Privacy** tab.

1 In Internet Explorer, select **Tools**, **Internet Options**, **Privacy**.

2 Clear the **Block pop-ups** check box in the **Pop-up Blocker** section of the screen. This disables any web pop-up blockers you may have enabled.

Figure 147 Internet Options



Internet Options

General | Security | Privacy | Content | Connections | Programs | Advanced

Settings

Move the slider to select a privacy setting for the Internet zone.

Medium

- Blocks third-party cookies that do not have a compact privacy policy
- Blocks third-party cookies that use personally identifiable information without your implicit consent
- Restricts first-party cookies that use personally identifiable information without implicit consent

Pop-up Blocker

Prevent most pop-up windows from appearing.

□ Block pop-ups

3 Click **Apply** to save this setting.

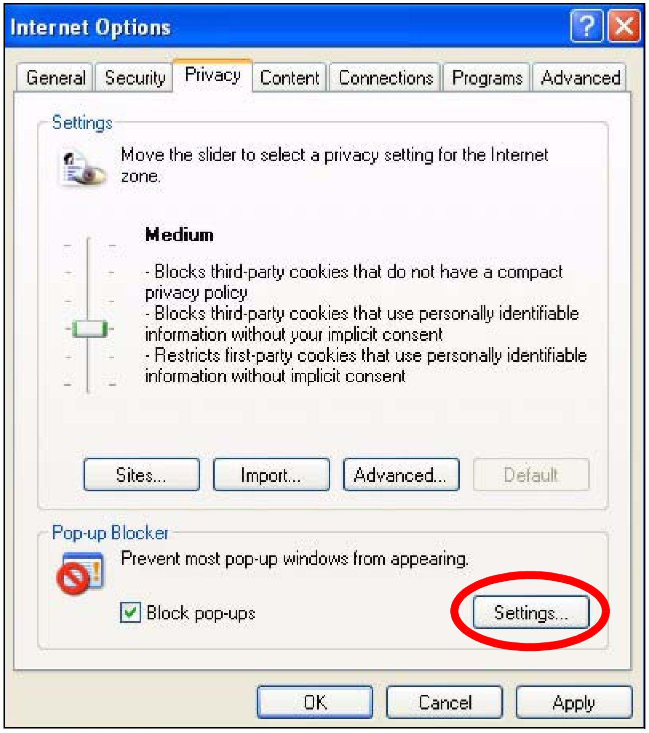
48.0.0.1.2 Enable pop-up Blockers with Exceptions

Alternatively, if you only want to allow pop-up windows from your device, see the following steps.

1 In Internet Explorer, select **Tools**, **Internet Options** and then the **Privacy** tab.

2 Select **Settings…**to open the **Pop-up Blocker Settings** screen.

Figure 148 Internet Options



Move the slider to select a privacy setting for the Internet zone.

Medium

- Blocks third-party cookies that do not have a compact privacy policy
- Blocks third-party cookies that use personally identifiable information without your implicit consent
- Restricts first-party cookies that use personally identifiable information without implicit consent

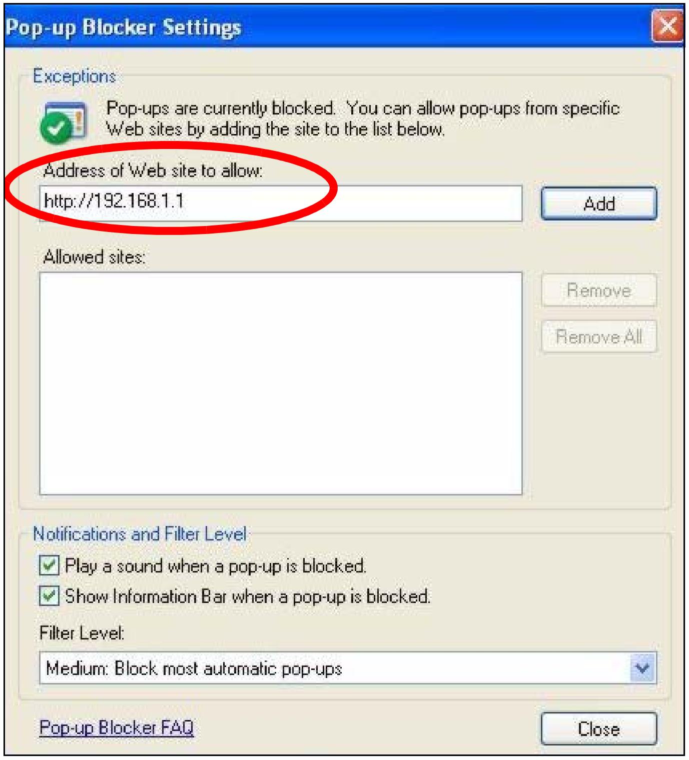
Prevent most pop-up windows from appearing.

☑ Block pop-ups

3 Type the IP address of your device (the web page that you do not want to have blocked) with the prefix “http://”. For example, http://192.168.1.1.

