NETGEAR

# GS716T and GS724T Gigabit Smart Switches

## Software Administration Manual

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## Revision History

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# Switch Information and Setup

# 1

The *NETGEAR® GS716T and GS724T Smart Switch Software Administration Manual* describes how to configure and operate the GS716T and GS724T Gigabit Smart Switches by using the Web-based graphical user interface (GUI). This manual describes the software configuration procedures and explains the options available within those procedures.

## Document Organization

The *GS716Tv2 and GS724Tv3 Software Administration Manual* contains the following chapters:

- *Chapter 1, Switch Information and Setup*, contains information about performing the initial system configuration and accessing the user interface.
- *Chapter 2, System Information Features*, describes how to configure administrative features such as SNMP, DHCP, and port information.
- *Chapter 3, Switching Features*, describes how to manage and monitor the layer 2 switching features.
- *Chapter 4, Quality of Service Features*, describes how to manage the Access Control Lists (ACLs), and how to configure Differentiated Services and Class of Service features.
- *Chapter 5, Device Security*, contains information about configuring switch security information such as port access control and RADIUS server settings.
- *Chapter 6, Monitoring the System*, describes how to view a variety of information about the switch and its ports, and to configure how the switch monitors events.
- *Chapter 7, Maintenance*, describes features to help you manage the switch.
- *Chapter 8, Help*, describes how to access Online Help resources for the switch.
- *Appendix A, Hardware Specifications and Default Values*, contains hardware specifications and default values on the GS716T and GS724T Smart Switches.
- *Appendix B, Configuration Examples*, contains examples of how to configure various features on the GS716T and GS724T Smart Switches, such as VLANs and ACLs.
- *Appendix C, Notification of Compliance* contains regulatory information about the GS716T and GS724T switch.

**Note:** Refer to the release notes for the GS716T and GS724T Gigabit Smart Switches for information about issues and workarounds.

# GS716T and GS724T Smart Switch Setup

This chapter provides an overview of starting your NETGEAR GS716T and GS724T Smart Switch and accessing the user interface. It also leads you through the steps to use the Smart Control Center utility. This chapter contains the following sections:



# Switch Management Interface

The NETGEAR GS716T and GS724T Smart Switches contains an embedded Web server and management software for managing and monitoring switch functions. The GS716T and GS724T functions as a simple switch without the management software. However, you can use the management software to configure more advanced features that can improve switch efficiency and overall network performance.

Web-based management lets you monitor, configure, and control your switch remotely using a standard Web browser instead of using expensive and complicated SNMP software products. From your Web browser, you can monitor the performance of your switch and optimize its configuration for your network. You can configure all switch features, such as VLANs, QoS, and ACLs by using the Web-based management interface.

NETGEAR provides the Smart Control Center utility with this product. This program runs under Microsoft® Windows® XP, Windows 2000, or Windows Vista® and provides a front end that discovers the switches on your network segment (L2 broadcast domain). When you power up your switch for the first time, use the Smart Control Center to discover the switch and view the network information that has been automatically assigned to the switch by a DHCP server; or, if no DHCP server is present on the network, use the Smart Control Center to discover the switch and assign static network information.

In addition to enabling NETGEAR switch discovery, the Smart Control Center provides several utilities to help you maintain the NETGEAR switches on your network, such as password management, firmware upgrade, and configuration file backup. For more information, see *Smart Control Center Utilities* on page 17.

# Connecting the Switch to the Network

To enable remote management of the switch through a Web browser or SNMP, you must connect the switch to the network and configure it with network information (an IP address, subnet mask, and default gateway). The switch has a default IP address of 192.168.0.239 and a default subnet mask of 255.255.255.0.

Use one of the following three methods to change the default network information on the switch:

- Dynamic assignment through DHCP—DHCP is enabled by default on the switch. If you connect the switch to a network with a DHCP server, the switch obtains its network information automatically. You can use the Smart Control Center to discover the automatically-assigned network information. For more information, see *Switch Discovery in a Network with a DHCP Server* on page 12.
- Static assignment through the Smart Control Center—If you connect the switch to a network that does not have a DHCP server, you can use the Smart Control Center to assign a static IP address, subnet mask, and default gateway. For more information, see *Switch Discovery in a Network without a DHCP Server* on page 14.
- Static assignment by connecting from a local host—If you do not want to use the Smart Control Center to assign a static address, you can connect to the switch from a host (administrative system) in the 192.168.0.0/24 network and change the settings by using the Web-based management interface on the switch. For information about how to set the IP address on the administrative system so it is in the same subnet as the default IP address of the switch, see *Network Settings Configuration on the Administrative System* on page 15.

# Switch Discovery in a Network with a DHCP Server

This section describes how to set up your switch in a network that has a DHCP server. The DHCP client on the switch is enabled by default. When you connect it to your network, the DHCP server will automatically assign an IP address to your switch. Use the Smart Control Center to discover the IP address automatically assigned to the switch.

To install the switch in a network with a DHCP server, use the following steps:

1. Connect the switch to a network with a DHCP server.
2. Power on the switch by connecting its power cord.
3. Install the Smart Control Center on your computer.
4. Start the Smart Control Center.
5. Click **Discover** for the Smart Control Center to find your switch. You should see a screen similar to the one shown in the following figure.

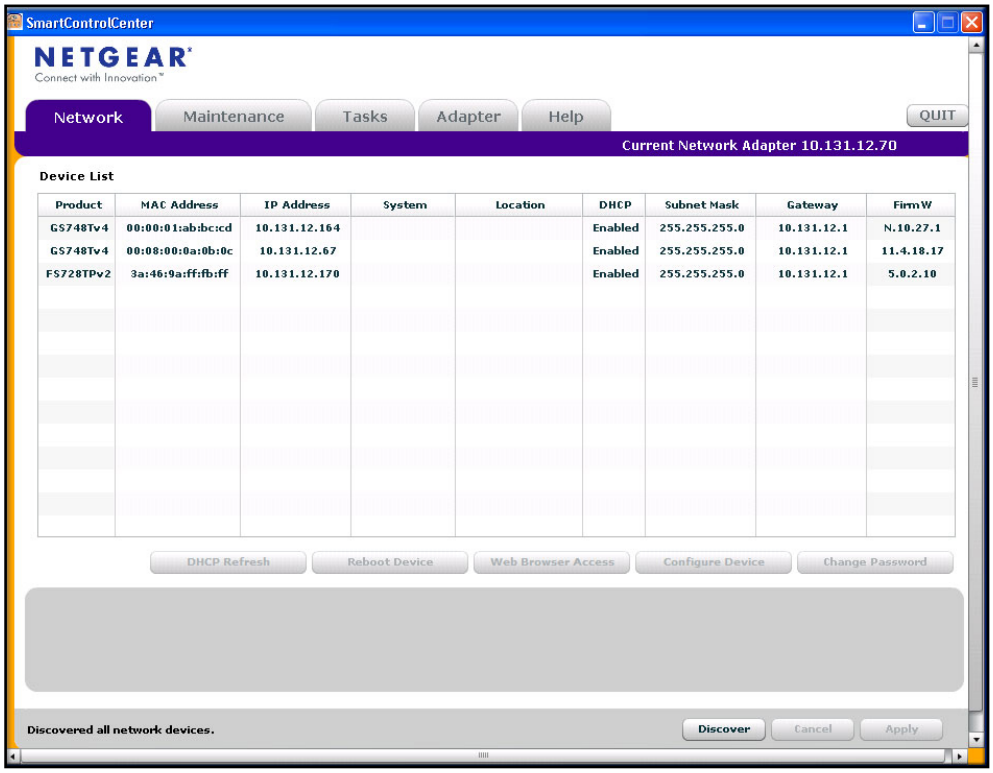
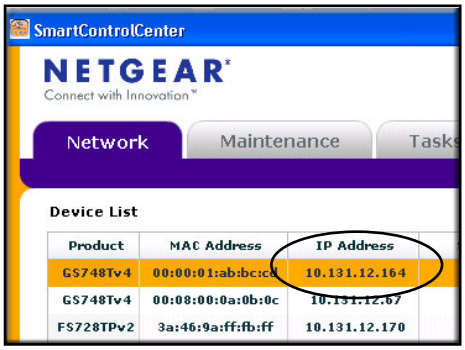
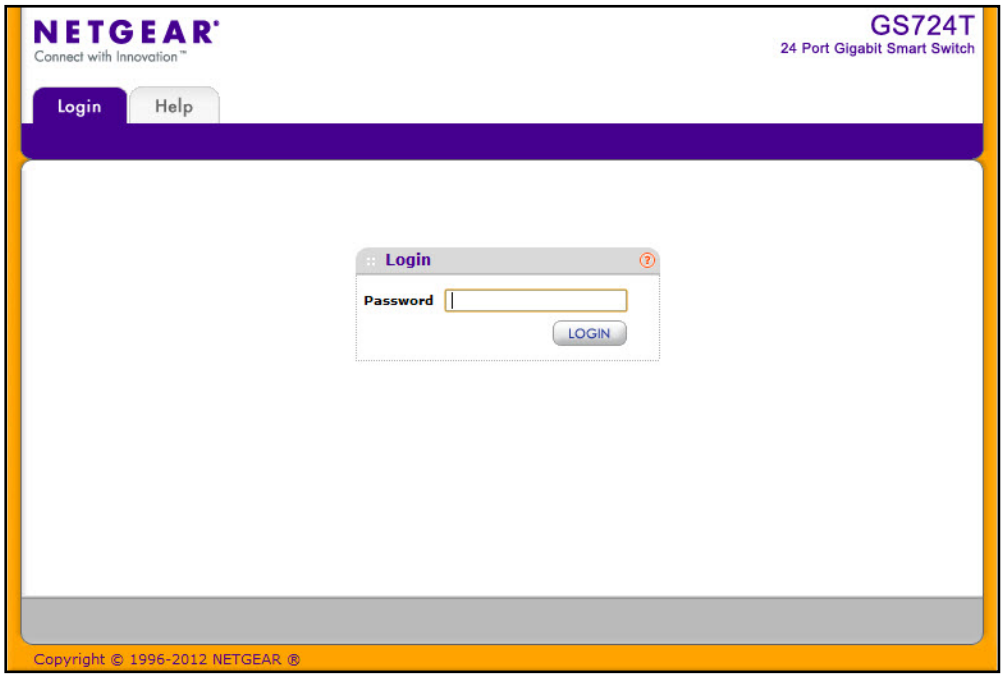



**Figure 1. Smart Switch Discovery**

6. Make a note of the displayed IP address assigned by the DHCP server. You will need this value to access the switch directly from a Web browser (without using the Smart Control Center).




7. Select your switch by clicking the line that displays the switch, then click the **Web Browser Access** button. The Smart Control Center displays a login window.



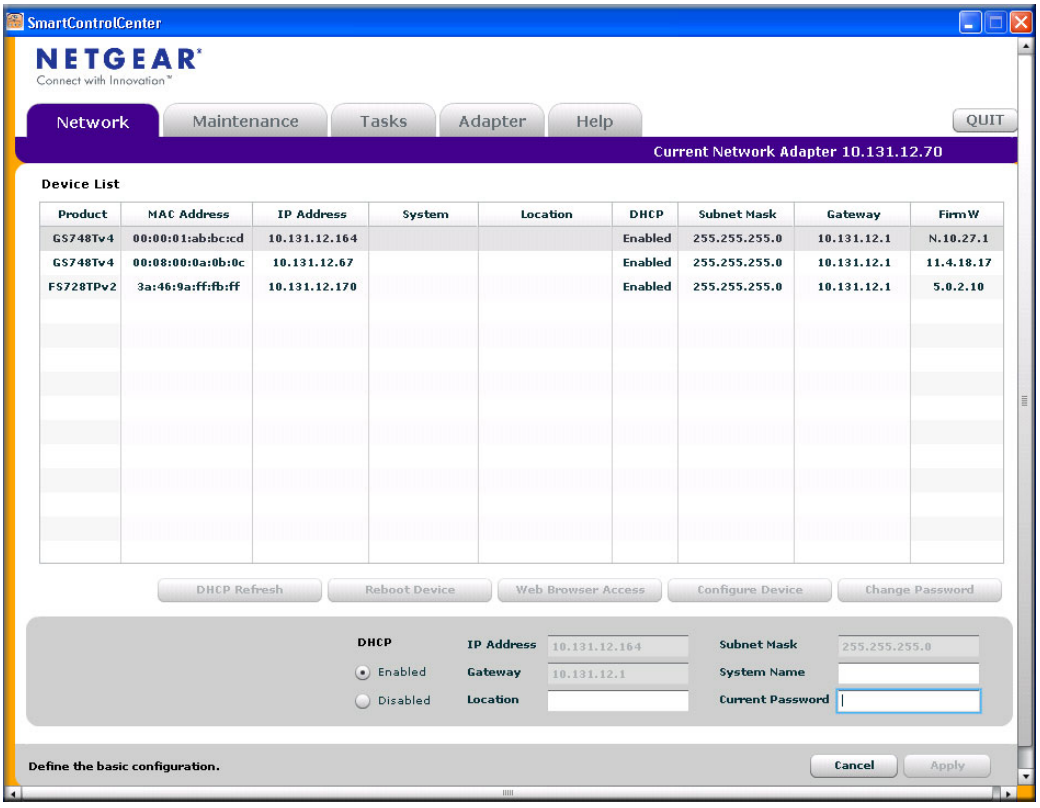

Use your Web browser to manage your switch. The default password is *password*. Then use this page to proceed to management of the switch covered in *Web Interface* on page 23.

# Switch Discovery in a Network without a DHCP Server

This section describes how to use the Smart Control Center to set up your switch in a network without a DHCP server. If your network has no DHCP service, you must assign a static IP address to your switch. If you choose, you can assign it a static IP address, even if your network has DHCP service.

To assign a static IP address:

1. Connect the switch to your existing network.
2. Power on the switch by connecting its power cord.
3. Install the Smart Control Center on your computer.
4. Start the Smart Control Center.
5. Click **Discover** for the Smart Control Center to find your GS716T and GS724T switch. The utility broadcasts Layer 2 discovery packets within the broadcast domain to discover the switch. You should see a screen similar to *Figure 1* on page 12.
6. Select the switch, then click **Configure Device**. The page expands to display additional fields at the bottom of the page, as the following figure shows.




7. Choose the **Disabled** radio button to disable DHCP.

8. Enter the static switch IP address, gateway IP address, and subnet mask for the switch, and then type your password.

   **Tip:** You must enter the current password every time you use the Smart Control Center to update the switch setting. The default password is *password*.

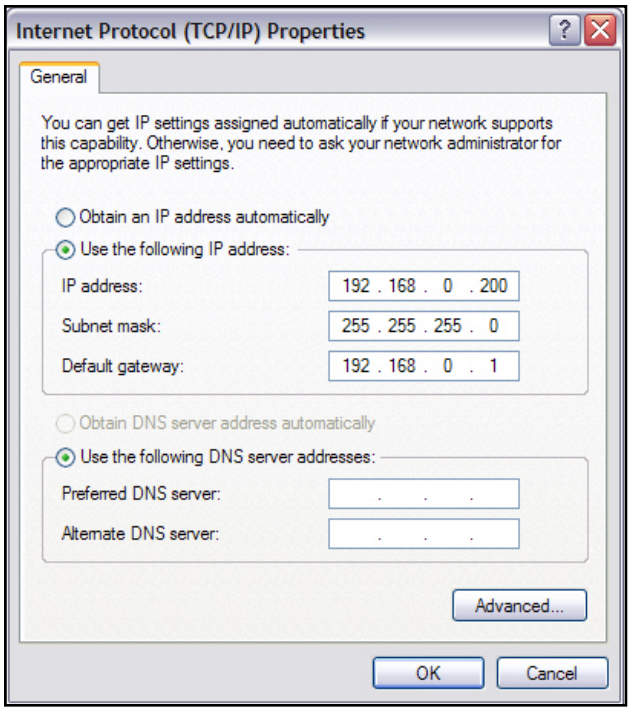
9. Click **Apply** to configure the switch with the network settings.

Please ensure that your PC and the switch are in the same subnet. Make a note of these settings for later use.

# Network Settings Configuration on the Administrative System

If you choose not to use the Smart Control Center to configure the network information on the switch, you can connect directly to the switch from an administrative system, such as a PC or laptop computer. The IP address of the administrative system must be in the same subnet as the default IP address on the switch. For most networks, this means you must change the IP address of the administrative system to be on the same subnet as the default IP address of the switch (192.168.0.239).

To change the IP address on an administrative system running a Microsoft® Windows® operating system, open the Internet Protocol (TCP/IP) properties screen that you access from the Local Area Connection properties, as shown in the following figure. You need Windows Administrator privileges to change these settings.



**WARNING:**

**When you change the IP address of your administrative system, you will loose your connection to the rest of the network. Be sure to write down your current network address settings before you change them.**

To modify the network settings on your administrative system:

1. On your PC, access the MS Windows operating system TCP/IP Properties.
2. Set the IP address of the administrative system to an address in the 192.168.0.0 network, such as 192.168.0.200. The IP address must be different from that of the switch but within the same subnet.
3. Click **OK**.

To configure a static address on the switch:

1. Use a straight-through cable to connect the Ethernet port on the administrative system directly to any port on the GS716T and GS724T.
2. Open a Web browser on your PC and connect to the management interface as described in *Web Access* on page 16.
3. Change the network settings on the switch to match those of your network (this procedure is described in *IP Configuration* on page 33).

After you change the network settings on the switch, return the network configuration on your administrative system to the original settings.

# Web Access

To access the GS716T and GS724T management interface, use one of the following methods:

- From the Smart Control Center, select the switch and click **Web Browser Access**.
- Open a Web browser and enter the IP address of the switch in the address field.

You must be able to ping the IP address of the GS716T and GS724T management interface from your administrative system for Web access to be available. If you used the Smart Control Center to set up the IP address and subnet mask, either with or without a DHCP server, use that IP address in the address field of your Web browser. If you did not change the IP address of the switch from the default value, enter 192.168.0.239 into the address field.

Clicking **Web Browser Access** on the Smart Control Center or accessing the switch directly from your Web browser displays the login screen shown in the following figure.

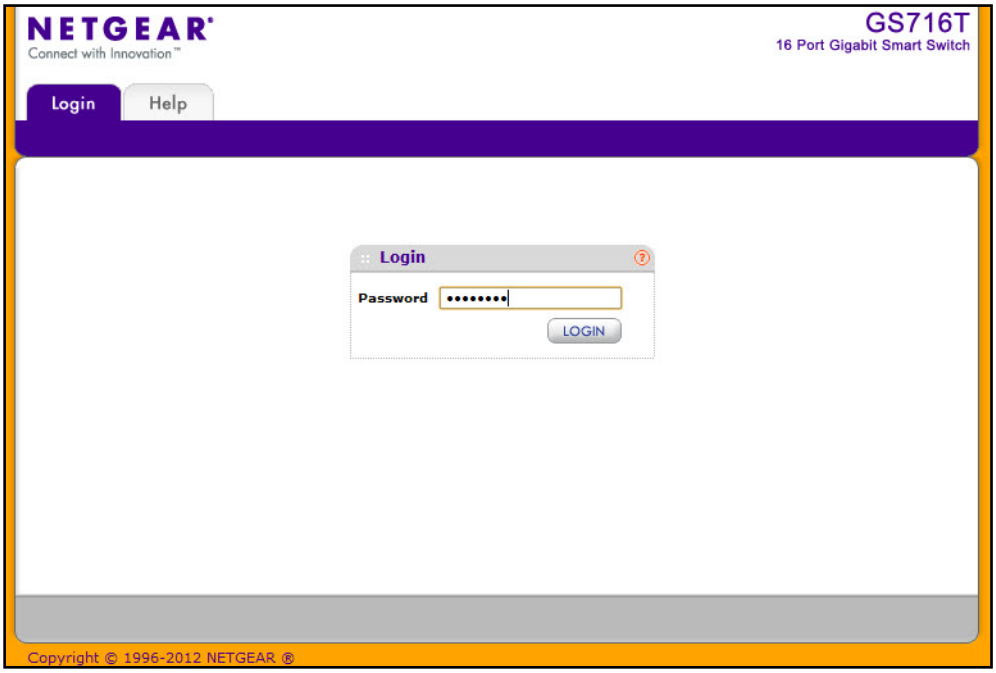



**Figure 2. Login Screen**

# Smart Control Center Utilities

In addition to device discovery and network address assignment, the Smart Control Center includes several maintenance features. This section describes the following Smart Control Center utilities:



## Network Utilities

From the **Network** tab, you can perform the following functions:

- **DHCP Refresh**—Forces the switch to release the current bindings and request new address information from the DHCP server.
- **Reboot Device**—Reboots the selected device.
- **Web Browser Access**—Launches a Web browser and connects to the management interface for the selected device.

- **Configure Device**—Allows you to modify network information for the switch, including the IP address, DHCP client mode, system name, and location. For more information about this feature, see *Configuring the Device* .
- **Change Password**—Allows you to set a new password for the device. For more information about this feature, see *Changing the Switch Password* .

## Configuring the Device

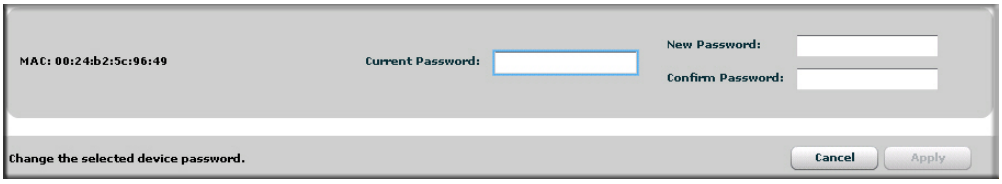
To modify switch information:

1. Select the switch.
2. Click **Configure Device**. Additional fields appear on the screen.


3. To assign or update a static IP address, default gateway, or subnet mask, disable the DHCP client and enter the new information. You can also specify a system name and location for the switch.
4. Type the password in the **Current Password** field. You cannot apply the changes without a valid switch password. The default password for the switch is *password*.
5. Click **Apply** to update the switch with the changes to the network information.

## Changing the Switch Password

1. Select the switch.
2. Click **Change Password**. Additional fields appear on the screen.




3. Type the switch password in the **Current Password** field. The default password for the switch is *password*.
4. Type the new password in the **New Password** and **Confirm Password** fields. The password can contain up to 20 ASCII characters.

Click **Apply** to update the switch with the new password.

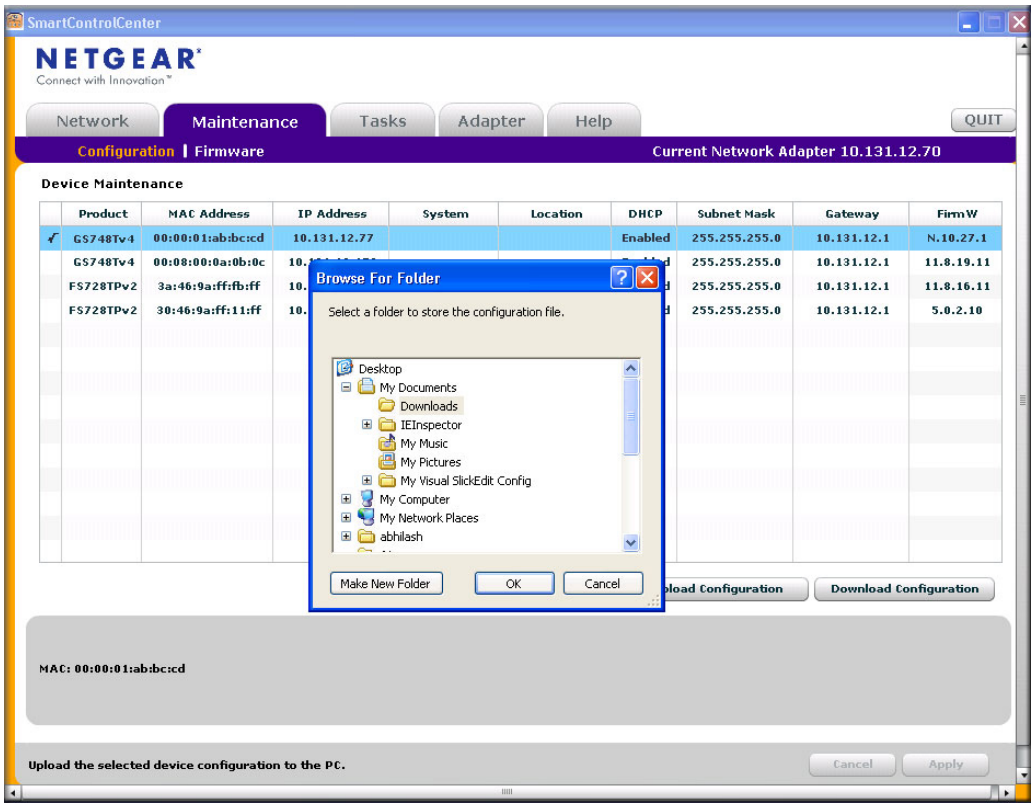
# Configuration Upload and Download

When you make changes to the switch, the configuration information is stored in a file on the switch. You can backup the configuration by uploading the configuration file from the switch to an administrative system. You can download a saved configuration file from the administrative system to the switch. The configuration file you download to the switch overwrites the running configuration on the switch.

Configuration upload and download is useful if you want to save a copy of the current switch configuration (Upload Configuration) before you make changes. If you do not like the changes, you can use the Download Configuration option to restore the switch to the settings in the saved configuration file.

To save a copy of the current switch configuration on your administrative system:

1. Click the **Maintenance** tab and select the device with the configuration to save.
2. Click **Upload Configuration**.
3. From the **Browse for Folder** window that appears, navigate to and select the folder where you want to store the configuration file.