4 Click **Add** to move the IP address to the list of **Allowed sites**.

Figure 149 Pop-up Blocker Settings



Pop-ups are currently blocked. You can allow pop-ups from specific Web sites by adding the site to the list below.

Address of Web site to allow:

http://192.168.1.1

Allowed sites:

☑ Play a sound when a pop-up is blocked.

☑ Show Information Bar when a pop-up is blocked.

Filter Level:

Medium: Block most automatic pop-ups

5 Click **Close** to return to the **Privacy** screen.

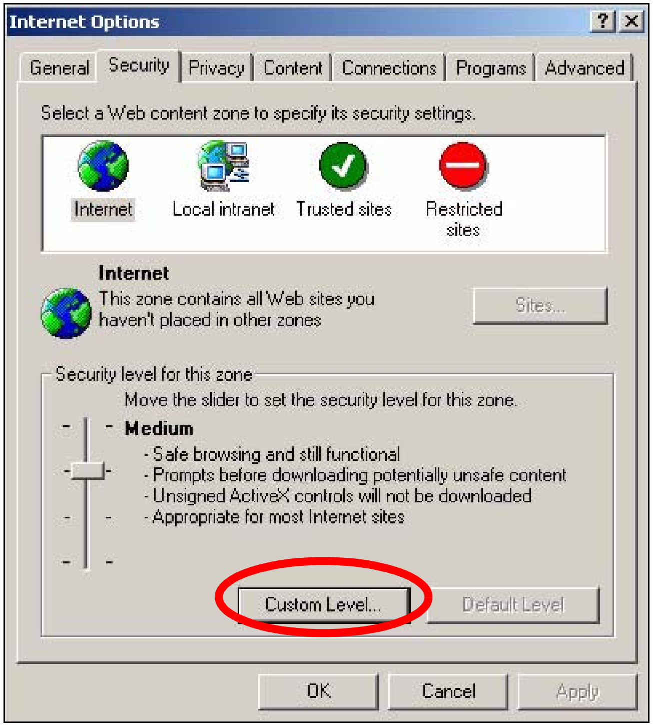
6 Click **Apply** to save this setting.

48.0.0.2 JavaScripts

If pages of the web configurator do not display properly in Internet Explorer, check that JavaScripts are allowed.

1 In Internet Explorer, click **Tools**, **Internet Options** and then the **Security** tab.

Figure 150 Internet Options



Select a Web content zone to specify its security settings.

Internet
This zone contains all Web sites you haven't placed in other zones

Security level for this zone

Move the slider to set the security level for this zone.

Medium
- Safe browsing and still functional
- Prompts before downloading potentially unsafe content
- Unsigned ActiveX controls will not be downloaded
- Appropriate for most Internet sites

2 Click the **Custom Level...** button.

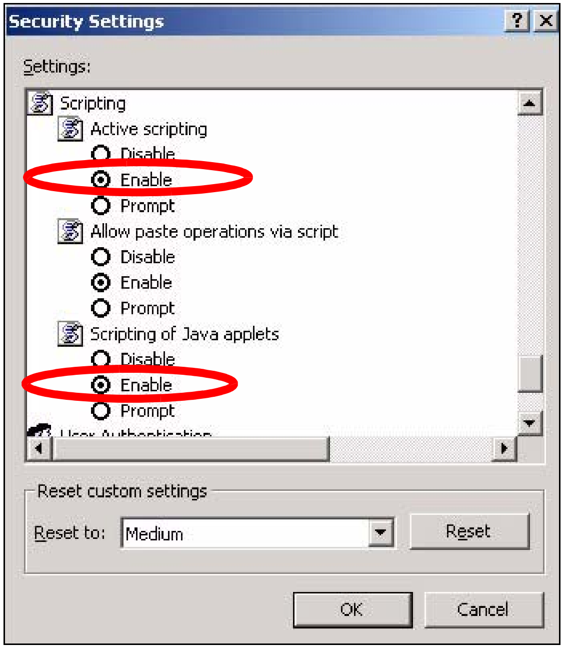
3 Scroll down to **Scripting**.

4 Under **Active scripting** make sure that **Enable** is selected (the default).

5 Under **Scripting of Java applets** make sure that **Enable** is selected (the default).

6 Click **OK** to close the window.

Figure 151 Security Settings - Java Scripting



Security Settings

Settings:

- Scripting
  - Active scripting
    - ○ Disable
    - ● Enable
    - ○ Prompt
  - Allow paste operations via script
    - ○ Disable
    - ● Enable
    - ○ Prompt
  - Scripting of Java applets
    - ○ Disable
    - ● Enable
    - ○ Prompt
- User Authentication