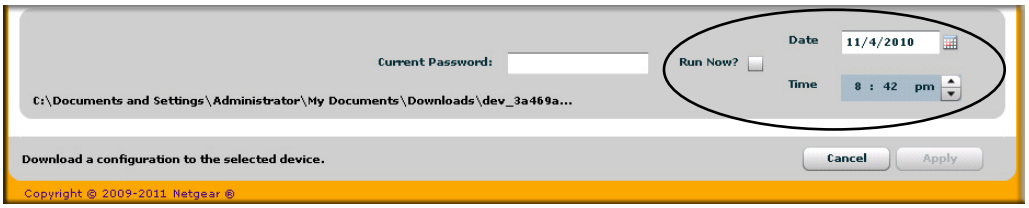

4. Click **OK**.
5. Enter the switch password and click **Apply**.

   The file is uploaded to the administrative computer as a *.cfg file. You can open it and view the contents with a text editor.

To restore the configuration to a previously saved version:

1. Click the **Maintenance** tab and select the device with the configuration to restore.
2. Click **Download Configuration**.
3. From the **Select a Configuration** window that appears, navigate to and select the configuration file to download to the switch.
4. Click **Open**.

   Optionally, you can schedule a different date and time to download the configuration file. To delay the download process, clear the **Run Now?** check box and enter a date and time to complete the download.




5. Enter the switch password and click **Apply** to begin the download process.

**Note:** Click the **Tasks** tab to view status information about the configuration download.

## Firmware Upgrade

The application software for the GS716T and GS724T Smart Switches is upgradable, enabling your switch to take advantage of improvements and additional features as they become available. The upgrade procedure and the required equipment are described in this section. This procedure assumes that you have downloaded or otherwise obtained the firmware upgrade and that you have it available as a binary file on your computer. This procedure uses the TFTP protocol to implement the transfer from computer to switch.

**Note:** You can also upgrade the firmware using the TFTP Download and HTTP Download features mentioned in this book. See *HTTP File Upload* on page 256.

To upgrade your firmware:

1. Click the **Maintenance** tab, and then click the **Firmware** link directly below the tabs (see *Figure 1* on page 12).
2. Select the switch to upgrade and click **Download Firmware**.

By default, the firmware is downloaded to primary storage and will be become the active image after the download completes and the switch reboots. To download firmware to use as a backup image, select the **Secondary Storage** option. To prevent the switch from using the downloaded firmware as the active image, make sure the **Run this FW after download** option is clear.


**Note:** NETGEAR recommends that you download the same image as the primary and secondary image for redundancy.

3. From the **Select new firmware** window that appears, navigate to and select the firmware image to download to the switch.
4. Click **Open**.

   You can choose to schedule a later time to complete the download and installation by clearing the **Run Now?** option and selecting a date and time to perform the firmware download and installation. The scheduled firmware download appears in the Tasks list.
5. Enter the switch password to continue downloading the firmware.
6. Click **Apply** to download the firmware and upgrade the switch with the new image.
7. When the process is complete, the switch automatically reboots.

**Note:** Click the **Tasks** tab to view status information about the firmware upgrade.

**WARNING:**

**It is important that you do not power-off the administrative system or the switch while the firmware upgrade is in progress.**

# Viewing and Managing Tasks

From the **Tasks** tab, you can view information about configuration downloads and firmware upgrades that have already occurred, are in progress, or are scheduled to take place at a later time. You can also delete or reschedule selected tasks. *Figure 3* shows the **Tasks** page.

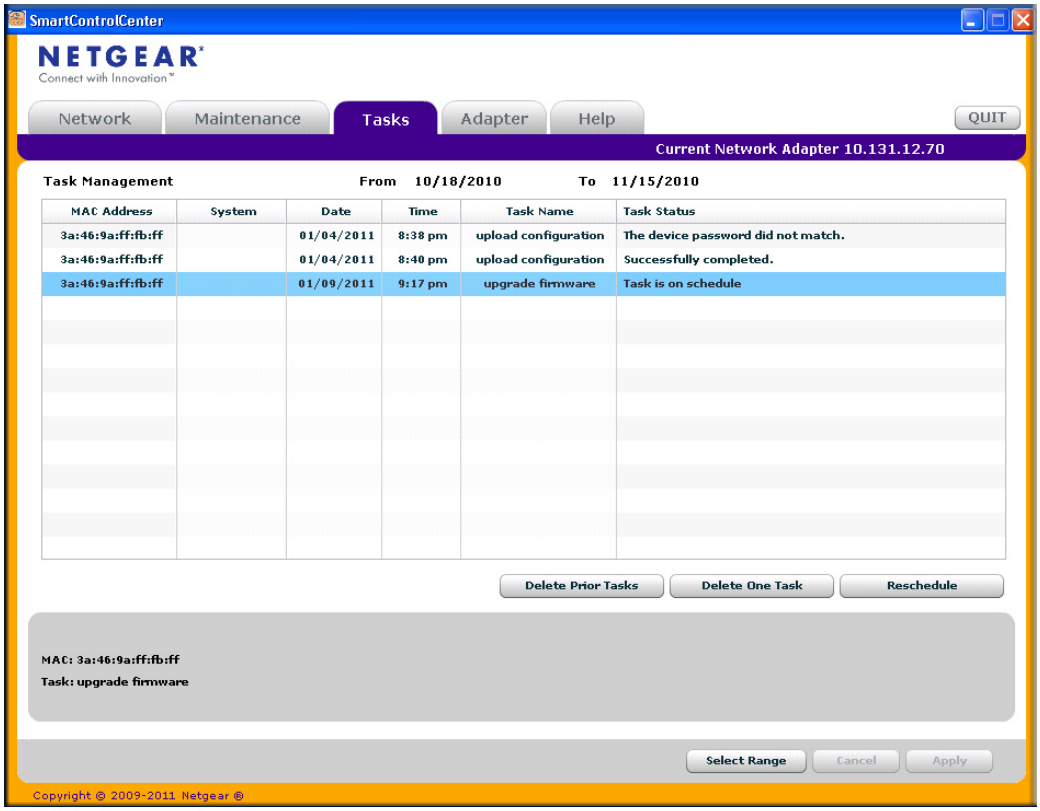



**Figure 3. Tasks Page**

The following list describes the command buttons that are specific to the **Tasks** page:

- **Delete Task**—Remove a completed or schedule task from the list.
- **Reschedule**—Change the scheduled date and time for a pending firmware upgrade.
- **Select Range**—Select all tasks that occurred or are scheduled to occur within a certain period of time.

# User Interfaces

The GS716T and GS724T Smart Switches software includes a set of comprehensive management functions for configuring and monitoring the system by using one of the following methods:

- Web user interface
- Simple Network Management Protocol (SNMP)

Each of the standards-based management methods allows you to configure and monitor the components of the GS716T and GS724T Smart Switches software. The method you use to manage the system depends on your network size and requirements, and on your preference.

The *GS716Tv2 and GS724Tv3 Software Administration Manual* describes how to use the Web-based interface to manage and monitor the system.

## Web Interface

To access the switch by using a Web browser, the browser must meet the following software requirements:

- HTML version 4.0, or later
- HTTP version 1.1, or later
- Java Runtime Environment 1.6 or later

Use the following procedures to log on to the Web interface:

1. Open a Web browser and enter the IP address of the switch in the Web browser address field.
2. The factory default password is **password**. Type the password into the field on the login screen, as shown in *Figure 2* on page 17, and then click **Login**. Passwords are case sensitive.
3. After the system authenticates you, the System Information page displays.

*Figure 4* on page 24 shows the layout of the GS716T and GS724T switch Web interface.

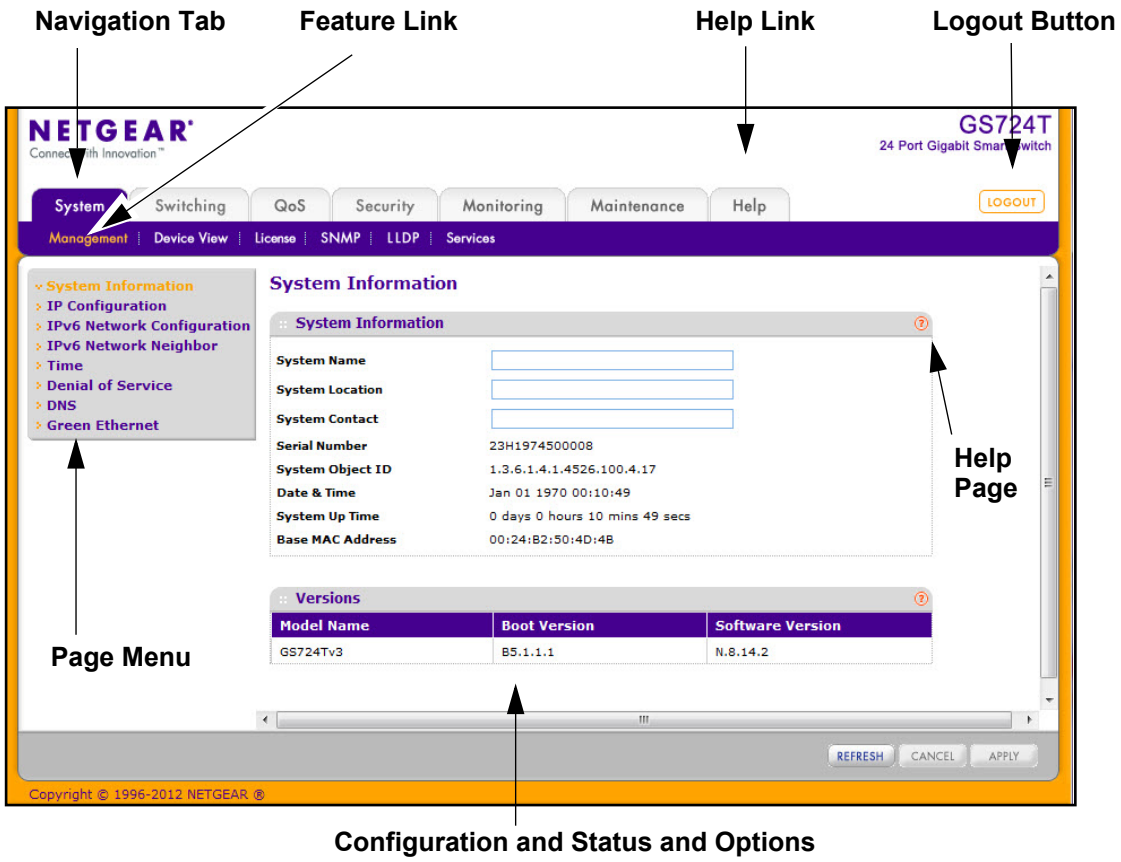



**Figure 4. Administrative Page Layout**

## *Navigation Tabs, Feature Links, and Page Menu*

The navigation tabs along the top of the Web interface give you quick access to the various switch functions. The tabs are always available and remain constant, regardless of which feature you configure.

When you select a tab, the features for that tab appear as links directly under the tabs. The feature links in the blue bar change according to the navigation tab that is selected.

The configuration pages for each feature are available as links in the page menu on the left side of the page. Some items in the menu expand to reveal multiple configuration pages, as *Figure 5* on page 25 shows. When you click a menu item that includes multiple configuration pages, the item becomes preceded by a down arrow symbol and expands to display the additional pages.

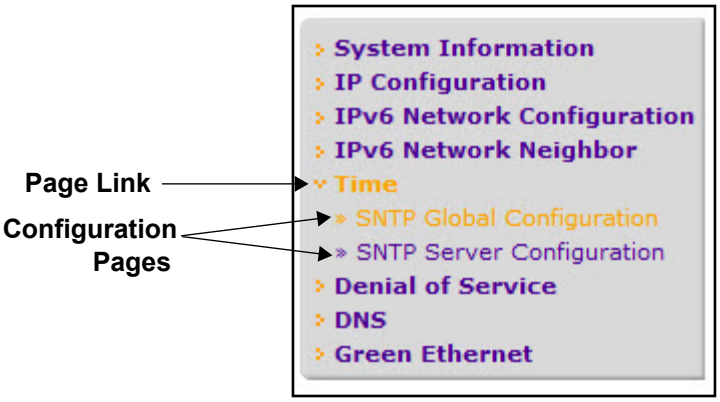



**Figure 5. Menu Hierarchy**

## *Configuration and Status Options*

The area directly under the feature links and to the right of the page menu displays the configuration information or status for the page you select. On pages that contain configuration options, you can input information into fields or select options from drop-down menus.

Each page contains access to the HTML-based help that explains the fields and configuration options for the page. Each page also contains command buttons.

The following table shows the command buttons that are used throughout the pages in the Web interface:

| Button | Function |
|---|---|
| Add | Clicking **Add** adds the new item configured in the heading row of a table. |
| Apply | Clicking the **Apply** button sends the updated configuration to the switch. Configuration changes take effect immediately. |
| Cancel | Clicking **Cancel** cancels the configuration on the screen and resets the data on the screen to the latest value of the switch. |
| Delete | Clicking **Delete** removes the selected item. |
| Refresh | Clicking the **Refresh** button refreshes the page with the latest information from the device. |
| Logout | Clicking the **Logout** button ends the session. |

## Device View

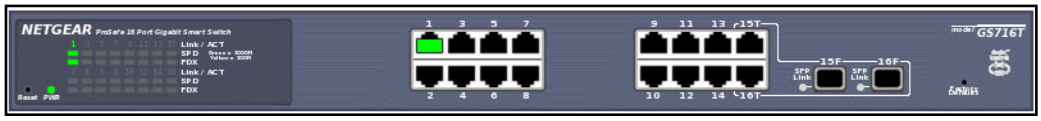
The Device View is a Java® applet that displays the ports on the switch. This graphic provides an alternate way to navigate to configuration and monitoring options. The graphic also provides information about device ports, current configuration and status, table information, and feature components.

The Device View is available from the **System** > **Device View** page.

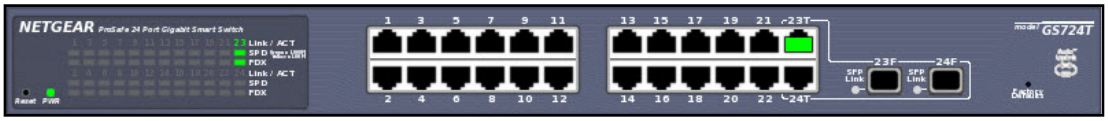
Depending upon the status of the port, the LED of the port illuminates either red, green, or yellow:

- A red LED indicates that the link is disabled.
- A green LED indicates that the port is enabled and operating at a transfer rate of 1000 Mbps.
- A yellow LED indicates that the port is enabled and operating at a transfer rate of 10 Mbps/100 Mbps.

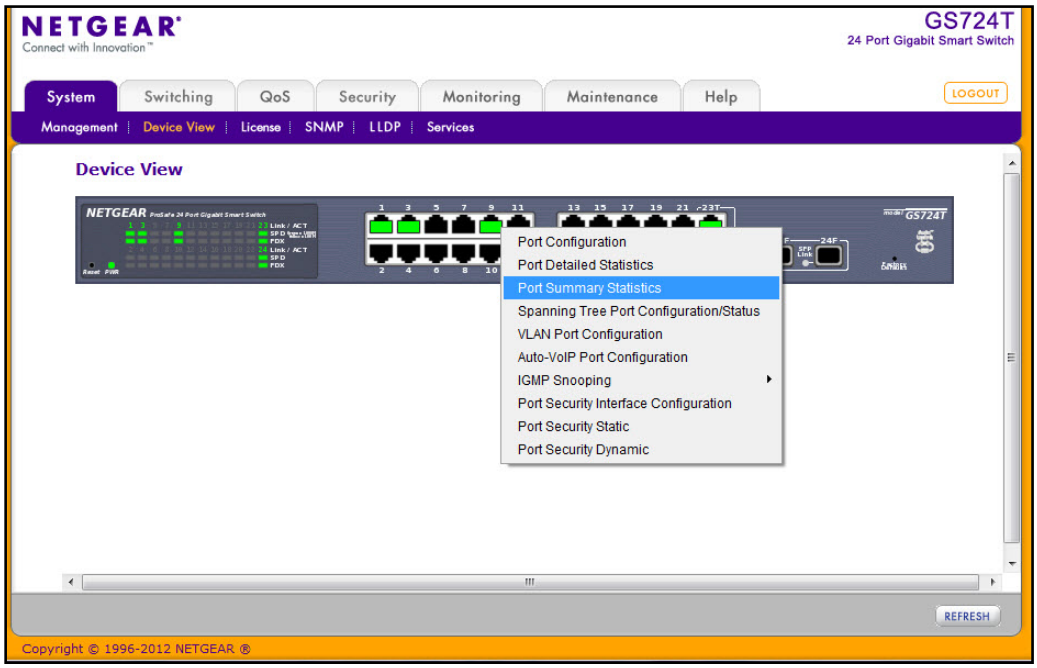
The following image shows the Device View of the GS716T.



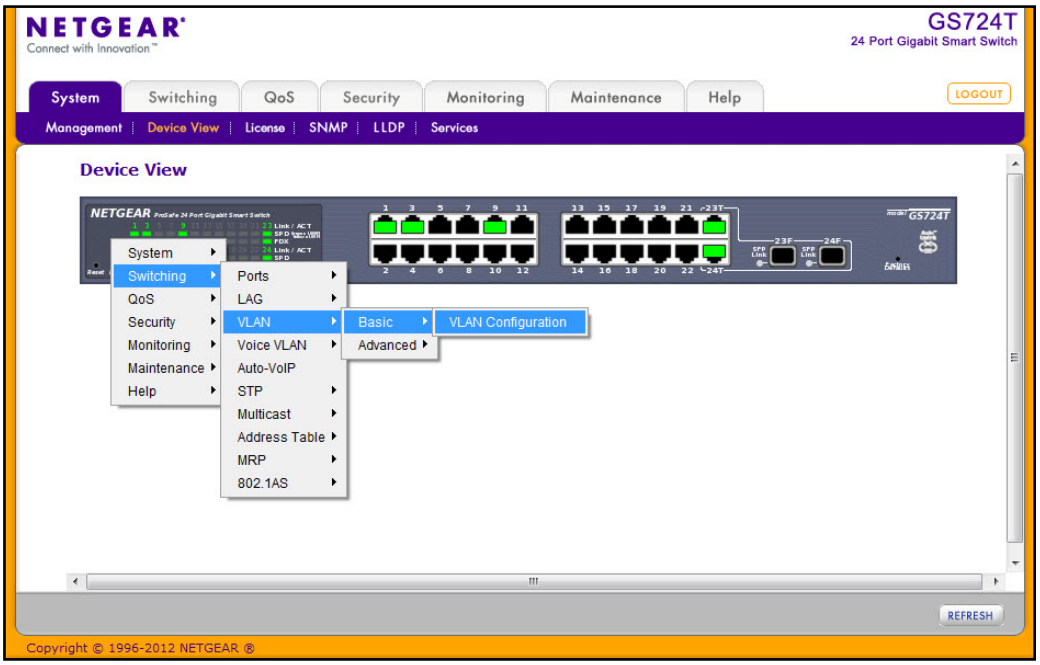

The following image shows the Device View of the GS724T.



Click the port you want to view or configure to see a menu that displays statistics and configuration options. Click the menu option to access the page that contains the configuration or monitoring options.




If you click the graphic, but do not click a specific port, the main menu appears, as the following figure shows. This menu contains the same option as the navigation tabs at the top of the page.



### *Help Page Access*

Every page contains a link to the online help  , which contains information to assist in configuring and managing the switch. The online help pages are context sensitive. For example, if the IP Addressing page is open, the help topic for that page displays if you click Help. *Figure 4* on page 24 shows the location of the Help link on the Web interface.

### *User-Defined Fields*

User-defined fields can contain 1 to 159 characters, unless otherwise noted on the configuration Web page. All characters may be used except for the following (unless specifically noted in for that feature):

\ <

/ >|

* |

?

## SNMP Management

The GS716T and GS724T Smart Switches software supports the configuration of SNMP groups and users that can manage traps that the SNMP agent generates. The switches use both standard public MIBs for standard functionality and private MIBs that support additional switch functionality. All private MIBs begin with a “-” prefix. The main object for interface configuration is in -SWITCHING-MIB, which is a private MIB. Some interface configurations also involve objects in the public MIB, IF-MIB.

SNMP is enabled by default. The **System** > **Management** > **System Information** Web page, which is the page that displays after a successful login, displays the information you need to configure an SNMP manager to access the switch.

Any user can connect to the switch using the SNMPv3 protocol, but for authentication and encryption, the switch supports only one user which is **admin**; therefore there is only one profile that can be created or modified.

To configure authentication and encryption settings for the SNMPv3 admin profile by using the Web interface:

1. Navigate to the **System** > **SNMP** > **SNMPv3** > **User Configuration** page.
2. To enable authentication, select an **Authentication Protocol** option, which is either **MD5** or **SHA**.
3. To enable encryption, select the **DES** option in the **Encryption Protocol** field. Then, enter an encryption code of eight or more alphanumeric characters in the **Encryption Key** field.
4. Click **Apply**.

To access configuration information for SNMPv1 or SNMPv2, click **System** > **SNMP** > **SNMPv1/v2** and click the page that contains the information to configure.

# Interface Naming Convention

The GS716T and GS724T Smart Switches supports physical and logical interfaces. Interfaces are identified by their type and the interface number. All the physical ports 1–48 are Gigabit ports and the SFP Ports 47–50 support 1000M Speed fiber modules. Ports 47–48 are Combo ports and ports 49–50 will support dedicated SFP modules. The number of the port is identified on the front panel. You can configure the logical interfaces by using the software. The following table describes the naming convention for all interfaces available on the switch.

| Interface | Description | Example |
|---|---|---|
| Physical | The physical ports include Gigabit ports and are numbered sequentially starting from one. | g1, g2, g3 |
| Link Aggregation Group (LAG) | LAG interfaces are logical interfaces that are only used for bridging functions. | l1, l2, l3 |
| CPU Management Interface | This is the internal switch interface responsible for the switch base MAC address. This interface is not configurable and is always listed in the MAC Address Table. | c1 |

# 2. System Information Features

Use the features in the **System** tab to define the switch's relationship to its environment. The **System** tab contains links to the following features:



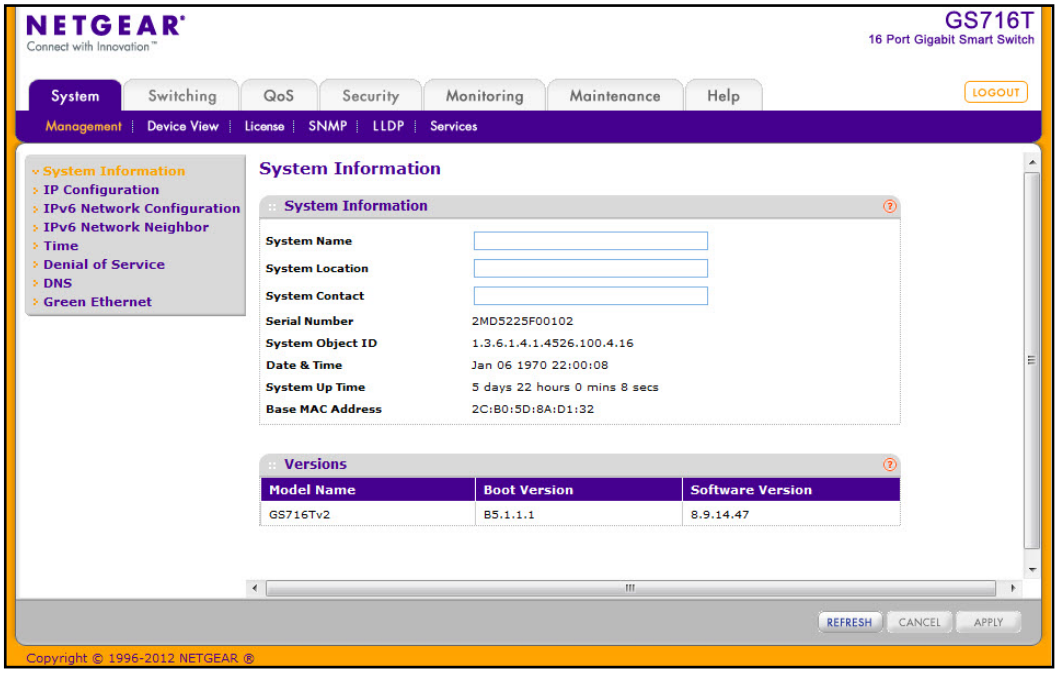
## Management

This section describes how to display the switch status and specify some basic switch information, such as the management interface IP address, system clock settings, and DNS information. From the Management link, you can access the following pages:

# System Information

After a successful login, the System Information page displays. Use this page to configure and view general device information.

To display the System Information page, click **System** > **Management** > **System Information**. A screen similar to the following displays.




To define system information:

1. Open the **System Information** page.
2. Define the following fields:
   - **System Name**. Enter the name you want to use to identify this switch. You may use up to 31 alphanumeric characters. The factory default is blank.
   - **System Location**. Enter the location of this switch. You may use up to 31 alphanumeric characters. The factory default is blank.
   - **System Contact**. Enter the contact person for this switch. You may use up to 31 alphanumeric characters. The factory default is blank.
3. Click **Apply**.

   The system parameters are applied, and the device is updated.

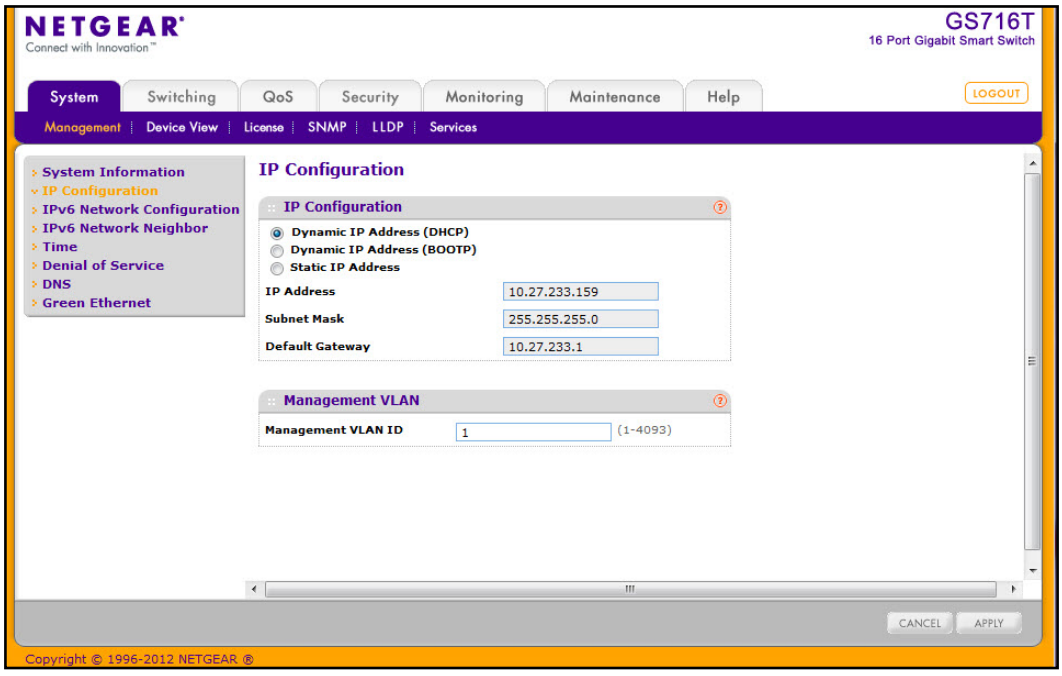
The following table describes the status information the System Page displays.

| Field | Description |
|---|---|
| Serial Number | The serial number of the switch. |
| System Object ID | The base object ID for the switch's enterprise MIB. |
| Date & Time | The current date and time. |
| System Up Time | Displays the number of days, hours, and minutes since the last system restart. |
| Base MAC Address | The universally assigned network address. |
| Model Name | The model name of the switch. |
| Boot Version | The boot code version of the switch. |
| Software Version | The software version of the switch. |

# IP Configuration

Use the IP Configuration page to configure network information for the management interface, which is the logical interface used for in-band connectivity with the switch through any of the switch's front panel ports. The configuration parameters associated with the switch's network interface do not affect the configuration of the front panel ports through which traffic is switched or routed.

To access the page, click **System** > **Management** > **IP Configuration**. A screen similar to the following displays.



To configure the network information for the management interface:

1. Select the appropriate radio button to determine how to configure the network information for the switch management interface:
   - **Dynamic IP Address (DHCP)**. Specifies that the switch must obtain the IP address through a DHCP server.
   - **Dynamic IP Address (BOOTP)**. Specifies that the switch must obtain the IP address through a BootP server.
   - **Static IP Address**. Specifies that the IP address, subnet mask, and default gateway must be manually configured. Enter this information in the fields below this radio button.
2. If you selected the Static IP Address option, configure the following network information:
   - **IP Address**. The IP address of the network interface. The factory default value is 192.168.0.239. Each part of the IP address must start with a number other than zero. For example, IP addresses 001.100.192.6 and 192.001.10.3 are not valid.
   - **Subnet Mask**. The IP subnet mask for the interface. The factory default value is 255.255.255.0.
   - **Default Gateway**. The default gateway for the IP interface. The factory default value is 192.168.0.254.
3. Specify the VLAN ID for the management VLAN.

   The management VLAN is used to establish an IP connection to the switch from a workstation that is connected to a port in the same VLAN. If not specified, the active management VLAN ID is 1 (default), which allows an IP connection to be established through any port.

   When the management VLAN is set to a different value, an IP connection can be made only through a port that is part of the management VLAN. It is also mandatory that the port VLAN ID (PVID) of the port to be connected in that management VLAN be the same as the management VLAN ID.

   The management VLAN has the following requirements:

   - Only one management VLAN can be active at a time.
   - When a new management VLAN is configured, connectivity through the existing management VLAN is lost.
   - The management station should be reconnected to the port in the new management VLAN.

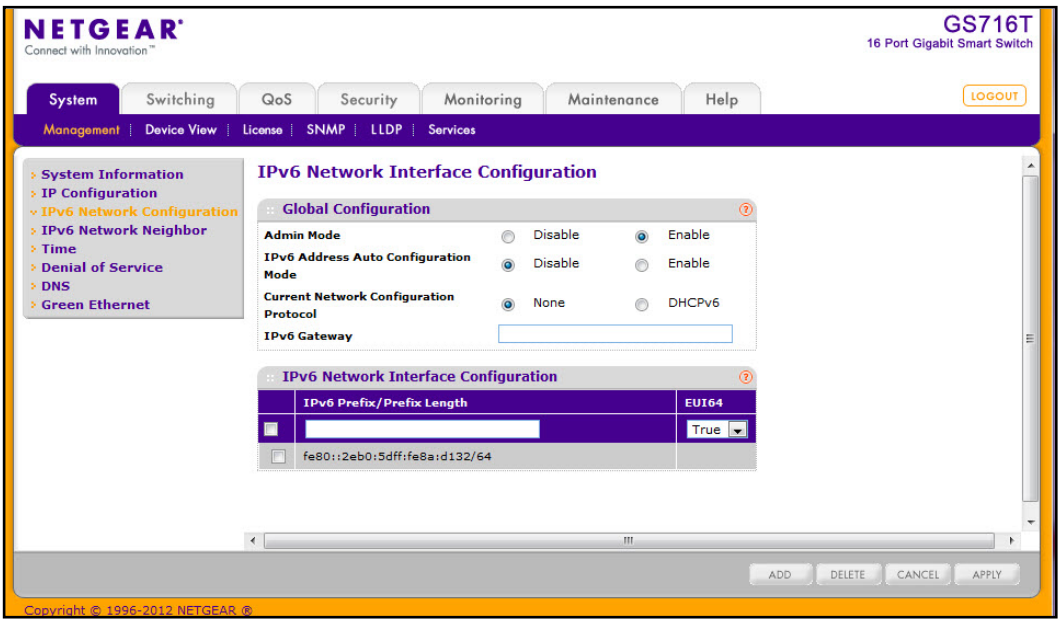
**Note:** Make sure that the VLAN to be configured as the management VLAN exists. And make sure that the PVID of at least one port that is a port of the VLAN is the same as the management VLAN ID. For information about creating VLANs and configuring the PVID for a port, see *VLANs* on page 89.

4. If you change any of the network connection parameters, click **Apply** to apply the changes to the system.
5. Click **Cancel** to cancel the configuration on the screen and reset the data on the screen to the latest value of the switch.

# IPv6 Network Configuration

Use the IPv6 Network Configuration page to configure the IPv6 network interface, which is the logical interface used for in-band connectivity with the switch via all of the switch's front-panel ports. The configuration parameters associated with the switch's network interface do not affect the configuration of the front-panel ports through which traffic is switched or routed.

To access the page, click **System** > **Management** > **IPv6 Network Configuration**. A screen similar to the following displays.




To access the switch over an IPv6 network, you must initially configure the switch with IPv6 information (IPv6 prefix, prefix length, and default gateway). IPv6 can be configured using any of the following options:

- IPv6 Auto Configuration
- DHCPv6

When in-band connectivity is established, IPv6 information can be changed using any of the following:

- SNMP-based management
- Web-based management

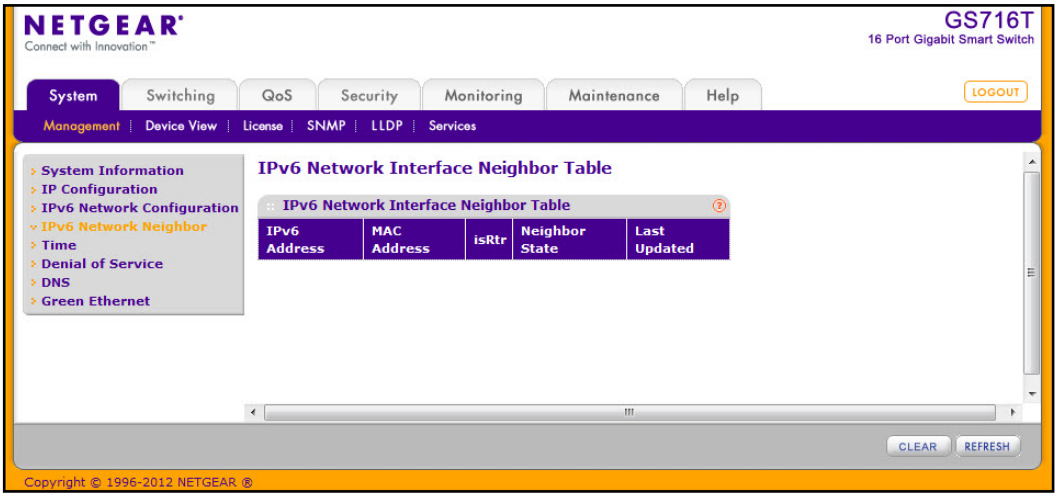
To configure the network information for an IPv6 network:

1. **Admin Mode**. Enable or disable the IPv6 network interface on the switch. The default value is Enable.
2. **IPv6 Address Auto Configuration Mode**. The IPv6 address for the IPv6 network interface is set in auto configuration mode if this option is enabled. The default value is Disable. Auto configuration can be enabled only when DHCPv6 is not enabled on any of the management interfaces.
3. **Current Network Configuration Protocol**. The IPv6 address for the IPv6 network interface is configured by DHCPv6 protocol if this option is enabled. The default value is None. DHCPv6 can be enabled only when IPv6 Auto config or DHCPv6 are not enabled on any of the management interfaces.
4. **DHCPv6 Client DUID**. Identifier used to identify the client's unique DUID value. This option only displays when DHCPv6 is enabled.
5. **IPv6 Gateway**. Specify the gateway for the IPv6 network interface. The gateway address is in IPv6 global or link-local address format.
6. **IPv6 Prefix/Prefix Length**. Add the IPv6 prefix and prefix length to the IPv6 network interface. The address is in the global address format.
7. **EUI64**. Specify whether format IPv6 address in EUI-64 format. The default value is False.
8. Click **Add** to add a new IPv6 address in global format.
9. Click **Delete** to delete a selected IPv6 address.
10. Click **Apply** to apply the changes to the system.
11. Click **Cancel** to cancel the configuration on the screen and reset the data on the screen to the latest value of the switch.

# IPv6 Network Neighbor

Use the IPv6 Network Neighbor page to configure the IPv6 Network Interface IPv6 Neighbor Table.

To access the page, click **System** > **Management** > **IPv6 Network Neighbor**. A screen similar to the following displays.




Click **Clear** to delete all entries from the table. The table is repopulated as the IPv6 neighbors are discovered on the network. Click **Refresh** to refresh the screen with most recent data.

The following table describes the information the IPv6 Network Interface Neighbor Table displays

| Field | Description |
|---|---|
| IPv6 Address | Specifies the IPv6 address of neighbor or interface. |
| MAC Address | Specifies MAC address associated with an interface. |
| IsRtr | Indicates whether the neighbor is a router. If the neighbor is a router, the value is True. If the neighbor is not a router, the value is False. |

| Field | Description |
|---|---|
| Neighbor State | Specifies the state of the neighbor cache entry. The following are the states for dynamic entries in the IPv6 neighbor discovery cache:<br>• **Reachable**. Positive confirmation was received within the last Reachable Time milliseconds that the forward path to the neighbor was functioning properly. While in REACH state, the device takes no special action as packets are sent.<br>• **Stale**. More than ReachableTime milliseconds have elapsed since the last positive confirmation was received that the forward path was functioning properly. While in STALE state, the device takes no action until a packet is sent.<br>• **Delay**. More than ReachableTime milliseconds have elapsed since the last positive confirmation was received that the forward path was functioning properly. A packet was sent within the last DELAY_FIRST_PROBE_TIME seconds. If no reachability confirmation is received within DELAY_FIRST_PROBE_TIME seconds of entering the DELAY state, send a neighbor solicitation message and change the state to PROBE.<br>• **Probe**. A reachability confirmation is actively sought by resending neighbor solicitation messages every RetransTimer milliseconds until a reachability confirmation is received.<br>• **Unknown**. The switch cannot determine the state of the cache entry. |
| Last Updated. | Time since the address was confirmed to be reachable. |

# Time

GS716T and GS724T Smart Switches software supports the Simple Network Time Protocol (SNTP). You can also set the system time manually

SNTP assures accurate network device clock time synchronization up to the millisecond. Time synchronization is performed by a network SNTP server. GS716T and GS724T Smart Switches software operates only as an SNTP client and cannot provide time services to other systems.

Time sources are established by Stratums. Stratums define the accuracy of the reference clock. The higher the stratum (where zero is the highest), the more accurate the clock. The device receives time from stratum 1 and above since it is itself a stratum 2 device.

The following is an example of stratums:

- **Stratum 0**: A real-time clock is used as the time source, for example, a GPS system.
- **Stratum 1**: A server that is directly linked to a Stratum 0 time source is used. Stratum 1 time servers provide primary network time standards.
- **Stratum 2**: The time source is distanced from the Stratum 1 server over a network path. For example, a Stratum 2 server receives the time over a network link, via NTP, from a Stratum 1 server.

Information received from SNTP servers is evaluated based on the time level and server type.

SNTP time definitions are assessed and determined by the following time levels:

- **T1**: Time at which the original request was sent by the client.
- **T2**: Time at which the original request was received by the server.
- **T3**: Time at which the server sent a reply.
- **T4**: Time at which the client received the server's reply.

The device can poll Unicast server types for the server time.

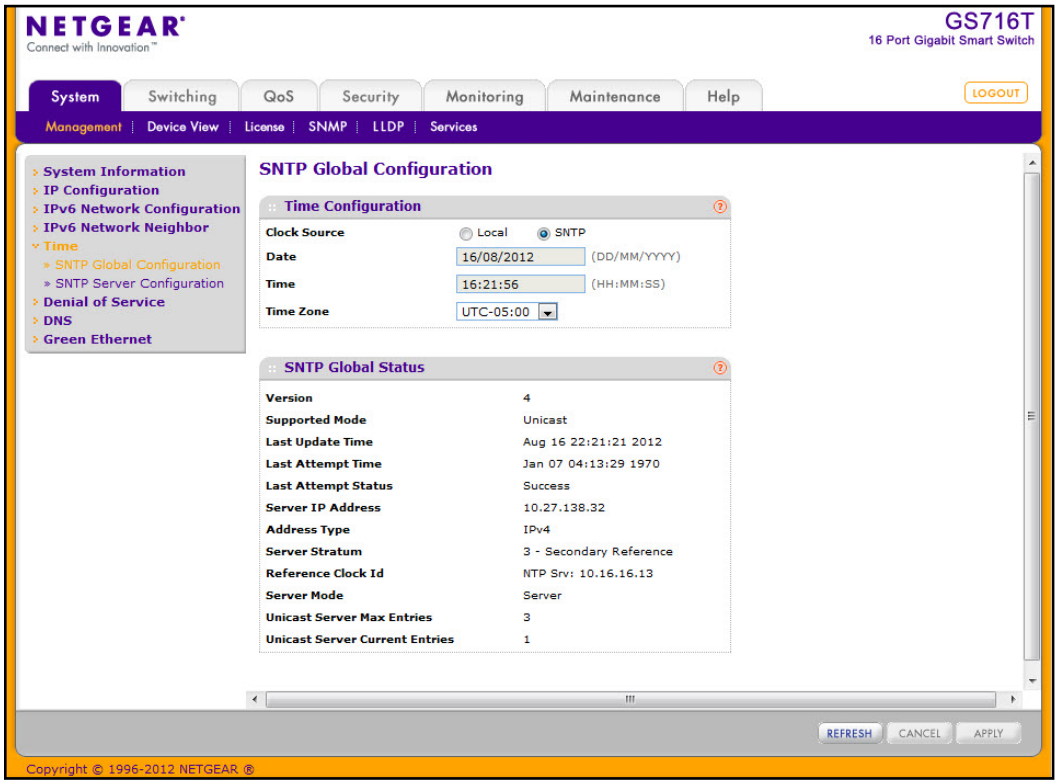
Polling for Unicast information is used for polling a server for which the IP address is known. SNTP servers that have been configured on the device are the only ones that are polled for synchronization information. T1 through T4 are used to determine server time. This is the preferred method for synchronizing device time because it is the most secure method. If this method is selected, SNTP information is accepted only from SNTP servers defined on the device using the SNTP Server Configuration page.

The device retrieves synchronization information, either by actively requesting information or at every poll interval.

## *Time Configuration*

Use the Time Configuration page to view and adjust date and time settings.

To display the Time Configuration page, click **System** > **Management** > **Time** > **SNTP Global Configuration**.



To configure the time by using the CPU clock cycle as the source:

1. From the Clock Source field, select **Local**.
2. In the **Date** field, enter the date in the DD/MM/YYYY format.
3. In the **Time** field, enter the time in HH:MM:SS format.

**Note:** If you do not enter a date and time, the switch will calculate the date and time using the CPU's clock cycle.

When the Clock Source is set to **Local**, the **Time Zone** field is grayed out (disabled):

4. Click **Apply** to send the updated configuration to the switch. Configuration changes occur immediately.

To configure the time through SNTP:

1. From the Clock Source field, select **SNTP**.

   When the **Clock Source** is set to SNTP, the Date and Time fields are grayed out (disabled). The switch gets the date and time from the network.
2. Use the menu to select the Coordinated Universal Time (UTC) time zone in which the switch is located, expressed as the number of hours.
3. Click **Apply** to send the updated configuration to the switch. Configuration changes take effect immediately.
4. Use the **SNTP Server Configuration** page to configure the SNTP server settings, as described in *SNTP Server Configuration* on page 42.
5. Click **Refresh** to refresh the page with the most current data from the switch.
6. Click **Cancel** to cancel the configuration on the screen and reset the data on the screen to the latest value of the switch.

The SNTP Global Status table on the **Time Configuration** page displays information about the system's SNTP client. The following table describes the SNTP Global Status fields.

| Field | Description |
|---|---|
| Version | Specifies the SNTP Version the client supports. |
| Supported Mode | Specifies the SNTP modes the client supports. Multiple modes may be supported by a client. |
| Last Update Time | Specifies the local date and time (UTC) the SNTP client last updated the system clock. |
| Last Attempt Time | Specifies the local date and time (UTC) of the last SNTP request or receipt of an unsolicited message. |

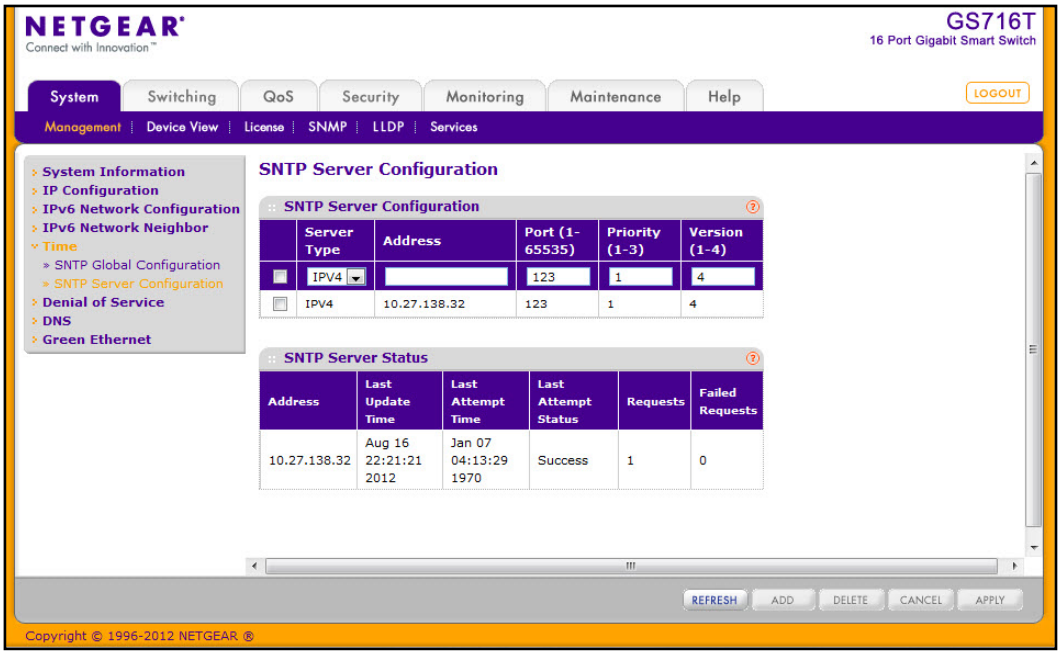
| Field | Description |
|---|---|
| Last Attempt Status | Specifies the status of the last SNTP request or unsolicited message for both unicast mode. If no message has been received from a server, a status of Other is displayed. These values are appropriate for all operational modes:<br>• **Other**: None of the following enumeration values.<br>• **Success**: The SNTP operation was successful and the system time was updated.<br>• **Request Timed Out**: A directed SNTP request timed out without receiving a response from the SNTP server.<br>• **Bad Date Encoded**: The time provided by the SNTP server is not valid.<br>• **Version Not Supported**: The SNTP version supported by the server is not compatible with the version supported by the client.<br>• **Server Unsynchronized**: The SNTP server is not synchronized with its peers. This is indicated via the 'leap indicator' field on the SNTP message.<br>• **Server Kiss Of Death**: The SNTP server indicated that no further queries were to be sent to this server. This is indicated by a stratum field equal to 0 in a message received from a server. |
| Server IP Address | Specifies the IP address of the server for the last received valid packet. If no message has been received from any server, an empty string is shown. |
| Address Type | Specifies the address type of the SNTP Server address for the last received valid packet. |
| Server Stratum | Specifies the claimed stratum of the server for the last received valid packet. |
| Reference Clock Id | Specifies the reference clock identifier of the server for the last received valid packet. |
| Server Mode | Specifies the mode of the server for the last received valid packet. |
| Unicast Sever Max Entries | Specifies the maximum number of unicast server entries that can be configured on this client. |
| Unicast Server Current Entries | Specifies the number of current valid unicast server entries configured for this client. |

Click **Refresh** to refresh the page with the most current data from the switch.

## SNTP Server Configuration

Use the SNTP Server Configuration page to view and modify information for adding and modifying Simple Network Time Protocol SNTP servers.

To display the SNTP Server Configuration page, click **System** > **Management** > **Time** > **SNTP Server Configuration**.




To configure a new SNTP Server:

1. Enter the appropriate SNTP server information in the available fields:
   - **Server Type**. Specifies whether the address for the SNTP server is an IP address (IPv4) or host name (DNS).
   - **Address**. Enter the IP address or the host name of the SNTP server.
   - **Port**. Enter a port number on the SNTP server to which SNTP requests are sent. The valid range is 1–65535. The default is 123.
   - **Priority**. Specifies the priority of this server entry in determining the sequence of servers to which SNTP requests are sent. Enter a priority from 1–3, with 1 being the default and the highest priority. Servers with lowest numbers have priority.
   - **Version**. Enter the protocol version number that corresponds to the NTP version running on the SNTP server. The range is 1–4, and the default version is SNTPv4.
2. Click **Add**.
3. Repeat the previous steps to add additional SNTP servers. You can configure up to three SNTP servers.
4. To removing an SNTP server, select the check box next to the configured server to remove, and then click **Delete**. The entry is removed, and the device is updated.

5. To change the settings for an existing SNTP server, select the check box next to the configured server and enter new values in the available fields, and then click **Apply**. Configuration changes take effect immediately.
6. Click **Cancel** to cancel the configuration on the screen and reset the data on the screen to the latest value of the switch.

The SNTP Server Status table displays status information about the SNTP servers configured on your switch. The following table describes the SNTP Global Status fields.

| Field | Description |
|---|---|
| Address | Specifies all the existing Server Addresses. If no Server configuration exists, a message saying “No SNTP server exists” flashes on the screen. |
| Last Update Time | Specifies the local date and time (UTC) that the response from this server was used to update the system clock. |
| Last Attempt Time | Specifies the local date and time (UTC) that this SNTP server was last queried. |
| Last Attempt Status | Specifies the status of the last SNTP request to this server. If no packet has been received from this server, a status of Other is displayed:<br>• **Other**: None of the following enumeration values.<br>• **Success**: The SNTP operation was successful and the system time was updated.<br>• **Request Timed Out**: A directed SNTP request timed out without receiving a response from the SNTP server.<br>• **Bad Date Encoded**: The time provided by the SNTP server is not valid.<br>• **Version Not Supported**: The SNTP version supported by the server is not compatible with the version supported by the client.<br>• **Server Unsynchronized**: The SNTP server is not synchronized with its peers. This is indicated via the 'leap indicator' field on the SNTP message.<br>• **Server Kiss Of Death**: The SNTP server indicated that no further queries were to be sent to this server. This is indicated by a stratum field equal to 0 in a message received from a server. |
| Requests | Specifies the number of SNTP requests made to this server since last agent reboot. |
| Failed Requests | Specifies the number of failed SNTP requests made to this server since last reboot. |

Click **Refresh** to refresh the page with the most current data from the switch.