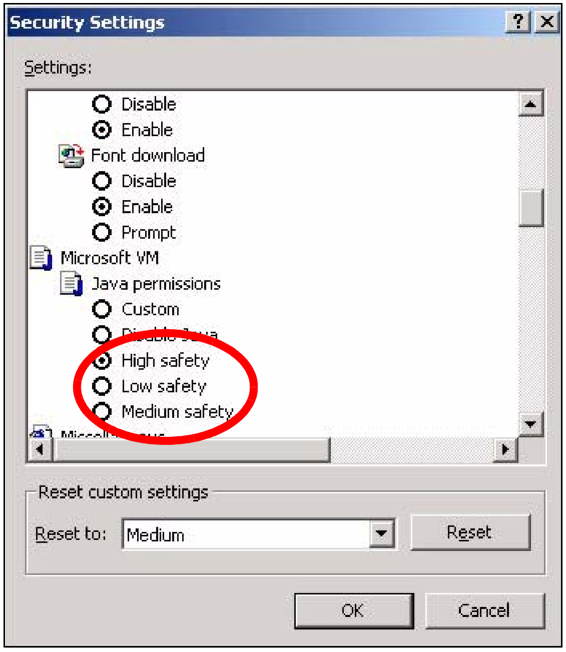
Reset custom settings

Reset to: Medium

48.0.0.3 Java Permissions

1. From Internet Explorer, click **Tools**, **Internet Options** and then the **Security** tab.
2. Click the **Custom Level...** button.
3. Scroll down to **Microsoft VM**.
4. Under **Java permissions** make sure that a safety level is selected.
5. Click **OK** to close the window.

Figure 152 Security Settings - Java



Security Settings

Settings:

- ○ Disable
- ● Enable
- Font download
  - ○ Disable
  - ● Enable
  - ○ Prompt
- Microsoft VM
  - Java permissions
    - ○ Custom
    - ○ Disable Java
    - ● High safety
    - ○ Low safety
    - ○ Medium safety
- Miscellaneous

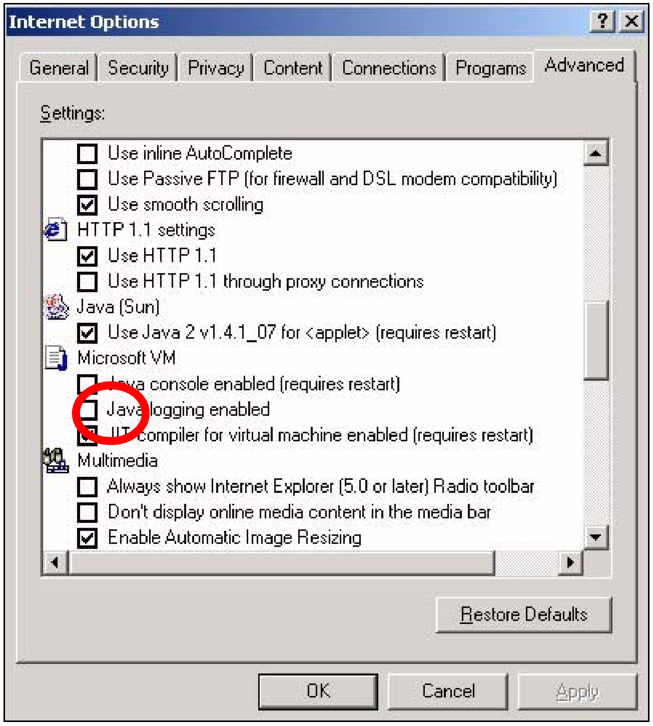
Reset custom settings

Reset to: Medium

48.0.0.3.1 JAVA (Sun)

1. From Internet Explorer, click **Tools**, **Internet Options** and then the **Advanced** tab.
2. make sure that **Use Java 2 for <applet>** under **Java (Sun)** is selected.
3. Click **OK** to close the window.

Figure 153 Java (Sun)



Internet Options

General | Security | Privacy | Content | Connections | Programs | Advanced

Settings:

- ☐ Use inline AutoComplete
- ☐ Use Passive FTP (for firewall and DSL modem compatibility)
- ☑ Use smooth scrolling

HTTP 1.1 settings

- ☑ Use HTTP 1.1
- ☐ Use HTTP 1.1 through proxy connections

Java (Sun)

- ☑ Use Java 2 v1.4.1_07 for <applet> (requires restart)

Microsoft VM

- ☐ Java console enabled (requires restart)
- ☐ Java logging enabled
- ☑ JIT compiler for virtual machine enabled (requires restart)

Multimedia

- ☐ Always show Internet Explorer (5.0 or later) Radio toolbar
- ☐ Don't display online media content in the media bar
- ☑ Enable Automatic Image Resizing

Restore Defaults

OK | Cancel | Apply

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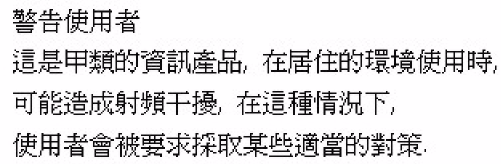

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D

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