# Denial of Service

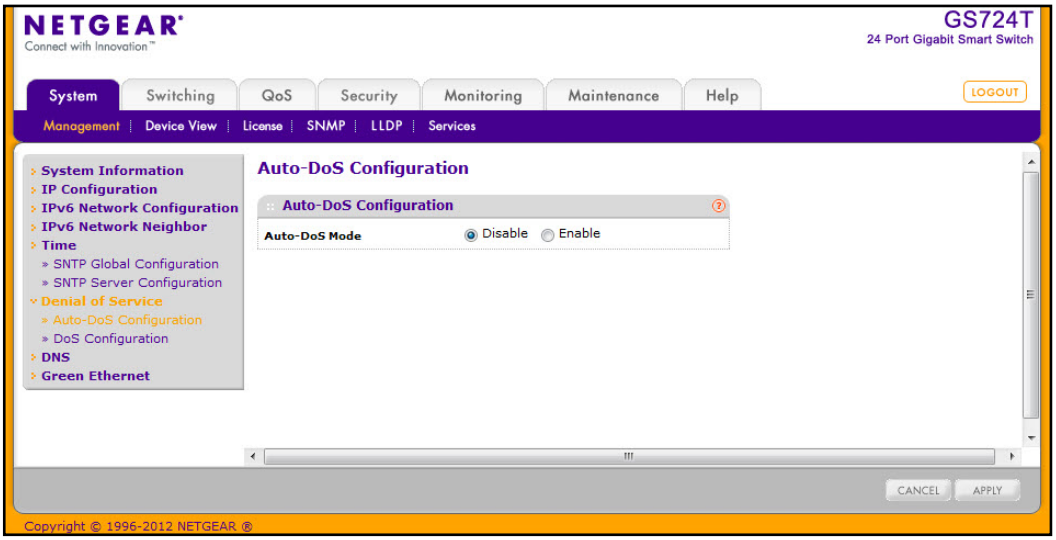
Use the Denial of Service (DoS) page to configure DoS control. The GS716T and GS724T switch provide support for classifying and blocking specific types of DoS attacks. The type of DoS attacks the switch can detect and prevent are described in *DoS Configuration* on page 45.

## *Auto-DoS Configuration*

The Auto-DoS Configuration page lets you automatically enable all the DoS features available on the switch, except for TCP and UDP port attacks. See *DoS Configuration* on page 45 for information about the types of DoS attacks the switch can monitor and block.

**Note:** When Auto-DoS is enabled, a port that is under attack is automatically shut down and does not forward traffic. The port can be enabled only manually by the *admin* user. A warning message is logged to the buffered log and is sent to the Syslog server.

To access the **Auto-DoS Configuration** page, click **System** > **Management** > **Denial of Service** > **Auto-DoS Configuration**.



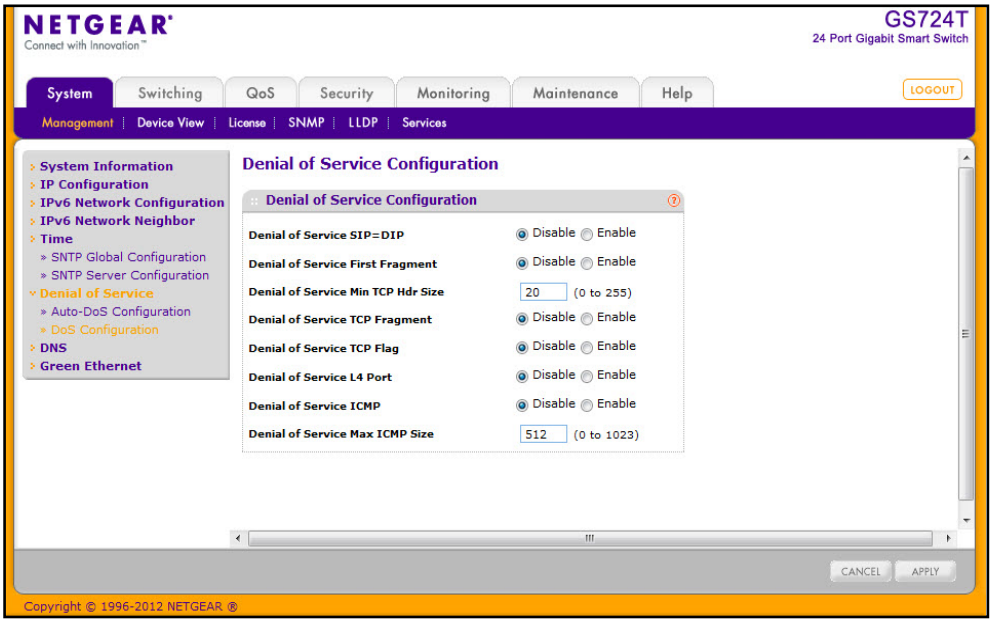
To configure the **Auto-DoS** feature:

1. Select a radio button to enable or disable Auto-DoS:
   - **Disable**. Auto-DoS is disabled (default).
   - **Enable**. Auto-DoS is enabled.
2. Click **Apply** to send the updated configuration to the switch. Configuration changes occur immediately.
3. Click **Cancel** to cancel the configuration on the screen and reset the data on the screen to the latest value of the switch.

## *DoS Configuration*

The **DoS Configuration** page lets you to select which types of DoS attacks for the switch to monitor and block.

To access the **DoS Configuration** page, click **System** > **Management** > **Denial of Service** > **DoS Configuration**.




To configure individual DoS settings:

1. Select the types of DoS attacks for the switch to monitor and block and configure any associated values, as the following list describes.
   - **Denial of Service SIP=DIP**: Enable or disable this option by selecting the corresponding line on the radio button. Enabling SIP=DIP DoS prevention causes the switch to drop packets that have a source IP address equal to the destination IP address. The factory default is disabled.
   - **Denial of Service First Fragment**: IP Fragment Offset = 1. Enable or disable this option by selecting the corresponding line on the radio button. Enabling First Fragment DoS prevention causes the switch to drop packets that have an IP fragment offset equal to 1. The factory default is disabled.

- **Denial of Service Min TCP Hdr Size**: Specifies the Min TCP Hdr Size allowed. If First TCP Fragment DoS prevention is enabled, then the switch will drop packets that have a TCP header smaller than this configured Min TCP Hdr Size. The factory default is 20.
- **Denial of Service TCP Fragment**: TCP Header size is smaller than the configured value. Enable or disable this option by selecting the corresponding line on the radio button. Enabling TCP Fragment DoS prevention causes the switch to drop packets that have a TCP header smaller than the configured Min TCP Hdr Size. The factory default is disabled.
- **Denial of Service TCP Flag**: Enable or disable this option by selecting the corresponding line on the radio button. Enabling TCP Flag DoS prevention causes the switch to drop packets that have TCP flag SYN set and TCP source port less than 1024 or TCP control flags set to 0 and TCP sequence number set to 0 or TCP flags FIN, URG, and PSH set and TCP sequence number set to 0 or both TCP flags SYN and FIN set. The factory default is disabled.
- **Denial of Service L4 Port**: Enable or disable this option by selecting the corresponding line on the radio button. Enabling L4 Port DoS prevention causes the switch to drop packets that have TCP/UDP source port equal to TCP/UDP destination port. The factory default is disabled.
- **Denial of Service ICMP**: Enable or disable this option by selecting the corresponding line on the radio button. Enabling ICMP DoS prevention causes the switch to drop ICMP packets that have a type set to ECHO_REQ (ping) and a size greater than the configured ICMP Pkt Size. The factory default is disabled.
- **Denial of Service Mx ICMP Pkt Size**: If ICMP DoS prevention is enabled and if the ICMP echo request is carried in an unfragmented IPv4/IPv6 datagram and if the total length (in the IP header) indicates a value greater than MAX ICMP Size configured + IP header length, then the specified packet is dropped. The factory default is 512.

2. If you change any of the DoS settings, click **Apply** to apply the changes to the switch.
3. Click **Cancel** to cancel the configuration on the screen and reset the data on the screen to the latest value of the switch.

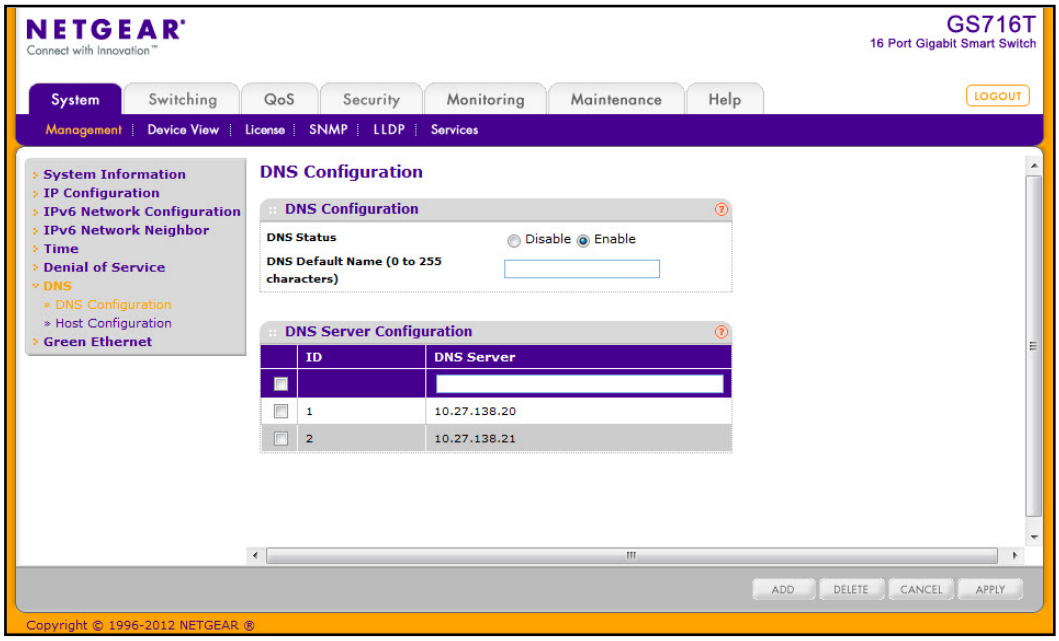
# DNS

You can use these pages to configure information about DNS servers the network uses and how the switch operates as a DNS client.

## *DNS Configuration*

Use this page to configure global DNS settings and DNS server information.

To access this page, click **System** > **Management** > **DNS** > **DNS Configuration**.




To configure the global DNS settings:

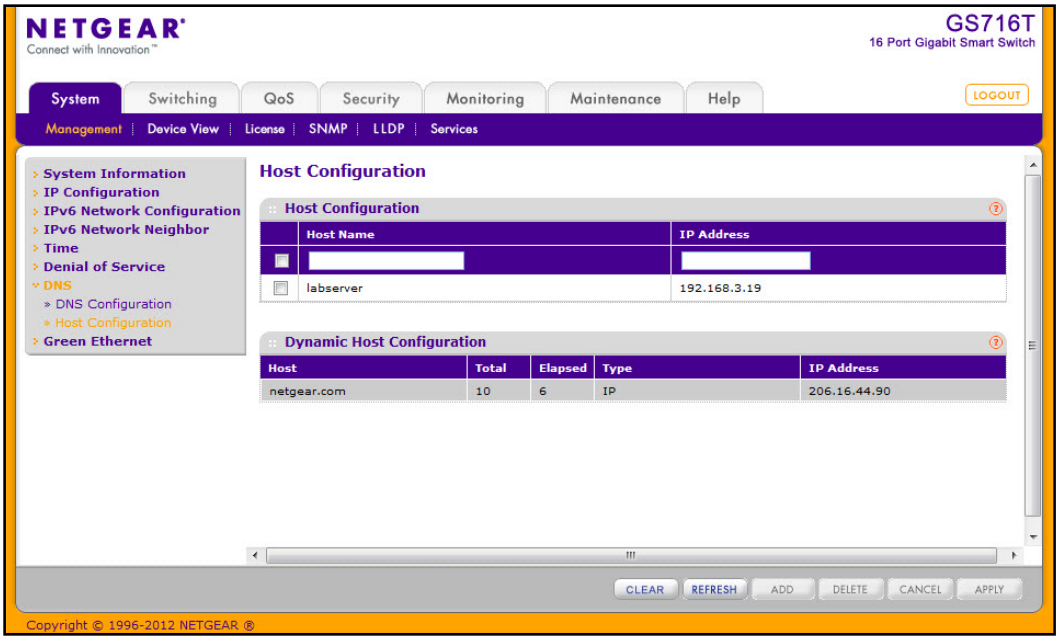
1. Specify whether to enable or disable the administrative status of the DNS Client.
   - **Enable**. Allow the switch to send DNS queries to a DNS server to resolve a DNS domain name. DNS is disabled by default.
   - **Disable**. Prevent the switch from sending DNS queries.
2. Enter the DNS default domain name to include in DNS queries. When the system is performing a lookup on an unqualified host name, this field is provided as the domain name (for example, if default domain name is netgear.com and the user enters test, then test is changed to test.netgear.com to resolve the name).
3. To specify the DNS server to which the switch sends DNS queries, enter an IP address in standard IPv4 dot notation in the **DNS Server Address** and click **Add**. The server appears in the list below. You can specify up to eight DNS servers. The precedence is set in the order created.
4. To remove a DNS server from the list, select the check box next to the server you want to remove and click **Delete**. If no DNS server is specified, the check box is global and will delete all the DNS servers listed.

5. Click **Cancel** to cancel the configuration on the screen and reset the data on the screen to the latest value of the switch.
6. Click **Apply** to send the updated configuration to the switch. Configuration changes take effect immediately.

## *Host Configuration*

Use this page to manually map host names to IP addresses or to view dynamic DNS mappings.

To access this page, click **System** > **Management** > **DNS** > **Host Configuration**.




To add a static entry to the local DNS table:

1. Specify the static host name to add. Each substring must be less than 64 characters in length separated by a dot or space, and the length of the whole string must not exceed 158 characters.
2. Specify the IP address in standard IPv4 dot notation to associate with the host name.
3. Click **Add**. The entry appears in the list below.
4. To remove an entry from the static DNS table, select the check box next to the entry and click **Delete**.
5. To change the host name or IP address in an entry, select the check box next to the entry and enter the new information in the appropriate field, and then click **Apply**.
6. Click **Cancel** to cancel the configuration on the screen and reset the data on the screen to the latest value of the switch.

The Dynamic Host Configuration table shows host name-to-IP address entries that the switch has learned. The following table describes the dynamic host fields:

| Field | Description |
|---|---|
| Host | Lists the host name you assign to the specified IP address. |
| Total | Amount of time since the dynamic entry was first added to the table. |
| Elapsed | Amount of time since the dynamic entry was last updated. |
| Type | The type of the dynamic entry. |
| Addresses | Lists the IP address associated with the host name. |

Click **Refresh** to refresh the table with the most current data from the switch.

Click **Clear** to delete Dynamic Host Entries. The table will be repopulated with entries as they are learned.

## Green Ethernet

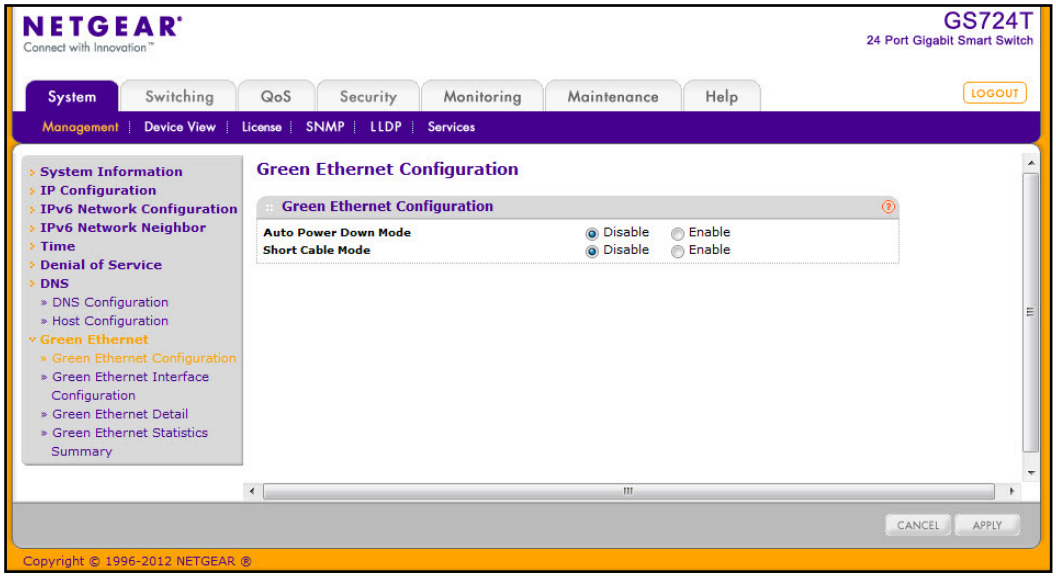
The Green Ethernet features allow the switch to reduce power consumption on a per-port basis, except for the Combo ports (g15–16 for GS716T; g23–24 for GS724T). Each switch can support one or more of the following features:

- Energy-detect Mode - When the Energy Detect mode is enabled and the port link is down, the PHY automatically goes down for short period of time and then wakes up to check link pulses. This mode reduces power consumption on the port when no link partner is present.
- Short Cable Mode: With Short Cable mode enabled, the PHY goes into low power mode when the cable length is less than a certain limit.

## Green Ethernet Configuration

Use this page to configure the administrative mode for the Green Ethernet features available on the switch. These features must also be enabled on each port to take advantage of the possible power savings.

To access this page, click **System** > **Management** > **Green Ethernet Configuration**.



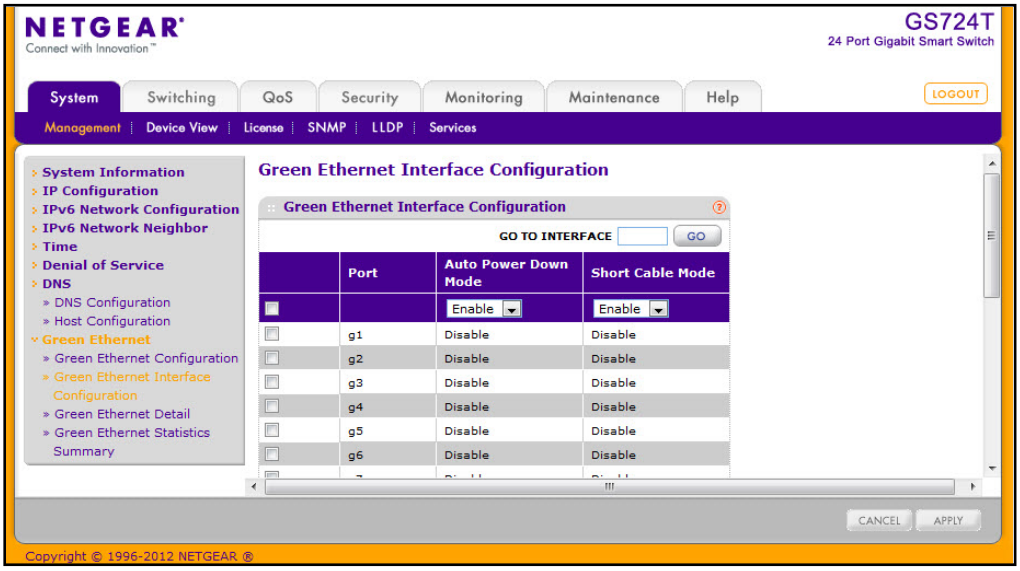

To configure the Green Ethernet feature:

1. Enable or disable the **Auto Power Down Mode**.
   - **Enable**. When the port link is down, the PHY will automatically go down for a short period of time and then wake up to check link pulses. This allows the port to continue to perform auto-negotiation while consuming less power when no link partner is present.
   - **Disable**. Provide full power to the port even if no link partner is present.
2. Enable or disable the **Short Cable Mode**.
   - **Enable**. The switch performs a cable test when the port link is up. If the cable that connects the port to its link partner has a length less than 10m, PHYs are placed in low-power mode (nominal power).
   - **Disable**. Do not perform an automatic cable test on a linked port or adjust the port power based on the cable length.
3. Click **Apply** to send the updated configuration to the switch. Configuration changes take effect immediately.

## *Green Ethernet Interface Configuration*

Use this page to configure Green Ethernet features on a per-port basis. The Green Ethernet modes must be administratively enabled on the switch for the mode enabled on the port to take effect.

To access this page, click **System** > **Management** > **Green Ethernet** > **Green Ethernet Interface Configuration**.



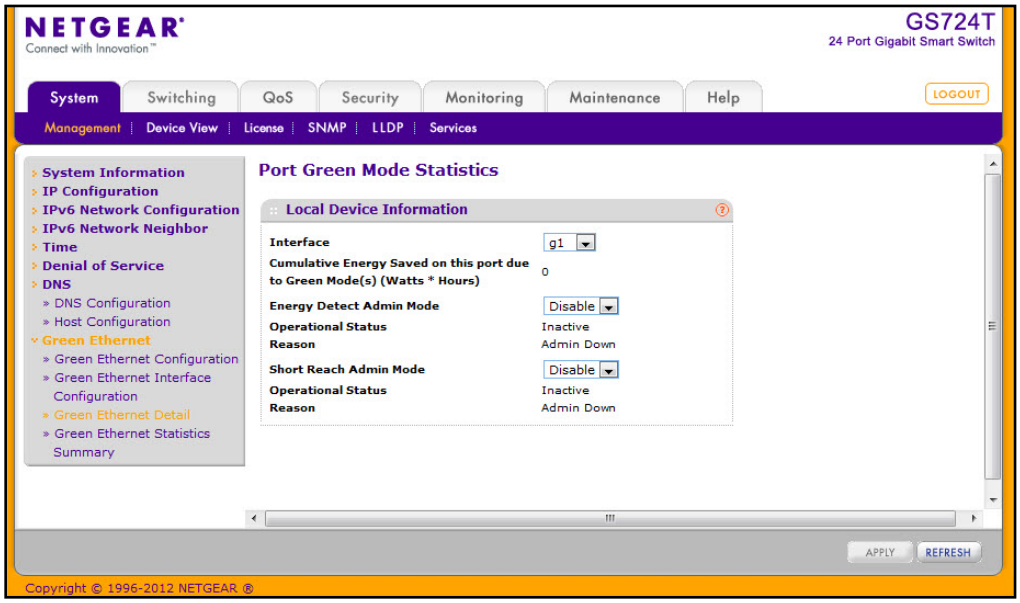

To configure the Green Ethernet Interface feature:

1. Select the check box next to the port to configure. You can select multiple ports to apply the same setting to all selected ports. To configure all ports, select the check box in the heading row.
2. Enable or disable the **Auto Power-Down Mode**.
   - **Enable**. When the port link is down, the PHY automatically goes down for a short period of time and then wake up to check link pulses. This behavior saves power consumption when there is no link partner while still allowing the port to perform auto-negotiation if a link partner does become present.
   - **Disable**. The PHY remains up even if no link partner is present.
3. Enable or disable the **Short Cable Mode**.
   - **Enable**. The switch performs a cable test on each cable connect to its ports. If the cable is less than 10m in length, the port is placed in low power mode (nominal power).
   - **Disable**. Full transmit power is provided to all ports, regardless of cable length.
4. Click **Apply** to apply the change to the system. Configuration changes take effect immediately.
5. Click **Cancel** to cancel the configuration on the screen and reset the data on the screen to the latest value of the switch.

## *Green Ethernet Detail*

Use this page to configure Green Ethernet monitor and manage Green Ethernet features on a specific port.

To access this page, click **System** > **Management** > **Green Ethernet** > **Green Ethernet Detail**.



To configure or view details about the Green Ethernet feature on a port:

1. Within the Local Device Information, select the port to view or configure from the Interface menu.
2. Enable or disable the Energy Detect or Short Reach administrative modes on the interface.
3. If you make any changes to the Green Ethernet modes for the port, click **Apply**.
4. View the additional Green Ethernet information that displays for the port:

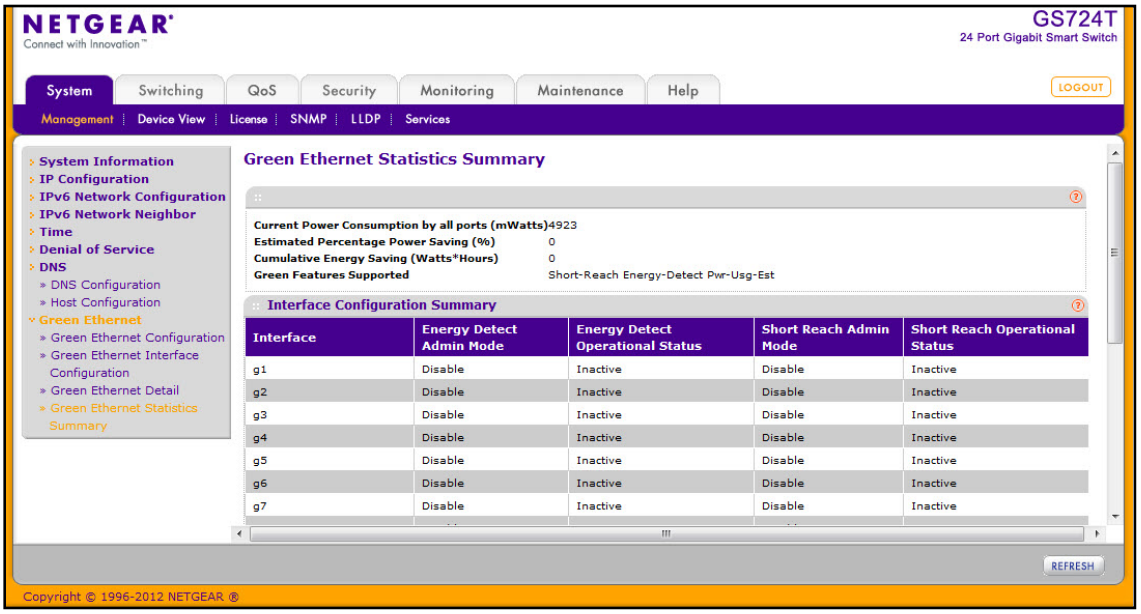
| Field | Description |
|---|---|
| Cumulative Energy Saved on this port due to Green Mode(s) (Watts * Hours) | Shows the energy savings per port, per hour. |
| Operational Status (Energy Detect) | Shows the Green Mode operational status, either Inactive or Active. |
| Reason | Shows the Admin status, either Admin Down or Admin Up. |
| Operational Status (Short Reach) | Shows the operational status of the port, either Active or Inactive. |
| Reason | Shows the reason why the port is either Active or Inactive. |

5. Click **Clear** to reset the counters on the page to their default values.
6. Click **Refresh** to update the page with the current information.

## *Green Ethernet Statistics Summary*

This page summarizes the Green Ethernet Summary settings currently in use.

To access this page, click **System** > **Management** > **Green Ethernet** > **Green Ethernet Statistics Summary**.




The following table describes the information available on the Green Mode Statistics Summary page.

| Field | Description |
|---|---|
| Current Power Consumption by all ports in Stack (mWatts) | Estimated Power Consumption by all ports in the stack in mWatts. |
| Estimated Percentage Power Saving per stack (%) | Estimated Percentage Power saved on all ports in the stack due to Green mode(s) enabled. |
| Cumulative Energy Saving per Stack (Watts*Hours) | Estimated Cumulative Energy saved per stack in (Watts × Hours) due to all green modes enabled. |
| Unit | Identifies the stack member number. |
| Green Features supported on this unit | List of Green Features supported on the given unit which could be one or more of the following:<br>• Energy-Detect (Energy Detect)<br>• Short-Reach (Short Reach)<br>• Pwr-Usg-Est (Power Usage Estimates). |
| Interface | Identifies the interface associated with the rest of the data in the row. |

| Field | Description |
|---|---|
| Energy Detect Admin Mode | Shows whether Energy Detect Mode is administratively enabled on the port. |
| Energy Detect Operational Status | Shows the current operational status of the Green Mode for the selected port. |
| Short Reach Admin Mode | Shows the administrative status of Short Reach Mode on the port. With short reach mode enabled, PHY goes into low power mode when cable length is less than a given limit. |
| Short Reach Operational Status | Indicates whether the port is in low-power mode due to the cable length. |

Click **Refresh** to update the page with the most current data from the switch

# License

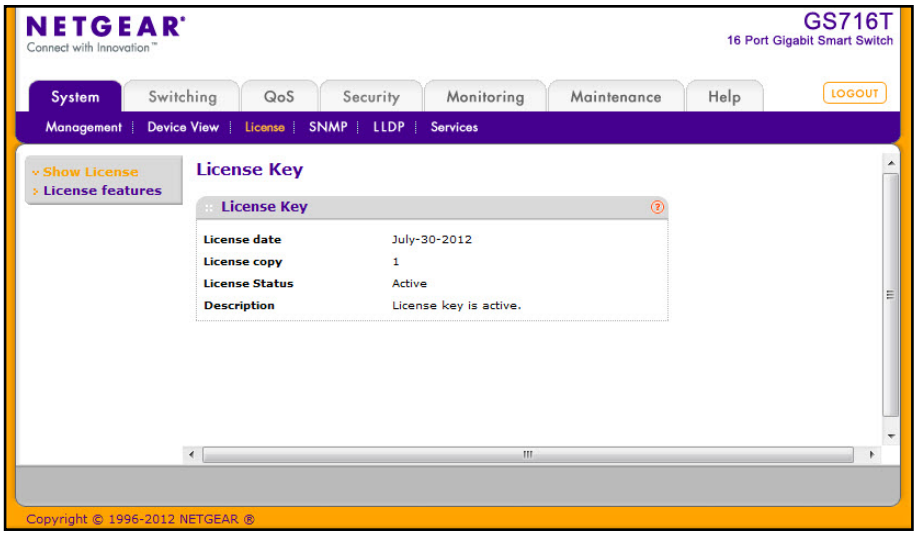
From the License link under the System tab, you can view information about the switch license.The License link provides access to the following pages:

- *Show License* on page 56
- *License Features* on page 57

## Show License

Use the Show License page to view information about the license key on the device. Some features might require a special license in order to be active. If a license is not active, the feature associated with the license is not available and cannot be configured.

To display the License Key page, click **System** > **License** > **Show License**. A screen similar to the following displays.



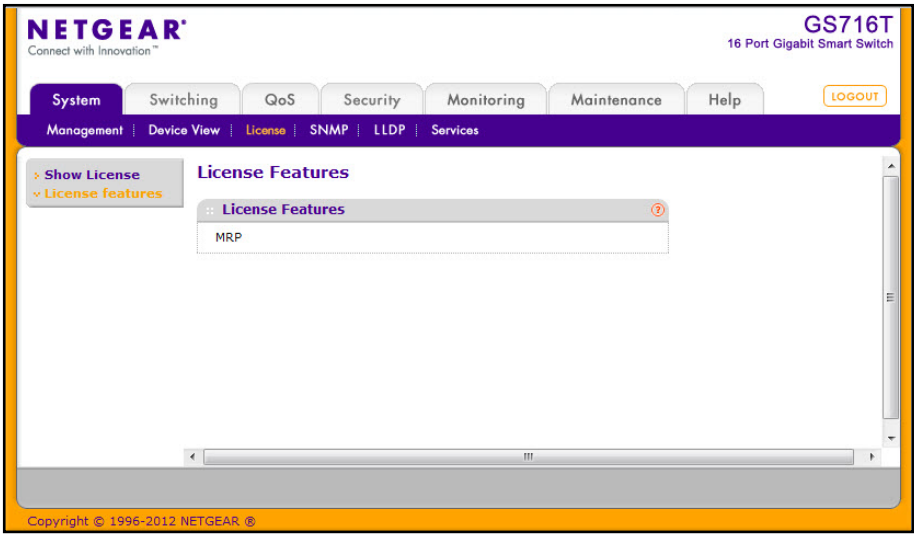

The following table describes the non-configurable fields on the License Key page.

| Field | Description |
|---|---|
| License Date | The date the license is purchased. |
| License Copy | The number of licenses that exist on the switch. |
| License Status | Indicates whether the license is active or inactive. If a license is inactive, a license should be purchased and downloaded to the switch. The license is not activated until the switch reboots. |
| Description | A description of the license key status. If the license is inactive, this field provides information about why it is inactive. |

# License Features

Use the License Features page to view information about the features on the device that require an active license.

To display the License Features page, click **System** > **License** > **License Features**. A screen similar to the following displays.



# SNMP

From SNMP link under the System tab, you can configure SNMP settings for SNMP V1/V2 and SNMPv3.

From the SNMP link, you can access the following pages:

- *SNMPV1/V2* on page 58
- *Trap Flags* on page 61
- *SNMP v3 User Configuration* on page 62

## SNMPV1/V2

The pages under the SNMPV1/V2 menu allow you to configure SNMP community information, traps, and trap flags.

### *Community Configuration*

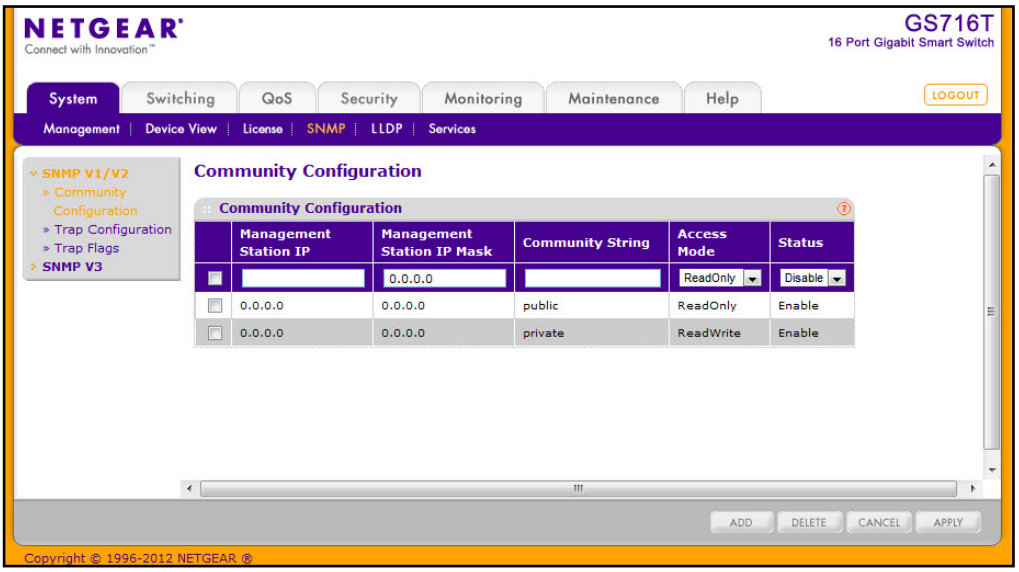
To display this page, click **System** > **SNMP** > **SNMP V1/V2** > **Community Configuration**.

By default, two SNMP Communities exist:

- Private, with Read/Write privileges and status set to **Enable**.
- Public, with Read Only privileges and status set to **Enable**.

These are well-known communities. Use this page to change the defaults or to add other communities. Only the communities that you define using this page will have access to the switch using the SNMPv1 and SNMPv2c protocols. Only those communities with read/write level access can be used to change the configuration using SNMP.

Use this page when you are using the SNMPv1 and SNMPv2c protocol.



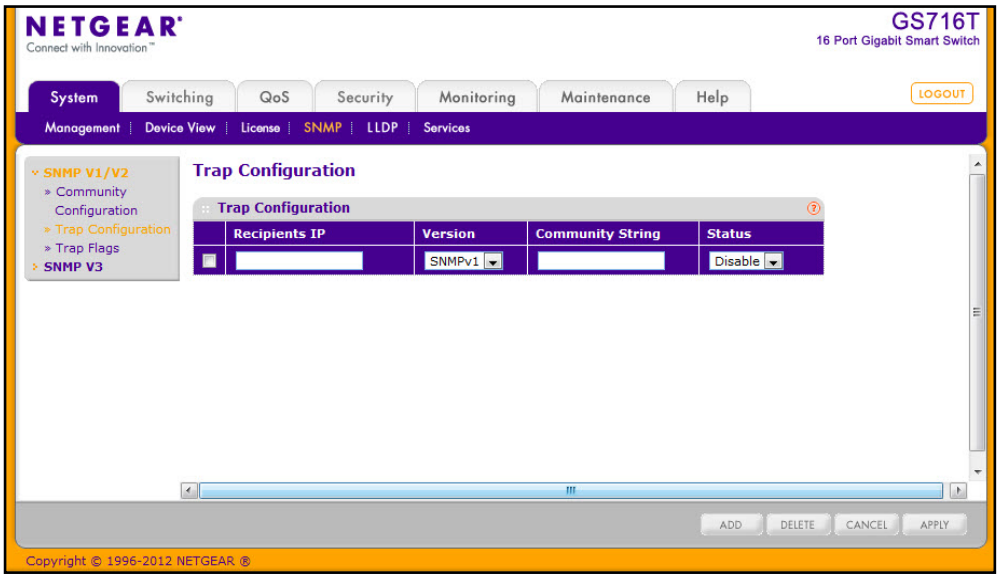

To configure SNMP communities:

1. To add a new SNMP community, enter community information in the available fields described below, and then click **Add**.
   - **Management Station IP**. Specify the IP address of the management station.Together, the Management Station IP and the Management Station IP Mask denote a range of IP addresses from which SNMP clients may use that community to access this device. If either (Management Station IP or Management Station IP Mask) value is 0.0.0.0, access is allowed from any IP address. Otherwise, every client's address is ANDed with the mask, as is the Management Station IP Address; and, if the values are equal, access is allowed. For example, if the Management Station IP and Management Station IP Mask parameters are 192.168.1.0/255.255.255.0, then any client whose address is 192.168.1.0 through 192.168.1.255 (inclusive) will be allowed access. To allow access from only one station, use a Management Station IP Mask value of 255.255.255.255, and use that machine's IP address for Client Address.
   - **Management Station IP Mas**k. Specify the subnet mask to associate with the management station IP address.
   - **Community String**. Specify a community name. A valid entry is a case-sensitive string of up to 16 characters.
   - **Access Mode**. Specify the access level for this community by selecting Read/Write or Read Only from the menu.
   - **Status**. Specify the status of this community by selecting Enable or Disable from the pull down menu. If you select Enable, the Community Name must be unique among all valid Community Names or the set request will be rejected. If you select Disable, the Community Name will become invalid.
2. To modify an existing community, select the check box next to the community, change the desired fields, and then click **Apply**. Configuration changes take effect immediately.

3. To delete a community, select the check box next to the community and click **Delete**.
4. Click **Cancel** to cancel the configuration on the screen and reset the data on the screen to the latest value of the switch.

## *Trap Configuration*

This page displays an entry for every active Trap Receiver. To access this page, click **System** > **SNMP** > **SNMP V1/V2** > **Trap Configuration**.




To configure SNMP trap settings:

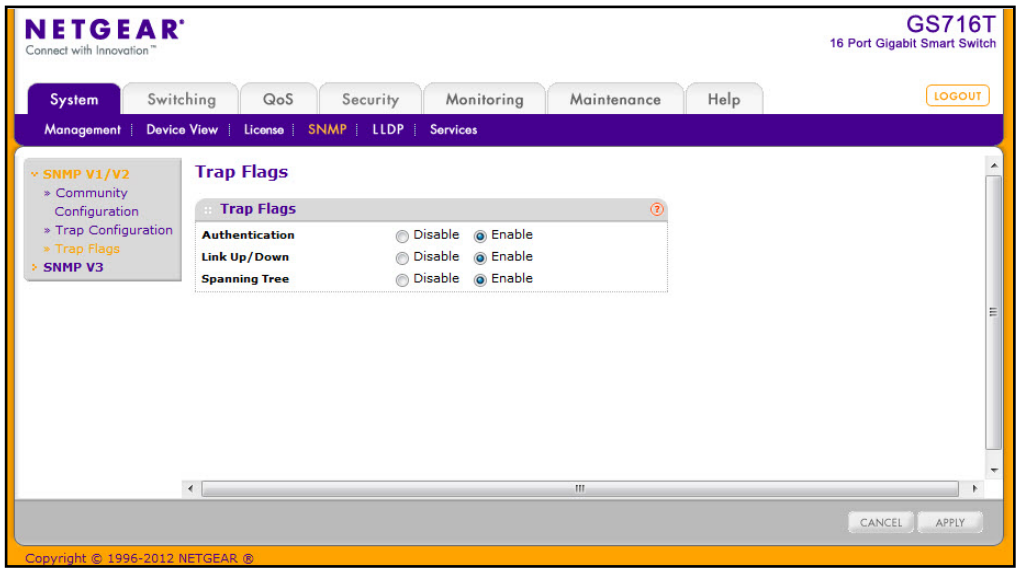
1. To add a host that will receive SNMP traps, enter trap configuration information in the available fields described below, and then click **Add.**
   - **Recipients IP**. The address in x.x.x.x format to receive SNMP traps from this device.
   - **Version**. The trap version to be used by the receiver from the menu.
     - SNMP v1: Uses SNMP v1 to send traps to the receiver.
     - SNMP v2: Uses SNMP v2 to send traps to the receiver.
   - **Community String**. The community string for the SNMP trap packet to be sent to the trap manager. This may be up to 16 characters and is case sensitive.
   - **Status**. Select the receiver's status from the menu:
     - Enable: Send traps to the receiver.
     - Disable: Do not send traps to the receiver.
2. To modify information about an existing SNMP recipient, select the check box next to the recipient, change the desired fields, and then click **Apply**. Configuration changes take effect immediately.
3. To delete a recipient, select the check box next to the recipient and click **Delete**.
4. Click **Cancel** to cancel the configuration on the screen and reset the data on the screen to the latest value of the switch.

# Trap Flags

The pages in the Trap Manager folder allow you to view and configure information about SNMP traps the system generates.

Use the Trap Flags page to enable or disable traps the switch can send to an SNMP manager. When the condition identified by an active trap is encountered by the switch, a trap message is sent to any enabled SNMP Trap Receivers, and a message is written to the trap log.

To access the Trap Flags page, click **System** > **SNMP** > **SNMP V1/V2** > **Trap Flags**.



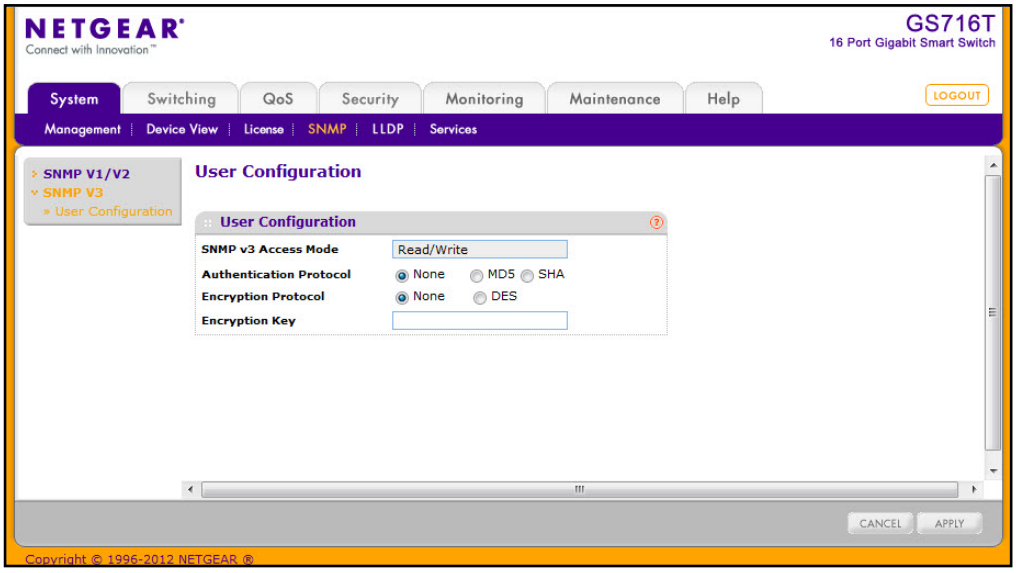

To configure the trap flags:

1. From the **Authentication** field, enable or disable activation of authentication failure traps by selecting the corresponding button. The factory default is Enable.
2. From the **Link Up/Down** field, enable or disable activation of link status traps by selecting the corresponding button. The factory default is Enable.
3. From the **Spanning Tree** field, enable or disable activation of spanning tree traps by selecting the corresponding button. The factory default is Enable.
4. If you make any changes to this page, click **Apply** to send the updated configuration to the switch. Configuration changes take effect immediately.
5. Click **Cancel** to cancel the configuration on the screen and reset the data on the screen to the latest value of the switch.

# SNMP v3 User Configuration

Use this page to configure user access for management of the switch using SNMP v3.

To access this page, click **System** > **SNMP** > **SNMP V3** > **User Configuration**.




The SNMPv3 Access Mode is a read-only field that shows the access privileges for the user account. The admin account always has Read/Write access, and all other accounts have Read Only access.

To configure SNMPv3 settings for the user account:

1. In the Authentication Protocol field, specify the SNMPv3 Authentication Protocol setting for the selected user account. The valid Authentication Protocols are None, MD5, or SHA. If you select:
   - **None**: The user will be unable to access the SNMP data from an SNMP browser.
   - **MD5 or SHA**: The user login password will be used as SNMPv3 authentication password, and you must therefore specify a password. The password must be eight characters in length.
2. In the Encryption Protocol field, choose whether to encrypt SNMPv3 packets transmitted by the switch.
   - **None**. Do not encrypt the contents of SNMPv3 packets transmitted from the switch.
   - **DES**. Encrypt SNMPv3 packets using the DES encryption protocol.
3. If you selected DES in the Encryption Protocol field, enter the SNMPv3 Encryption Key here. Otherwise, this field is ignored. Valid keys are 0 to 15 characters long.
4. Click **Apply** to send the updated configuration to the switch. Configuration changes take effect immediately.
5. Click **Cancel** to cancel the configuration on the screen and reset the data on the screen to the latest value of the switch.

# LLDP

The IEEE 802.1AB-defined standard, Link Layer Discovery Protocol (LLDP), allows stations on an 802 LAN to advertise major capabilities and physical descriptions. This information is viewed by a network manager to identify system topology and detect bad configurations on the LAN.

From the LLDP link, you can access the following pages:



LLDP is a one-way protocol; there are no request/response sequences. Information is advertised by stations implementing the transmit function, and is received and processed by stations implementing the receive function. The transmit and receive functions can be enabled/disabled separately per port. By default, both transmit and receive are enabled on all ports. The application is responsible for starting each transmit and receive state machine appropriately, based on the configured status and operational state of the port.

The Link Layer Discovery Protocol-Media Endpoint Discovery (LLDP-MED) is an enhancement to LLDP with the following features:

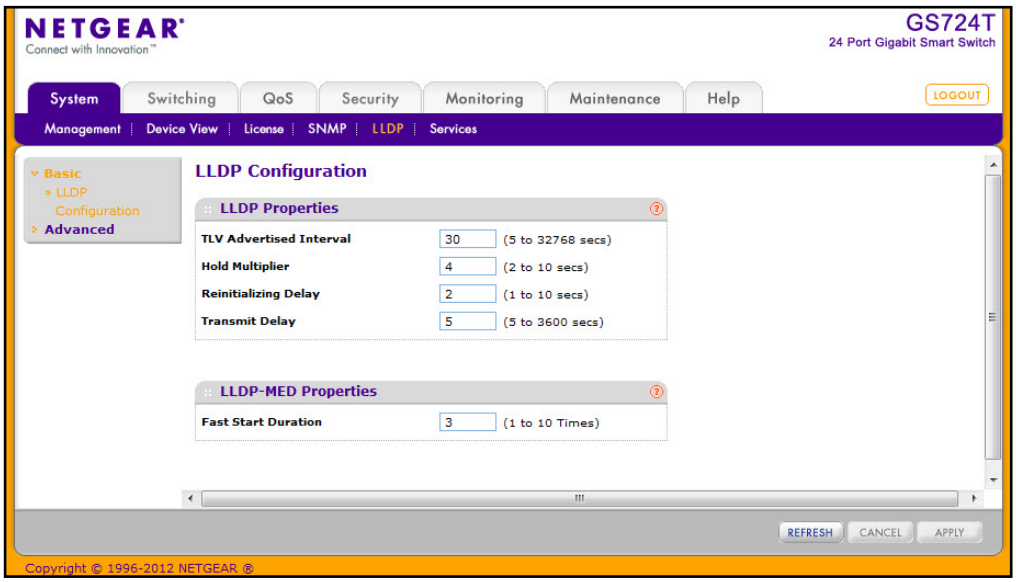
- Auto-discovery of LAN policies (such as VLAN, Layer 2 Priority, and DiffServ settings), enabling plug and play networking.
- Device location discovery for creation of location databases.
- Extended and automated power management of Power over Ethernet endpoints.
- Inventory management, enabling network administrators to track their network devices and determine their characteristics (manufacturer, software and hardware versions, serial/asset number).

## LLDP Configuration

Use the LLDP Configuration page to specify LLDP and LLDP-MED parameters that are applied to the switch.

To display the LLDP Configuration page, click **System > LLDP > Basic > LLDP Configuration**.

**Note:** You can also access the LLDP Configuration page by clicking **System > LLDP > Advanced > LLDP Configuration.**



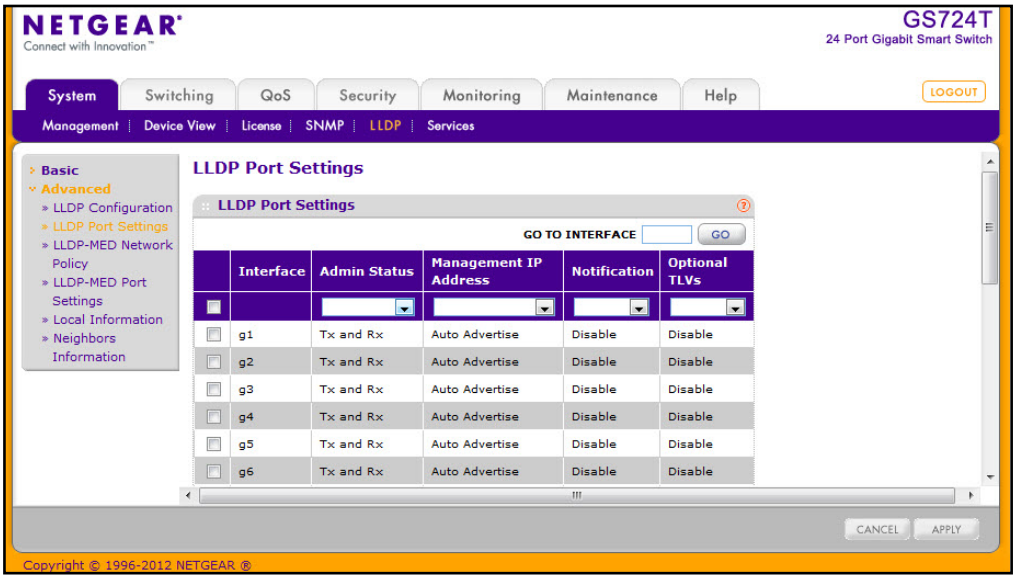

To configure global LLDP settings:

1. Configure the following LLDP properties.
   - **TLV Advertised Interval**. Specify the interval at which frames are transmitted. The default is 30 seconds, and the valid range is 5–32768 seconds.
   - **Hold Multiplier**. Specify multiplier on the transmit interval to assign to Time-to-Live (TTL). The default is 4, and the range is 2–10.
   - **Reinitializing Delay**. Specify the delay before a reinitialization. The default is 2 seconds, and the range is 1–10 seconds.
   - **Transmit Delay**. Specify the interval for the transmission of notifications. The default is 5 seconds, and the range is 5–3600 seconds.
2. To change the LLDP-MED properties in the **Fast Start Duration** field, specify the number of LLDP packets sent when the LLDP-MED Fast Start mechanism is initialized, which occurs when a new endpoint device links with the LLDP-MED network connectivity device. The default value is 3, and the range is from 1–10.
3. Click **Apply** to apply the new settings to the system.
4. Click **Cancel** to cancel the configuration on the screen and reset the data on the screen to the latest value of the switch.
5. Click **Refresh** to update the screen with the current information.

# LLDP Port Settings

Use the LLDP Port Settings page to specify LLDP parameters that are applied to a specific interface.

To display the LLDP Port Settings page, click **System** > **LLDP** > **Advanced** > **LLDP Port Settings**.




To configure LLDP port settings:

1. Change the LLDP port settings described below:
   - **Interface.** Specifies the port to be affected by these parameters.
   - **Admin Status**. Select the status for transmitting and receiving LLDP packets:
     - **Tx Only**: Enable only transmitting LLDP PDUs on the selected ports.
     - **Rx Only**: Enable only receiving LLDP PDUs on the selected ports.
     - **Tx and Rx**: Enable both transmitting and receiving LLDP PDUs on the selected ports. This is the default value.
     - **Disabled**: Do not transmit or receive LLDP PDUs on the selected ports.
   - **Management IP Address.** Choose whether to advertise the management IP address from the interface. The possible field values are:
     - **Stop Advertise**: Do not advertise the management IP address from the interface.
     - **Auto Advertise**: Advertise the current IP address of the device as the management IP address.
   - **Notification.** When notifications are enabled, LLDP interacts with the Trap Manager to notify subscribers of remote data change statistics. The default is Disabled.

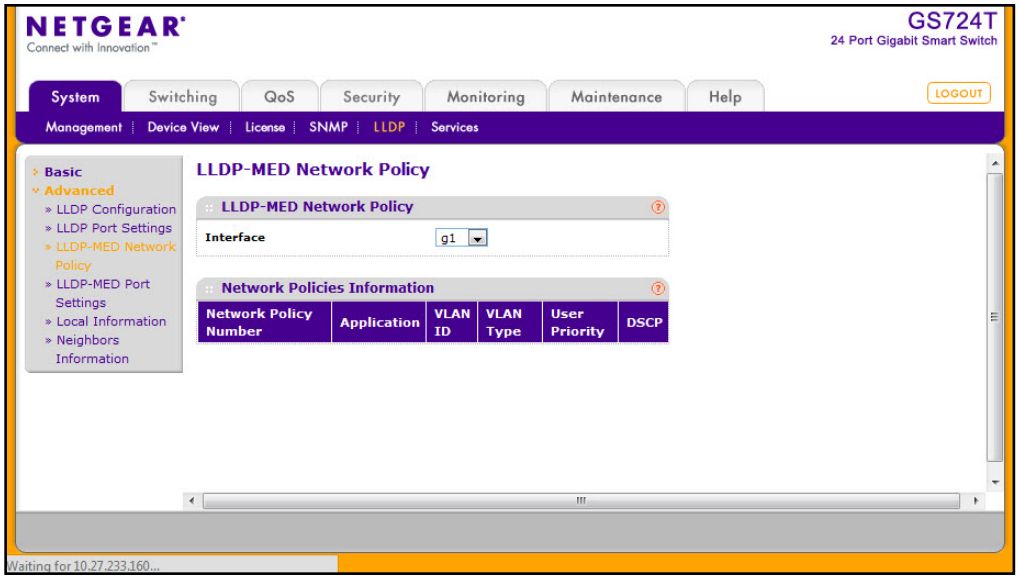
- **Optional TLV(s).** Enable or disable the transmission of optional type-length value (TLV) information from the interface. The TLV information includes the system name, system description, system capabilities, and port description. The default is enabled. To configure the System Name, see *Management* on page 31. To configure the Port Description, see *Ports* on page 79.

2. If you make any changes to the page, click **Apply** to apply the new settings to the system.
3. Click **Cancel** to cancel the configuration on the screen and reset the data on the screen to the latest value of the switch.

# LLDP-MED Network Policy

This page displays information about the LLPD-MED network policy TLV transmitted in the LLDP frames on the selected local interface.

To display this page, click **System** > **LLDP** > **Advanced** > **LLDP-MED Network Policy**.




From the **Interface** menu, select the interface with the information to view. The following table describes the LLDP-MED network policy information that displays on the screen.

| Field | Description |
|---|---|
| Network Policy Number | Specifies the policy number. |
| Application | Specifies the media application type associated with the policy, which can only be Voice.<br>The application information is displayed only if a network policy TLV has been transmitted from the port. |
| VLAN ID | Specifies the VLAN ID associated with the policy. |

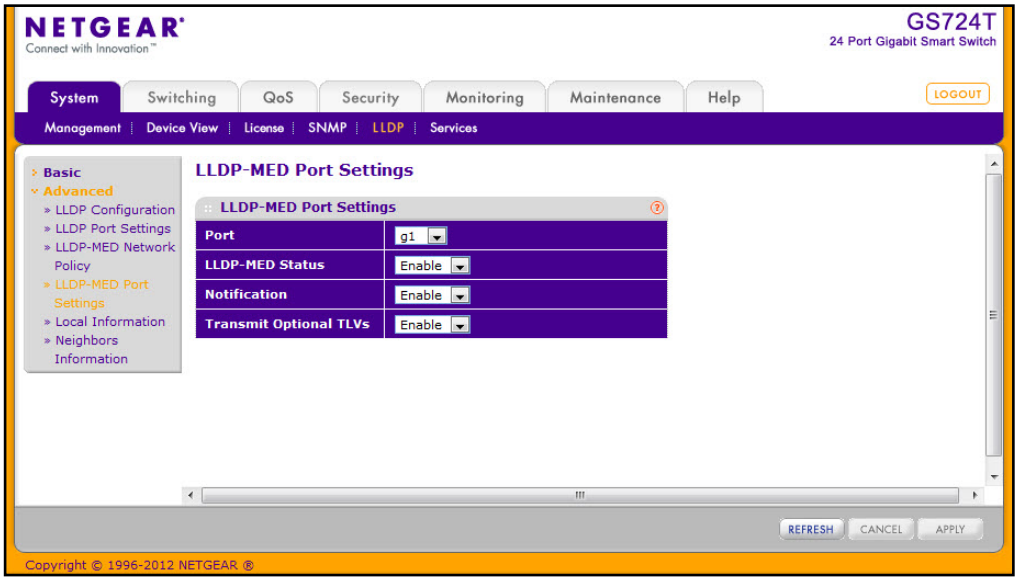
| Field | Description |
|---|---|
| VLAN Type | Specifies whether the VLAN associated with the policy is tagged or untagged. |
| User Priority | Specifies the priority associated with the policy. |
| DSCP | Specifies the DSCP associated with a particular policy type. |

Click **Refresh** to refresh the page with the most current data from the switch.

# LLDP-MED Port Settings

Use this page to enable LLDP-MED mode on an interface and configure its properties.

To display this page, click **System** > **LLDP** > **Advanced** > **LLDP-MED Port Settings**.




To configure LLDP-MED settings for a port:

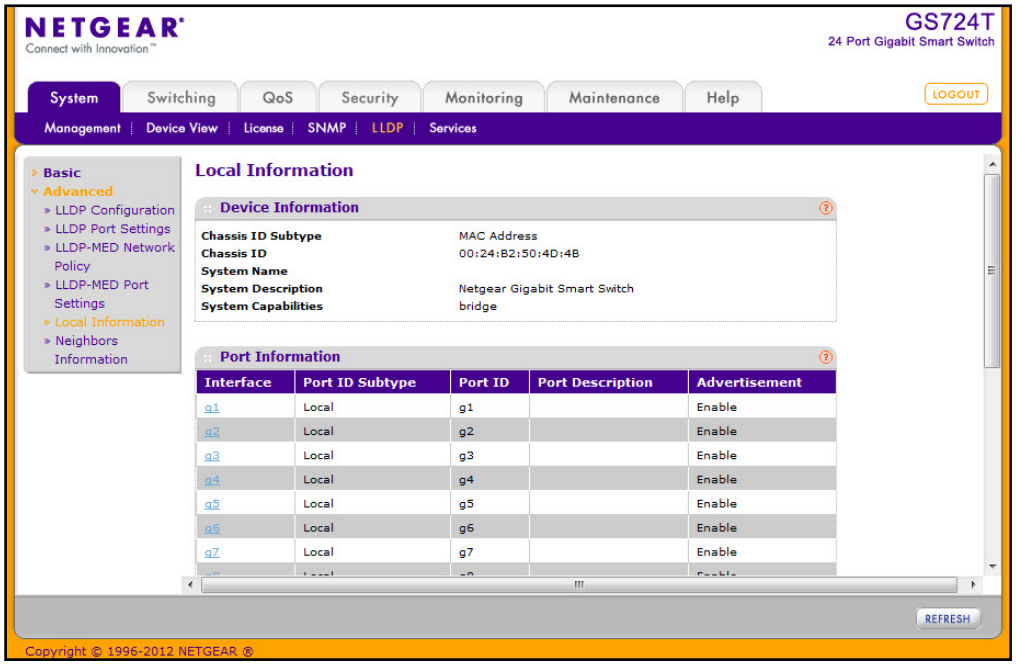
1. From the **Port** field, select the port to configure.
2. From the **LLDP-MED Status** field, enable or disable the LLDP-MED mode for the selected interface.
3. From the **Notification** field, specify whether the port should send a topology change notification if a device is connected or removed.

4. From the Transmit Optional TLVs field, specify whether the port should transmit optional type length values (TLVs) in the LLDP PDU frames. If enabled, the following LLDP-MED TLVs are transmitted:
   - MED Capabilities
   - Network Policy
   - Location Identification
   - Extended Power via MDI: PSE
   - Extended Power via MDI: PD
   - Inventory
5. Click **Apply** to send the updated configuration to the switch. These changes occur immediately and the configuration will be saved.
6. Click **Cancel** to cancel the configuration on the screen and reset the data on the screen to the latest value of the switch.

# Local Information

Use the LLDP Local Information page to view the data that each port advertises through LLDP.

To display the LLDP Local Device Information page, click **System** > **Advanced** > **LLDP** > **Local Information**.



If LLDP or LLDP-MED is enabled on one or more ports, the **Device Information** table displays information about the device that is transmitted in TLVs, as the following table describes:

| Field | Description |
|---|---|
| Chassis ID Subtype | The type of information used to identify the GS716T and GS724T in the Chassis ID field. |
| Chassis ID | The hardware platform identifier for the GS716T and GS724T. |
| System Name | The user-configured system name for the GS716T and GS724T. |
| System Description | The device description, which includes information about the product model and platform. |
| System Capabilities | The primary function(s) the GS716T and GS724T supports. |

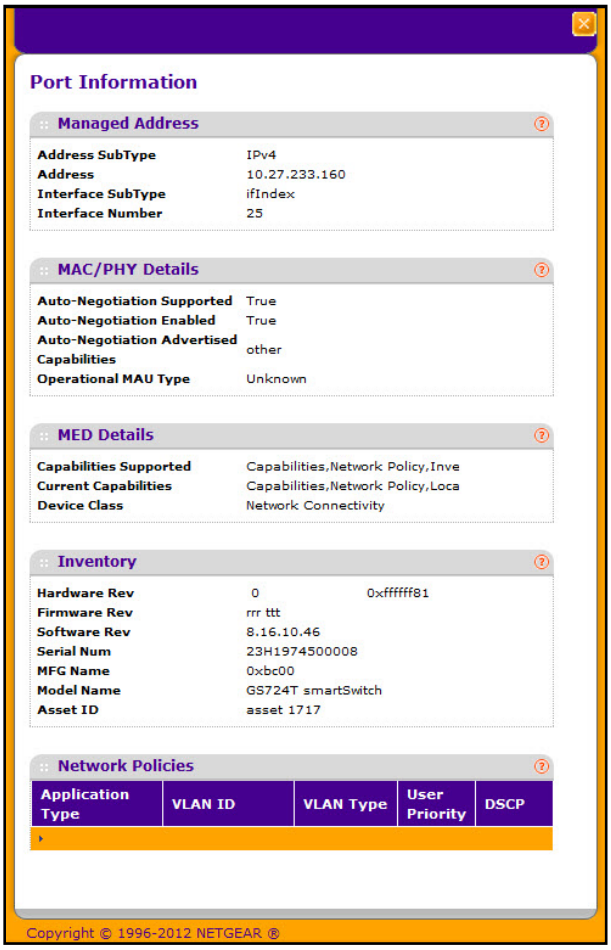
The **Port Information** table provides information about the LLDP and LLDP-MED status of each port, as the following table describes:

| Field | Description |
|---|---|
| Interface | Select the interface with the information to display. |
| Port ID Subtype | Identifies the type of data displayed in the **Port ID** field. |
| Port ID | Identifies the physical address of the port. |
| Port Description | Identifies the user-defined description of the port. To configure the Port Description, see *Ports* on page 79. |
| Advertisement | Displays the advertisement status of the port. |

Click **Refresh** to refresh the page with the most current data from the switch.

To view additional details about a port, click the name of the port in the Interface column of the Port Information table.

A popup window displays information for the selected port.




The following table describes the detailed local information that displays for the selected port.

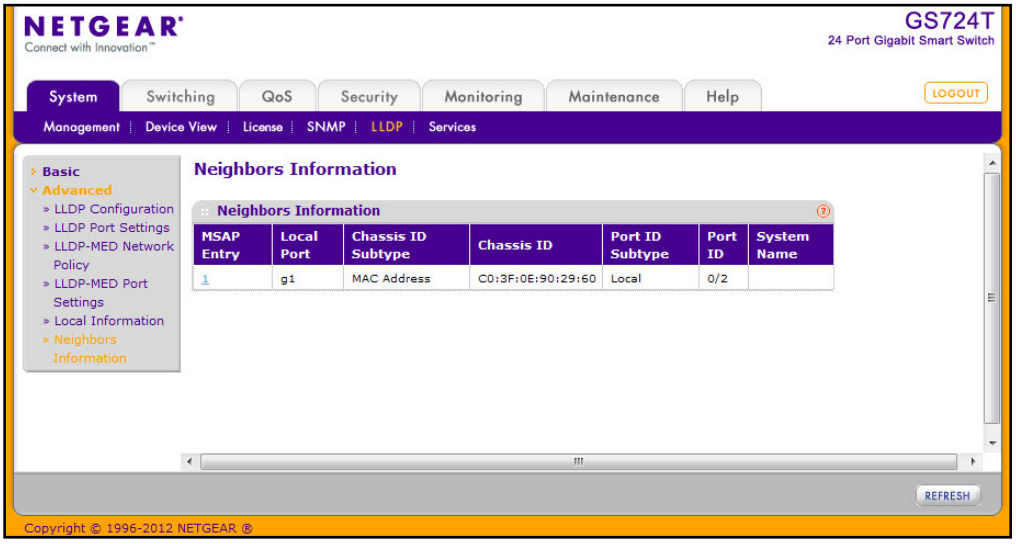
| Field | Description |
|---|---|
| Managed Address | |
| Address SubType | Displays the type of address the management interface uses, such as an IPv4 address. |
| Address | Displays the address used to manage the device. |
| Interface SubType | Displays the port subtype. |
| Interface Number | Displays the number that identifies the port. |
| MAC/PHY Details | |

| Field | Description |
|---|---|
| Auto-Negotiation Supported | Specifies whether the interface supports port-speed auto-negotiation. The possible values are True or False. |
| Auto-Negotiation Enabled | Displays the port speed auto-negotiation support status. The possible values are True (enabled) or False (disabled). |
| Auto Negotiation Advertised Capabilities | Displays the port speed auto-negotiation capabilities such as 1000BASE-T half-duplex mode or 100BASE-TX full-duplex mode. |
| Operational MAU Type | Displays the Medium Attachment Unit (MAU) type. The MAU performs physical layer functions, including digital data conversion from the Ethernet interface collision detection and bit injection into the network. |
| MED Details | |
| Capabilities Supported | Displays the MED capabilities enabled on the port. |
| Current Capabilities | Displays the TLVs advertised by the port. |
| Device Class | Network Connectivity indicates the device is a network connectivity device. |
| Network Policies | |
| Application Type | Specifies the media application type associated with the policy. |
| VLAN ID | Specifies the VLAN ID associated with the policy. |
| VLAN Type | Specifies whether the VLAN associated with the policy is tagged or untagged. |
| User Priority | Specifies the priority associated with the policy. |
| DSCP | Specifies the DSCP associated with a particular policy type. |

# Neighbors Information

Use the LLDP Neighbors Information page to view the data that a specified interface has received from other LLDP-enabled systems.

To display the LLDP Neighbors Information page, click **System > LLDP > Advanced > Neighbors Information**.



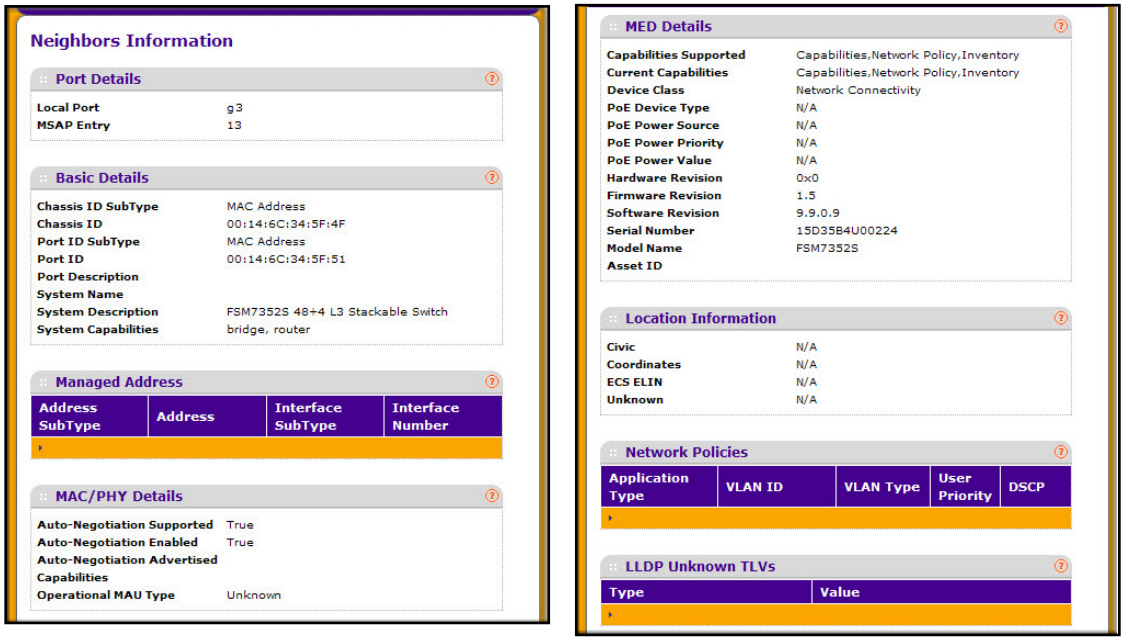

The following table describes the information that displays for all LLDP neighbors that have been discovered.

| Field | Description |
|---|---|
| MSAP Entry | Displays the Media Service Access Point (MSAP) entry number for the remote device. |
| Local Port | Displays the interface on the local system that received LLDP information from a remote system. |
| Chassis ID Subtype | Identifies the type of data displayed in the **Chassis ID** field on the remote system. |
| Chassis ID | Identifies the remote 802 LAN device's chassis. |
| Port ID Subtype | Identifies the type of data displayed in the remote system's **Port ID** field. |
| Port ID | Identifies the physical address of the port on the remote system from which the data was sent. |
| System Name | Identifies the system name associated with the remote device. If the field is blank, the name might not be configured on the remote system. |

Click **Refresh** to update the information on the screen with the most current data.

To view additional information about the remote device, click the link in the MSAP Entry field.

A popup window displays information for the selected port.




| Field | Description |
|---|---|
| **Port Details** | |
| Local Port | Displays the interface on the local system that received LLDP information from a remote system. |
| MSAP Entry | Displays the Media Service Access Point (MSAP) entry number for the remote device. |
| **Basic Details** | |
| Chassis ID Subtype | Identifies the type of data displayed in the **Chassis ID** field on the remote system. |
| Chassis ID | Identifies the remote 802 LAN device's chassis. |
| Port ID Subtype | Identifies the type of data displayed in the remote system's **Port ID** field. |
| Port ID | Identifies the physical address of the port on the remote system from which the data was sent. |
| Port Description | Identifies the user-defined description of the port. |
| System Name | Identifies the system name associated with the remote device. |
| System Description | Specifies the description of the selected port associated with the remote system. |
| System Capabilities | Specifies the system capabilities of the remote system. |

| Field | Description |
|---|---|
| **Managed Addresses** | |
| Address SubType | Specifies the type of the management address. |
| Address | Specifies the advertised management address of the remote system. |
| Interface SubType | Specifies the port subtype. |
| Interface Number | Identifies the port on the remote device that sent the information. |
| **MAC/PHY Details** | |
| Auto-Negotiation Supported | Specifies whether the remote device supports port-speed auto-negotiation. The possible values are True or False |
| Auto-Negotiation Enabled | Displays the port speed auto-negotiation support status. The possible values are True or False |
| Auto Negotiation Advertised Capabilities | Displays the port speed auto-negotiation capabilities. |
| Operational MAU Type | Displays the Medium Attachment Unit (MAU) type. The MAU performs physical layer functions, including digital data conversion from the Ethernet interface collision detection and bit injection into the network. |
| **MED Details** | |
| Capabilities Supported | Specifies the supported capabilities that were received in MED TLV from the device. |
| Current Capabilities | Specifies the advertised capabilities that were received in MED TLV from the device. |
| Device Class | Displays the LLDP-MED endpoint device class. The possible device classes are:<br>• Endpoint Class 1 Indicates a generic endpoint class, offering basic LLDP services.<br>• Endpoint Class 2 Indicates a media endpoint class, offering media streaming capabilities as well as all Class 1 features.<br>• Endpoint Class 3 Indicates a communications device class, offering all Class 1 and Class 2 features plus location, 911, Layer 2 switch support and device information management capabilities. |
| Hardware Revision | Displays the hardware version advertised by the remote device. |
| Firmware Revision | Displays the firmware version advertised by the remote device. |
| Software Revision | Displays the software version advertised by the remote device. |
| Serial Number | Displays the serial number advertised by the remote device. |
| Model Name | Displays the model name advertised by the remote device. |
| Asset ID | Displays the asset ID advertised by the remote device. |

| Field | Description |
|---|---|
| **Location Information** | |
| Civic | Displays the physical location, such as the street address, the remote device has advertised in the location TLV. For example, 123 45th St. E. The field value length range is 6–160 characters. |
| Coordinates | Displays the location map coordinates the remote device has advertised in the location TLV, including latitude, longitude and altitude. |
| ECS ELIN | Displays the Emergency Call Service (ECS) Emergency Location Identification Number (ELIN) the remote device has advertised in the location TLV. The field range is 10–25. |
| Unknown | Displays unknown location information for the remote device. |
| **Network Policies** | |
| Application Type | Specifies the media application type associated with the policy advertised by the remote device. |
| VLAN ID | Specifies the VLAN ID associated with the policy. |
| VLAN Type | Specifies whether the VLAN associated with the policy is tagged or untagged. |
| User Priority | Specifies the priority associated with the policy. |
| DSCP | Specifies the DSCP associated with a particular policy type. |
| **LLDP Unknown TLVs** | |
| Type | Displays the unknown TLV type field. |
| Value | Displays the unknown TLV value field. |

# Services — DHCP Filtering

DHCP Filtering is a useful feature that can be employed as a security measure against unauthorized DHCP servers. A known attack is when an unauthorized DHCP server responds to a client that is requesting an IP address. The server configures the gateway for the client to be equal to the IP address of the server. At that point, the client sends all of its IP traffic destined to other networks to the unauthorized machine. This gives the attacker the possibility of snooping traffic for passwords or employing a man-in-the-middle attack. DHCP Filtering works by allowing the administrator to configure each port as either a trusted port or an untrusted port. The port that has the authorized DHCP server should be configured as a trusted port. Any DHCP responses received on a trusted port are forwarded. All other ports should be configured as untrusted. Any DHCP (or BootP) responses received are discarded.

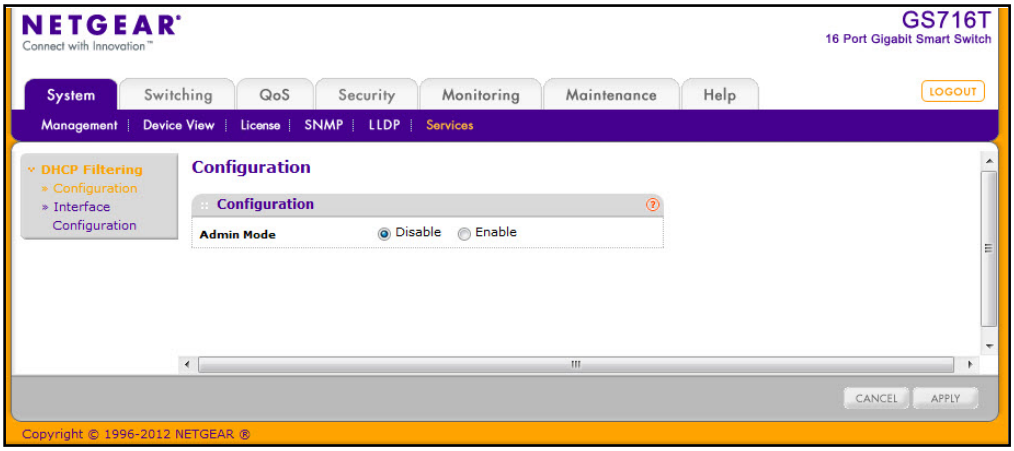
From the Services link, you can access the following pages:

- *DHCP Filtering Configuration* on page 76
- *Interface Configuration* on page 77

## DHCP Filtering Configuration

Use the DHCP Filtering Configuration page to enable or disable the DHCP Filtering feature on the switch.

To access the DHCP Filter Configuration page, click **System** > **Services** > **DHCP Filtering** > **Configuration**.



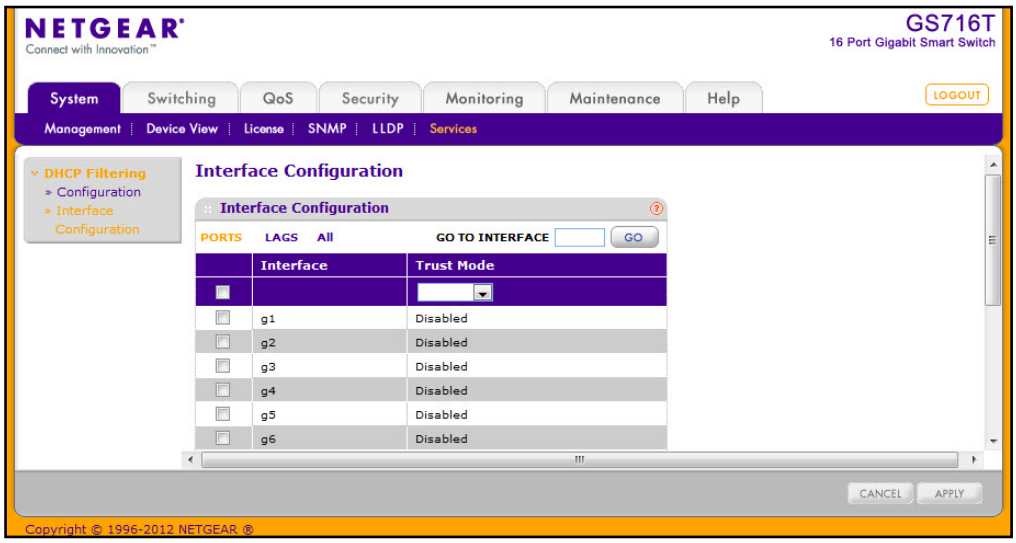

To configure global DHCP filtering settings:

1. In the **Admin Mode** field, select **Enable** or **Disable** to turn the DHCP Filtering feature on or off.
2. Click **Apply** to apply the change to the system. Configuration changes take effect immediately.
3. Click **Cancel** to cancel the configuration on the screen and reset the data on the screen to the latest value of the switch.

# Interface Configuration

Use the DHCP Filtering Interface Configuration page to view and configure each port as a trusted or untrusted port. Any DHCP responses received on a trusted port are forwarded. If a port is configured as untrusted, any DHCP (or BootP) responses received on that port are discarded.

To access the DHCP Filtering Interface Configuration page, click **System** > **Services** > **DHCP Filtering** > **Interface Configuration**.




To configure DHCP filtering settings for an interface:

1. To configure DHCP filtering settings for a physical port, click **PORTS**.
2. To configure DHCP filtering settings for a Link Aggregation Group (LAG), click **LAGS**.
3. To configure DHCP filtering settings for both physical ports and LAGs, click **ALL**.
4. Select the check box next to the port or LAG to configure. You can select multiple ports and LAGs to apply the same setting to the selected interfaces. Select the check box in the heading row to apply the same settings to all interfaces.
5. Choose the trust mode for the selected port(s) or LAG(s).
   - **Enable**: Any DHCP responses received on this port are forwarded. The port connected downstream from the authorized DHCP server should be configured as a trusted port. Any DHCP responses received on a trusted port are forwarded. All other ports should be configured as untrusted. Any DHCP (or BootP) responses received are discarded.
   - **Disable**: Any DHCP (or BootP) responses received on this port are discarded. Ports connected to hosts should be configured as untrusted. This is the default value.
6. Click **Apply** to apply the change to the system. Configuration changes take effect immediately.
7. Click **Cancel** to cancel the configuration on the screen and reset the data on the screen to the latest value of the switch.

# Switching Features

# 3

Use the features in the **Switching** tab to define Layer 2 features. The **Switching** tab contains links to the following features:



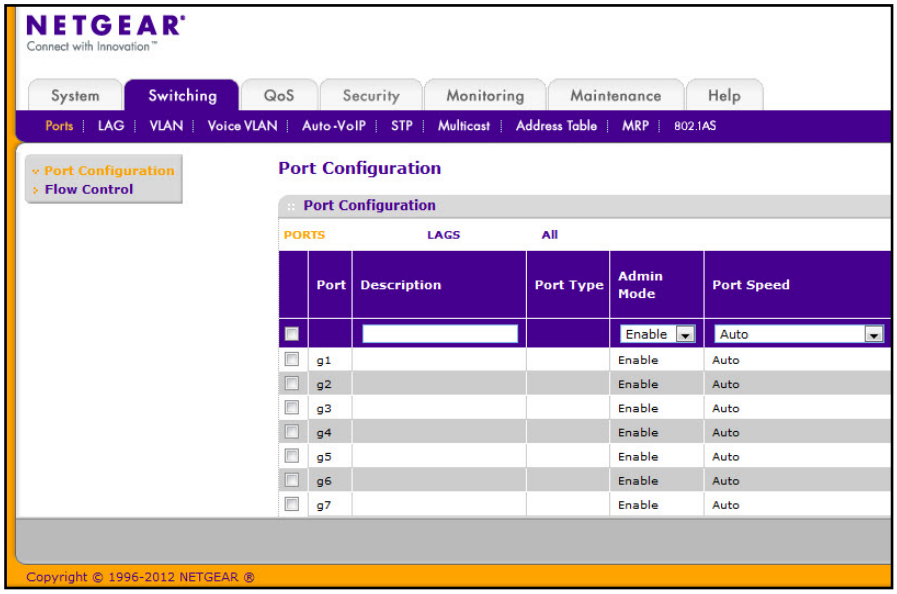
## Ports

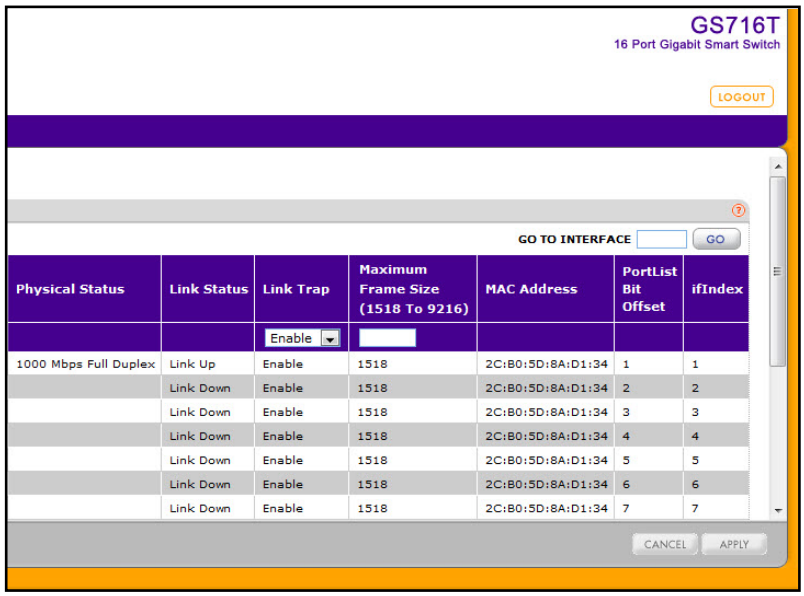
The pages on the Ports tab allow you to view and monitor the physical port information for the ports available on the switch. From the Ports link, you can access the following pages:

# Port Configuration

Use the Port Configuration page to configure the physical interfaces on the switch.

To access the Port Configuration page, click **Switching** > **Ports** > **Port Configuration**.




To configure port settings:

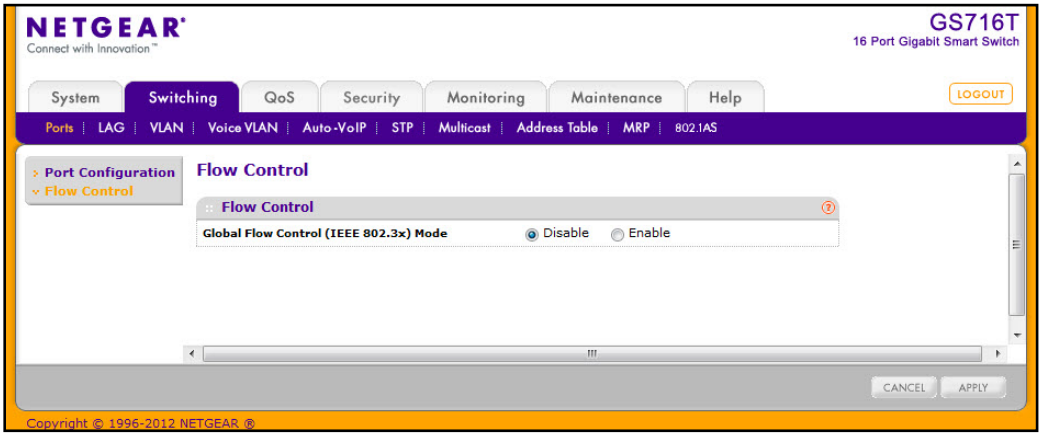
1. To configure settings for a physical port, click **PORTS**.
2. To configure settings for a Link Aggregation Group (LAG), click **LAGS**.
3. To configure settings for both physical ports and LAGs, click **ALL**.

4. Select the check box next to the port or LAG to configure. You can select multiple ports and LAGs to apply the same setting to the selected interfaces. Select the check box in the heading row to apply the same settings to all interfaces.
5. Configure or view the settings:
   - **Description**. Enter the description string to be attached to a port. The string can be up to 64 characters in length.
   - **Port Type.** For most ports this field is blank. Otherwise, the possible values are:
     - Probe: Indicates that the port is a monitoring (destination) port. For additional information about port monitoring see *Port Mirroring* on page 250.
     - Mirrored: The port is a source port and mirrors traffic to the probe port. For additional information about port monitoring see *Port Mirroring* on page 250.
     - LAG: Indicates that the port is a member of a Link Aggregation trunk. For more information see *Link Aggregation Groups* on page 83.
   - **Admin Mode**. Use the menu to select the port control administration state, which can be one of the following:
     - Enable: The port can participate in the network (default).
     - Disable: The port is administratively down and does not participate in the network.
   - **Port Speed**. Use the menu to select the port's speed and duplex mode. If you select Auto, the duplex mode and speed will be set by the auto-negotiation process. The port's maximum capability (full duplex and 1000 Mbps) will be advertised. Otherwise, your selection will determine the port's duplex mode and transmission rate. The factory default is Auto.
   - **Physical Status**. Indicates the physical port's speed and duplex mode
   - **Link Status**. Indicates whether the Link is up or down.
   - **Link Trap**. This object determines whether or not to send a trap when link status changes. The factory default is Enable.
     - Enable: Specifies that the system sends a trap when the link status changes.
     - Disable: Specifies that the system does not send a trap when the link status changes.
   - **Maximum Frame Size**. Specifies the maximum Ethernet frame size the interface supports. The size includes the Ethernet header, CRC, and payload. Any change to the maximum frame size is immediately applied to all interfaces.
   - **MAC Address**. Displays the physical address of the specified interface.
   - **PortList Bit Offset**. Displays the bit offset value which corresponds to the port when the MIB object type PortList is used to manage in SNMP.
   - **ifIndex**. The ifIndex of the interface table entry associated with this port. If the interface field is set to All, this field is blank.
6. Click **Cancel** to cancel the configuration on the screen and reset the data on the screen to the latest value of the switch.
7. If you make any changes to the page, click **Apply** to apply the changes to the system.

# Flow Control

IEEE 802.3x flow control works by pausing a port when the port becomes oversubscribed and dropping all traffic for small bursts of time during the congestion condition. This can lead to high-priority and/or network control traffic loss. When IEEE 802.3x flow control is enabled, lower speed switches can communicate with higher speed switches by requesting that the higher speed switch refrains from sending packets. Transmissions are temporarily halted to prevent buffer overflows.

To display the Flow Control page, click **Switching** > **Ports**, and then click the **Flow Control** link.




To configure global flow control settings:

1. From the Global Flow Control (IEEE 802.3x) Mode field, enable or disable IEEE 802.3x flow control on the system. The factory default is Disable.
   - **Enable**. The switch sends pause packets if the port buffers become full.
   - **Disable**. The switch does not send pause packets if the port buffers become full.
2. Click **Cancel** to cancel the configuration on the screen and reset the data on the screen to the latest value of the switch.
3. If you change the mode, click **Apply** to apply the changes to the system.

The GS716T and GS724T supports two combo ports using 1000M SFP modules. Each combo port can operate in either ‘copper’ or ‘fiber’ mode. When a cable is plugged into the RJ-45 port, copper mode is used. When a SFP module is plugged in, fiber mode is used.

The system automatically detects the media that is in use on a combo port and operates accordingly. The SFP transceiver takes precedence over the RJ-45 copper port.

In particular, the following behavior of combo port mechanism is followed:

1. When SFP transceiver is present in (plugged into) the SFP slot and optical link is established via the SFP transceiver the combo port mechanism will use the SFP transceiver and shut down the RJ-45 copper port regardless of the state of the latter (that is, regardless of the copper port link being up or down);
2. If (and while) the optical link is down (SFP transceiver is not present in the SFP slot or fiber cable is unplugged from SFP transceiver or optical link is shut down on the other side of the fiber cable, etc.), then the combo port mechanism will use the RJ-45 copper port.

It is possible to switch between the RJ-45 copper port and the SFP transceiver without a system reboot or reset.

# Link Aggregation Groups

Link aggregation groups (LAGs), which are also known as port-channels, allow you to combine multiple full-duplex Ethernet links into a single logical link. Network devices treat the aggregation as if it were a single link, which increases fault tolerance and provides load sharing. You assign the LAG VLAN membership after you create a LAG. The LAG by default becomes a member of the management VLAN.

A LAG interface can be either static or dynamic, but not both. All members of a LAG must participate in the same protocols. A static port-channel interface does not require a partner system to be able to aggregate its member ports.

Static LAGs are supported. When a port is added to a LAG as a static member, it neither transmits nor receives LAGPDUs. The GS716T and GS724T Smart Switches supports eight LAGs.

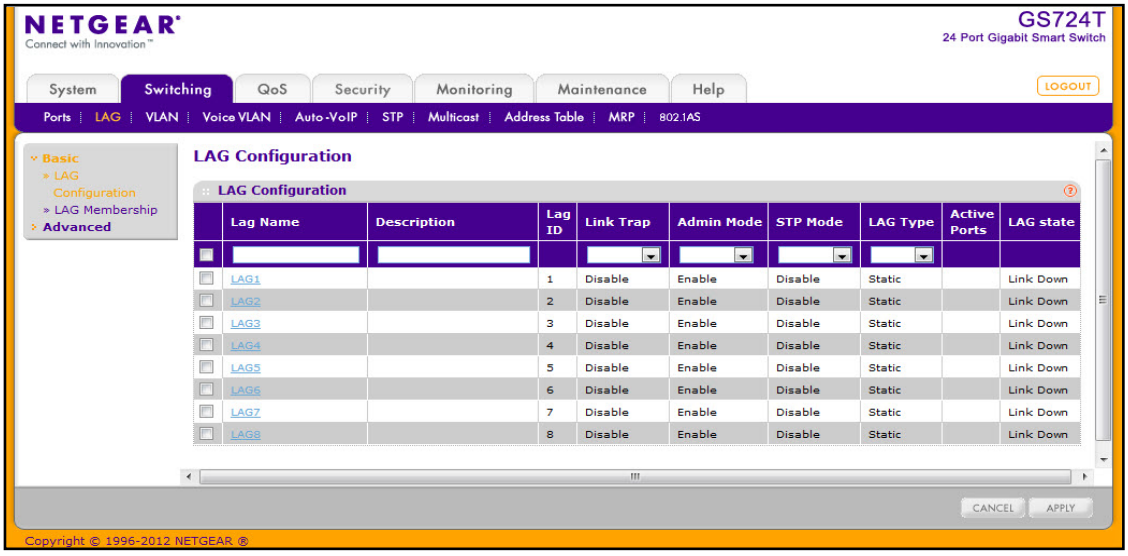
From the LAGs link, you can access the following pages:

- *LAG Configuration* on page 84
- *LAG Membership* on page 85
- *LACP Configuration* on page 87
- *LACP Port Configuration* on page 88

# LAG Configuration

Use the LAG (Port Channel) Configuration page to group one or more full-duplex Ethernet links to be aggregated together to form a link aggregation group, which is also known as a port-channel. The switch treats the LAG as if it were a single link.

To access the LAG Configuration page, click **Switching** > **LAG** > **Basic** > **LAG Configuration**.




To configure LAG settings:

1. Select the check box next to the LAG to configure. You can select multiple LAGs to apply the same setting to the selected interfaces. Select the check box in the heading row to apply the same settings to all interfaces.
2. Configure or view the following settings:
   - **LAG Name**. Specify the name you want assigned to the LAG. You may enter any string of up to 15 alphanumeric characters. A valid name has to be specified in order to create the LAG
   - **Description**. Specify the Description string to be attached to a LAG. It can be up to 64 characters in length.
   - **LAG ID**. Displays the number assigned to the LAG. This field is read-only.
   - **Link Trap**. Specify whether you want to have a trap sent when link status changes. The factory default is Disable, which will cause the trap to be sent.
   - **Admin Mode**. Select Enable or Disable from the menu. When the LAG (port channel) is disabled, no traffic will flow and LAGPDUs will be dropped, but the links that form the LAG (port channel) will not be released. The factory default is Enable.
   - **STP Mode.** Select the Spanning Tree Protocol Administrative Mode associated with the LAG.

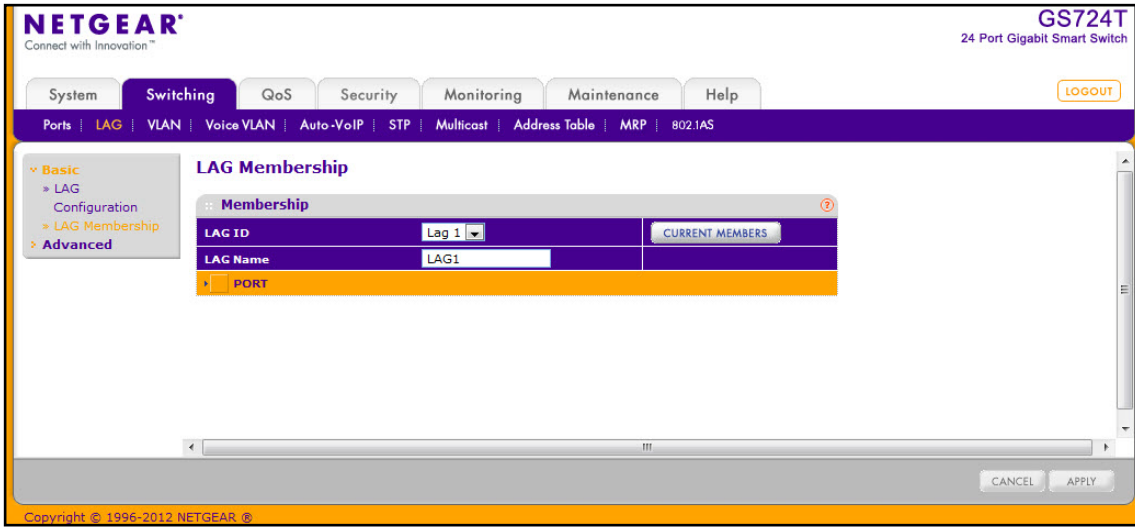
- **LAG Type**. Specifies whether the LAG is configured as a Static or LACP port. When the LAG is static, it does not transmit or process received LAGPDUs, for example the member ports do not transmit LAGPDUs and all the LAGPDUs it may receive are dropped. The default is Static.
- **Active Ports**. A listing of the ports that are actively participating members of this Port Channel. A maximum of 8 ports can be assigned to a port channel.
- **LAG State**. Indicates whether the link is Up or Down.

3. Click **Cancel** to cancel the configuration on the screen and reset the data on the screen to the latest value of the switch.
4. If you make any changes to this page, click **Apply** to send the updated configuration to the switch. Configuration changes take effect immediately.

# LAG Membership

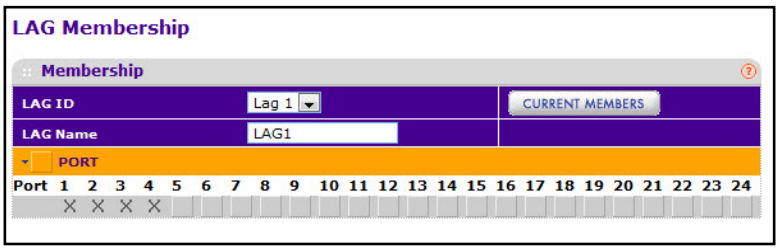
Use the LAG Membership page to select two or more full-duplex Ethernet links to be aggregated together to form a link aggregation group (LAG), which is also known as a port-channel. The switch can treat the port-channel as if it were a single link.

To access the LAG Membership page, click **Switching** > **LAG** > **Basic** > **LAG Membership**.



To add ports to a LAG:

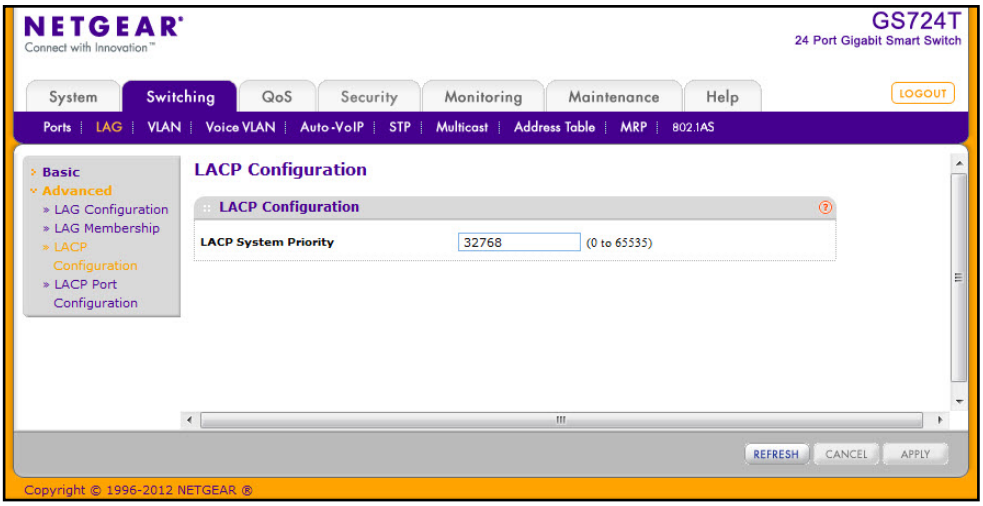
1. From the **LAG ID** field, select the LAG to configure.
2. Optionally, in the **LAG Name** field, enter the name you want assigned to the LAG. You may enter any string of up to 15 alphanumeric characters. A valid name has to be specified to create the LAG.
3. Click the orange bar to display the ports.
4. Click the box below each port to include in the LAG. The following figure shows an example of how to configure LAG1 with ports g1–g4 as members.




5. Click **Cancel** to cancel the configuration on the screen and reset the data on the screen to the latest value of the switch.
6. If you make any changes to this page, click **Apply** to send the updated configuration to the switch. Configuration changes take effect immediately.
7. To view the ports that are members of the selected LAG, click **Current Members**.

# LACP Configuration

To display the LACP Configuration page, click **Switching** > **LAG** > **Advanced** > **LACP Configuration**.

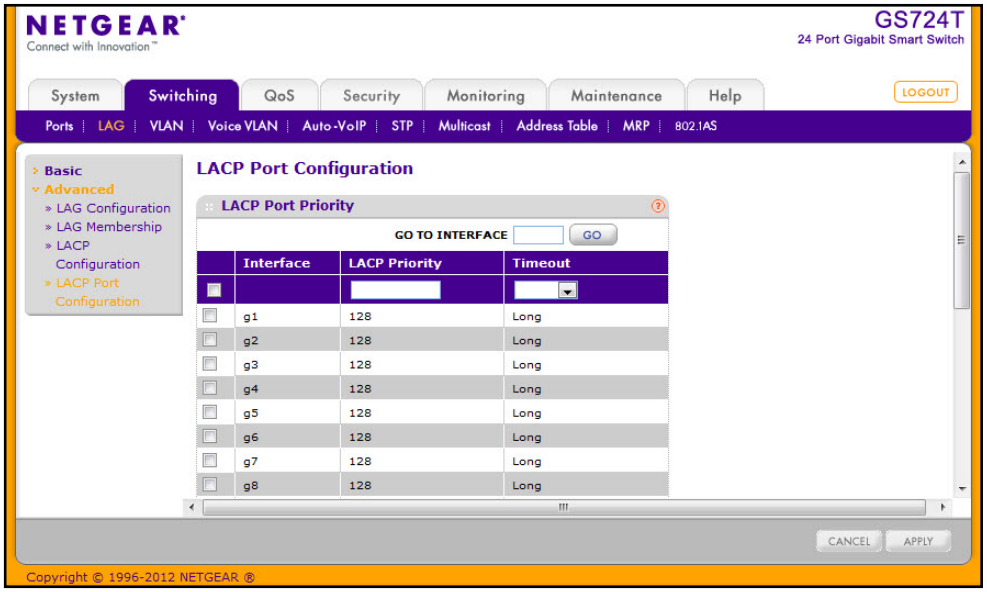



To configure LACP:

1. From the LACP System Priority field, specify the device's link aggregation priority relative to the devices at the other ends of the links on which link aggregation is enabled. A higher value indicates a lower priority. You can change the value of the parameter globally by specifying a priority from 0–65535. The default value is 32768.
2. Click **Refresh** to reload the page and display the most current information.
3. Click **Cancel** to cancel the configuration on the screen and reset the data on the screen to the latest value of the switch.
4. If you make any changes to this page, click **Apply** to send the updated configuration to the switch. Configuration changes take effect immediately.

# LACP Port Configuration

To display the LACP Port Configuration page, click **Switching** > **LAG** > **Advanced** > **LACP Port Configuration**.




To configure LACP port priority settings:

1. Select the check box next to the port to configure. You can select multiple ports to apply the same setting to all selected ports.

   **Note:** You cannot select ports that are not participating in a LAG

2. Configure the **LACP Priority** value for the selected port. The field range is 0–255. The default value is 128.
3. Configure the administrative LACP **Timeout** value.
   - **Long**. Specifies a long timeout value.
   - **Short**. Specifies a short timeout value.
4. Click **Cancel** to cancel the configuration on the screen and reset the data on the screen to the latest value of the switch.
5. If you make any changes to this page, click **Apply** to send the updated configuration to the switch. Configuration changes take effect immediately.

# VLANs

Adding Virtual LAN (VLAN) support to a Layer 2 switch offers some of the benefits of both bridging and routing. Like a bridge, a VLAN switch forwards traffic based on the Layer 2 header, which is fast, and like a router, it partitions the network into logical segments, which provides better administration, security and management of multicast traffic.

By default, all ports on the switch are in the same broadcast domain. VLANs electronically separate ports on the same switch into separate broadcast domains so that broadcast packets are not sent to all the ports on a single switch. When you use a VLAN, users can be grouped by logical function instead of physical location.

Each VLAN in a network has an associated VLAN ID, which appears in the IEEE 802.1Q tag in the Layer 2 header of packets transmitted on a VLAN. An end station may omit the tag, or the VLAN portion of the tag, in which case the first switch port to receive the packet may either reject it or insert a tag using its default VLAN ID. A given port may handle traffic for more than one VLAN, but it can only support one default VLAN ID.

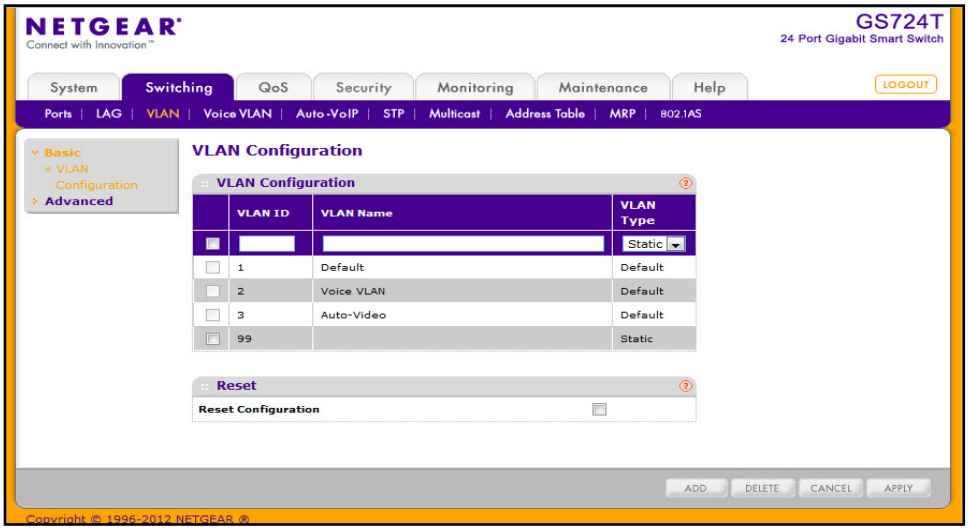
From the VLAN link, you can access the following pages:

- *VLAN Configuration* on page 89
- *VLAN Membership Configuration* on page 90
- *Port VLAN ID Configuration* on page 92

## VLAN Configuration

Use the VLAN Configuration page to define VLAN groups stored in the VLAN membership table. The GS716T and GS724T supports up to 256 VLANs. VLAN 1 is created by default, and all ports are untagged members.

To display the VLAN Configuration page, lick **Switching** > **VLAN** > **Basic** > **VLAN Configuration**.



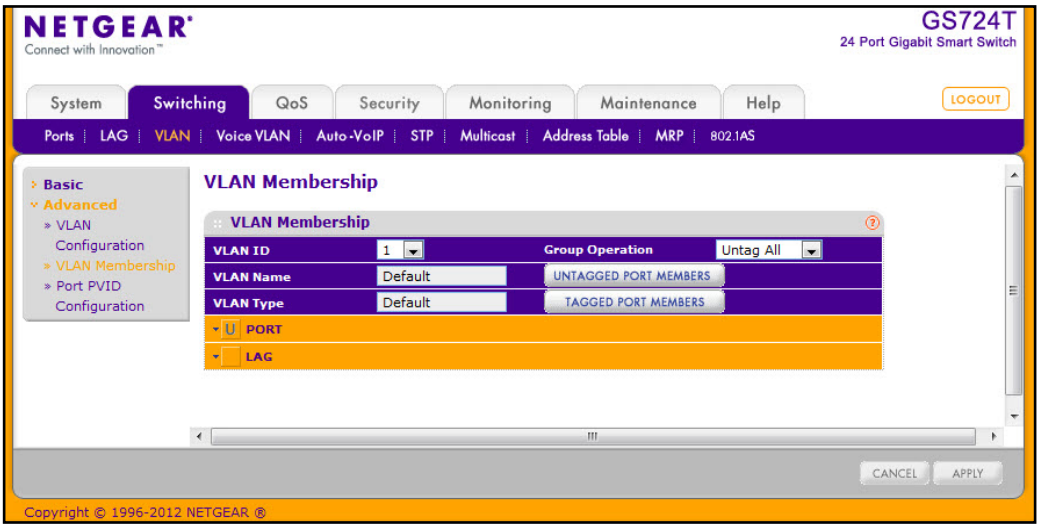
To configure VLANs:

1. To add a VLAN, configure the VLAN ID, name, and type, and then click **Add**.
   - **VLAN ID**. Specify the VLAN Identifier for the new VLAN. (You can enter data in this field only when you are creating a new VLAN.) The range of the VLAN ID is 1–4093.
   - **VLAN Name**. Use this optional field to specify a name for a non-default VLAN. It can be up to 32 alphanumeric characters long, including blanks. The default is blank. VLANs 1–3 cannot be renamed.
   - **VLAN Type**. This field identifies the type of the VLAN you are configuring. The switch is preconfigured with three VLANS that have a VLAN Type of *Default*. VLAN 1 is the Default VLAN, VLAN 2 is the Voice VLAN, and VLAN 3 is the Auto-Video VLAN. These VLANs cannot be changed or deleted. When you create a VLAN on this page, its type will always be Static.
2. To delete a VLAN, select the check box next to the VLAN ID and click **Delete**. You cannot delete the default VLANs.
3. To modify settings for a VLAN, select the check box next to the VLAN ID, change the desired information, and then click **Apply**. Configuration changes occur immediately.
4. Click **Cancel** to cancel the configuration on the screen and reset the data on the screen to the latest value of the switch.
5. To reset the VLAN settings on the switch to the factory defaults, select the **Reset Configuration** check box, and click OK in the popup message to confirm. If the Management VLAN is set to a non-default VLAN (VLAN 1), it is automatically set to 1 after a Reset Configuration.

## VLAN Membership Configuration

Use this page to configure VLAN Port Membership for a particular VLAN. You can select the Group operation through this page.

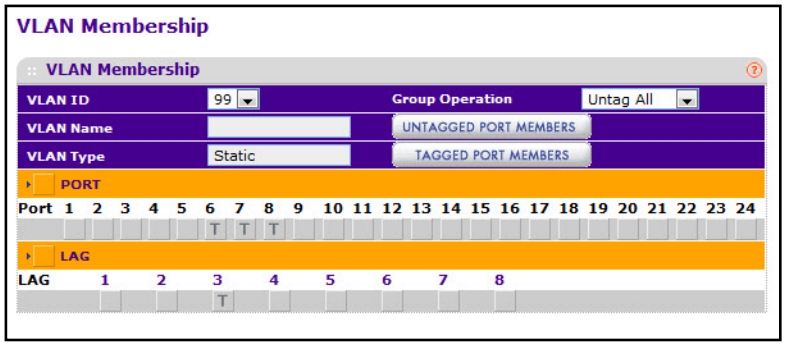
To display the VLAN Membership Configuration page, click **Switching** > **VLAN** > **Advanced** > **VLAN Membership**.




To configure VLAN membership:

1. From the VLAN ID field, select the VLAN to which you want to add ports.
2. Click the orange bar below the VLAN Type field to display the physical ports on the switch.
3. Click the lower orange bar to display the LAGs on the switch.
4. To select the port(s) or LAG(s) to add to the VLAN, click the square below each port or LAG. You can add each interface as a tagged (T) or untagged (U) VLAN member. A blank square means that the port is not a member of the VLAN.
   - **Tagged**: Frames transmitted from this port are tagged with the port VLAN ID.
   - **Untagged**: Frames transmitted from this port are untagged. Each port can be an untagged member of only one VLAN. By default, all ports are an untagged member of VLAN 1.

   In the following figure, ports g6, g7, g8, and LAG 1 are being added as tagged members to VLAN 99.



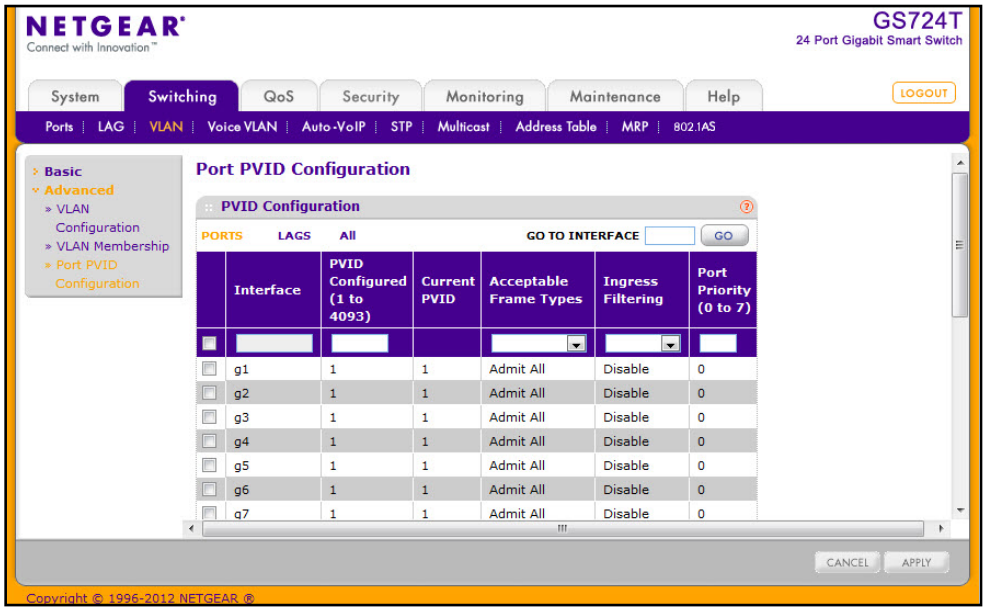
5. Use the **Group Operations** field to select all the ports and configure them. Possible values are:
   - **Untag All**: Select all the ports on which all frames transmitted from this VLAN will be untagged. All the ports will be included in the VLAN.
   - **Tag All**: Select the ports on which all frames transmitted for this VLAN will be tagged. All the ports will be included in the VLAN.
   - **Remove All**: This selection has the effect of excluding all ports from the selected VLAN.
6. Click **Cancel** to cancel the configuration on the screen and reset the data on the screen to the latest value of the switch.
7. If you make any changes to this page, click **Apply** to send the updated configuration to the switch. Configuration changes take place immediately.

# Port VLAN ID Configuration

The Port PVID Configuration screen lets you assign a port VLAN ID (PVID) to an interface. There are certain requirements for a PVID:

- All ports must have a defined PVID.
- If no other value is specified, the default VLAN PVID is used.

To access the Port PVID Configuration page, click **Switching** > **VLAN** > **Advanced** > **Port PVID Configuration**.



To configure PVID information:

1. To configure PVID settings for a physical port, click **PORTS**.
2. To configure PVID settings for a Link Aggregation Group (LAG), click **LAGS**.
3. To configure PVID settings for both physical ports and LAGs, click **ALL**.
4. Select the check box next to the interfaces to configure. You can select multiple interfaces to apply the same setting to the selected interfaces. Select the check box in the heading row to apply the same settings to all interfaces.
5. Configure the PVID to assign to untagged or priority tagged frames received on this port.
6. In the **Acceptable Frame Type** field, specify how you want the port to handle untagged and priority tagged frames. Whichever you select, VLAN tagged frames will be forwarded in accordance with the IEEE 802.1Q VLAN standard. The factory default is Admit All.
   - **VLAN Only**: The port will accept only VLAN-tagged frames and will discard any untagged or priority tagged frames it receives.
   - **Admit All**: Untagged and priority tagged frames received on the port will be accepted and assigned the value of the Port VLAN ID for this port.
7. In the **Ingress Filtering** field, specify how you want the port to handle tagged frames:
   - **Enable**: A tagged frame will be discarded if this port is not a member of the VLAN identified by the VLAN ID in the tag. In an untagged frame, the VLAN is the Port VLAN ID specified for the port that received this frame.
   - **Disable**: All frames are forwarded in accordance with the IEEE 802.1Q VLAN standard. The factory default is Disable.
8. Specify the default 802.1p priority assigned to untagged packets arriving at the port. Possible values are 0–7.
9. Click **Cancel** to cancel the configuration on the screen and reset the data on the screen to the latest value of the switch.
10. If you make any changes to this page, click **Apply** to send the updated configuration to the switch. Configuration changes take place immediately.

# Voice VLAN

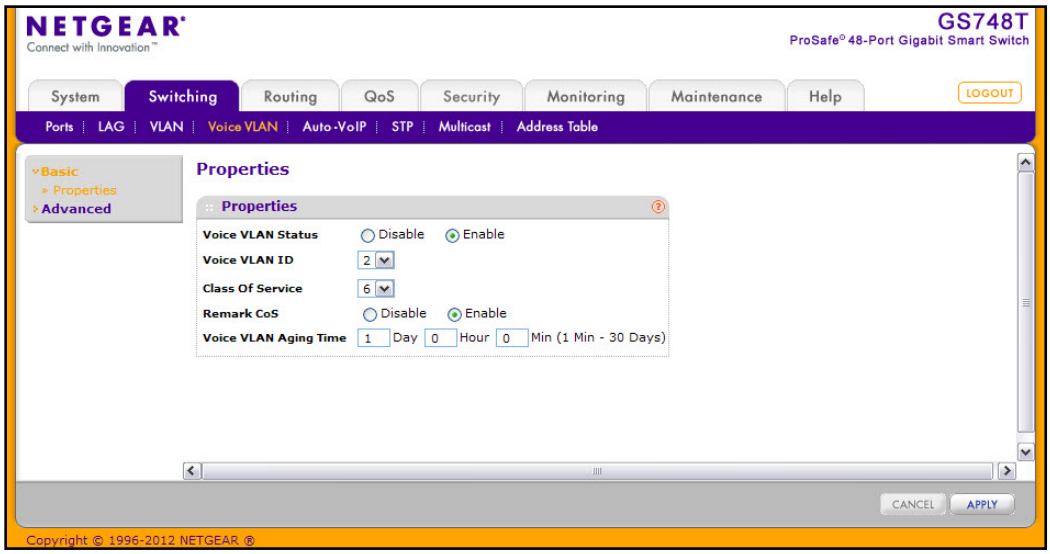
Configure the Voice VLAN settings for ports that carry traffic from IP phones. The Voice VLAN feature can help ensure that the sound quality of an IP phone is safeguarded from deteriorating when the data traffic on the port is high.

From the VLAN link, you can access the following pages:

- *Voice VLAN Properties* on page 94
- *Voice VLAN Port Setting* on page 95
- *Voice VLAN OUI* on page 96

## Voice VLAN Properties

To display the Voice VLAN Properties page, click **Switching** > **Voice VLAN** > **Basic** > **Properties**.



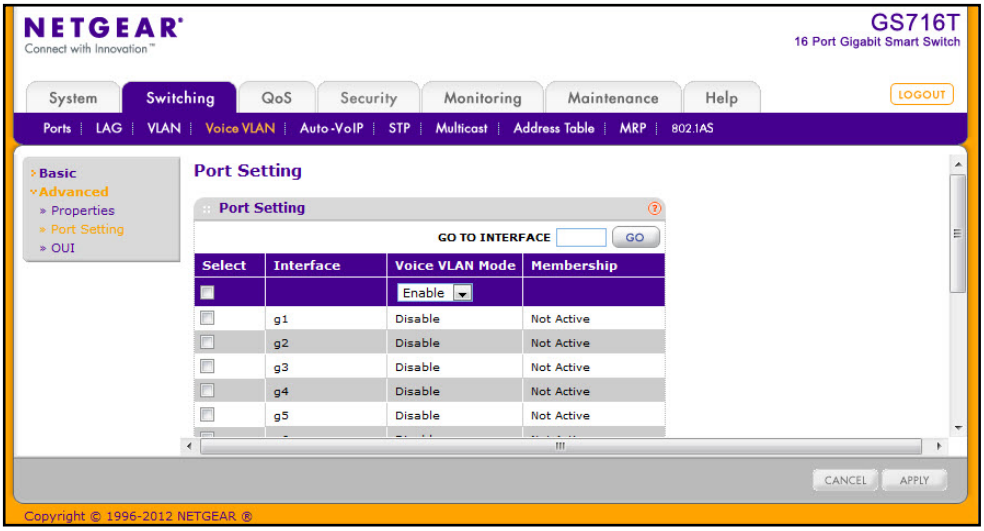

To configure Voice VLAN:

1. From the **Voice VLAN Status** field, enable or disable Voice VLAN on the switch. If the switch does not handle traffic from IP phones, the status should be disabled.
2. From the **Voice VLAN ID** field, select the VLAN to use for voice traffic on the switch. The VLAN must already exist on the switch. For information about how to create VLANs, see *VLAN Configuration* on page 89.
3. From the **Class of Service** field, set the CoS tag value to be reassigned for packets received on the Voice VLAN when Remark CoS is enabled.
4. From the **Remark CoS** field, select Enable or Disable to reassign the CoS tag value to packets received on the Voice VLAN.

5. From the **Voice VLAN Aging Time** field, specify the amount of time after the last IP phone's OUI is aged out for a specific port. The port will age out after the bridge and voice aging time.
6. Click **Cancel** to cancel the configuration on the screen and reset the data on the screen to the latest value of the switch.
7. If you make any changes to this page, click **Apply** to send the updated configuration to the switch.

## Voice VLAN Port Setting

To display the Voice VLAN Port Setting page, click **Switching** > **Voice VLAN** > **Advanced** > **Port Setting**.




To configure Voice VLAN port settings:

1. Select the check box next to the port to configure. You can select multiple check boxes to apply the same setting to all selected ports.
2. From the **Voice VLAN Mode** menu, specify whether to enable or disable Voice VLAN on the selected port.
3. Click **Cancel** to cancel the configuration on the screen and reset the data on the screen to the latest value of the switch.
4. If you make any changes to this page, click **Apply** to send the updated configuration to the switch.

**Note:** The **Membership** field displays whether the current operational status of the voice VLAN on the interface is active or not active.

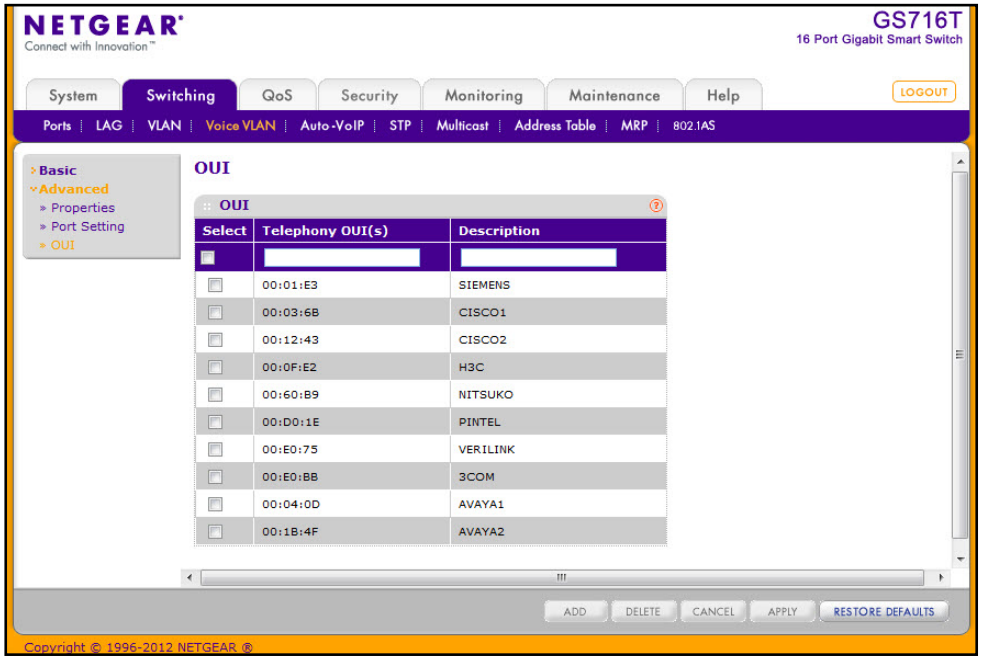
# Voice VLAN OUI

The Organizational Unique Identifier (OUI) identifies the IP phone manufacturer. The switch comes preconfigured with the following OUIs:

- 00:01:E3: SIEMENS
- 00:03:6B: CISCO1
- 00:12:43: CISCO2
- 00:0F:E2: H3C
- 00:60:B9: NITSUKO
- 00:D0:1E: PINTEL
- 00:E0:75: VERILINK
- 00:E0:BB: 3COM
- 00:04:0D: AVAYA1
- 00:1B:4F: AVAYA2

You can select an existing OUI or add a new OUI and description to identify the IP phones on the network.

To display the Voice VLAN OUI page, click **Switching** > **Voice VLAN** > **Advanced** > **OUI**.



To configure OUI settings:

1. To add a new OUI prefix, type the VOIP OUI prefix in the **Telephony OUI(s)** field, provide a description of the prefix, and click **Add**. The OUI prefix must be in the format AA:BB:CC.
2. To delete an OUI prefix from the list, select the check box next to the OUI prefix and click **Delete**.
3. To modify information for an entry in the OUI list, select the check box next to the OUI prefix, update the OUI prefix or description, and then click **Apply**.
4. Click **Cancel** to cancel the configuration on the screen and reset the data on the screen to the latest value of the switch.
5. Click **Restore Defaults** to restore the list to the preconfigured OUIs.

# Auto-VoIP Configuration

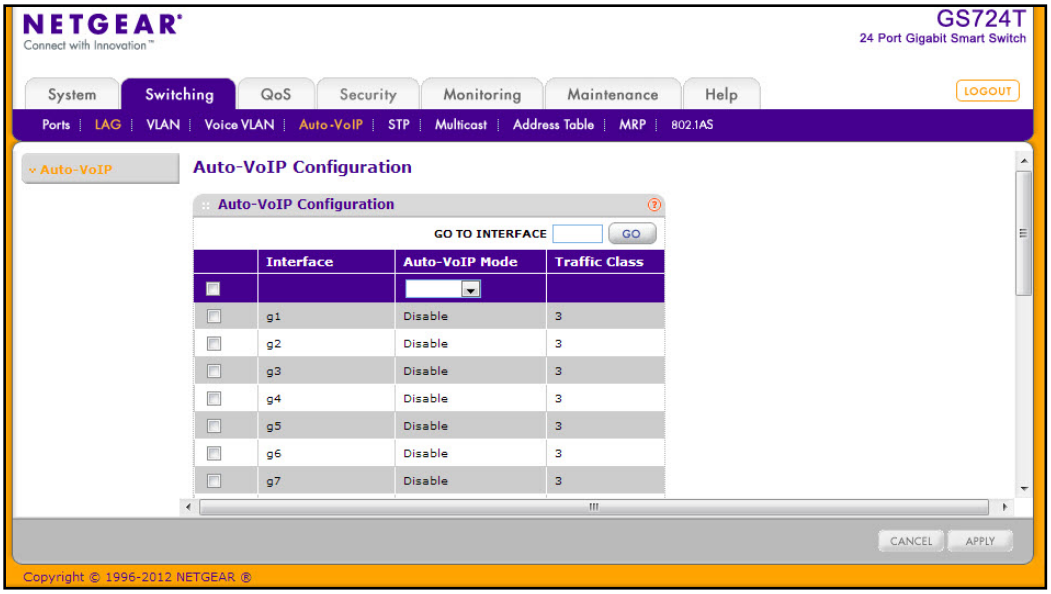
The Auto-VoIP automatically makes sure that time-sensitive voice traffic is given priority over data traffic on ports that have this feature enabled. Auto-VoIP checks for packets carrying the following VoIP protocols:

- Session Initiation Protocol (SIP)
- H.323
- Skinny Client Control Protocol (SCCP)

VoIP frames that are received on ports that have the Auto-VoIP feature enabled are marked with CoS Traffic Class 3.

Use the Auto-VoIP Configuration menu to configure the Auto-VoIP parameters. **Interface** specifies all the configurable Auto-VoIP interfaces. **Traffic Class** displays the Traffic Class on which the received VoIP frames are marked.

To display the Auto-VoIP Configuration page, click **Switching** > **Auto-VoIP**.




To enable Auto-VoIP:

1. **Auto-VoIP Mode**. Select the Auto-VoIP administrative mode for the interface. This selector lists the two options for administrative mode: Enable and Disable. The administrative mode of Auto-VoIP is disabled by default.
2. Click **Cancel** to cancel the configuration on the screen and reset the data on the screen to the latest value of the switch.
3. If you make any configuration changes, click **Apply** to send the updated configuration to the switch. Configuration changes occur immediately.

# Spanning Tree Protocol

The Spanning Tree Protocol (STP) provides a tree topology for any arrangement of bridges. STP also provides one path between end stations on a network, eliminating loops. Spanning tree versions supported include Common STP, Multiple STP, and Rapid STP.

Classic STP provides a single path between end stations, avoiding and eliminating loops. For information on configuring Common STP, see *CST Port Configuration* on page 103.

Multiple Spanning Tree Protocol (MSTP) supports multiple instances of Spanning Tree to efficiently channel VLAN traffic over different interfaces. Each instance of the Spanning Tree behaves in the manner specified in IEEE 802.1w, Rapid Spanning Tree (RSTP), with slight modifications in the working but not the end effect (chief among the effects, is the rapid transitioning of the port to ‘Forwarding’). The difference between the RSTP and the traditional STP (IEEE 802.1D) is the ability to configure and recognize full-duplex connectivity and ports which are connected to end stations, resulting in rapid transitioning of the port to ‘Forwarding’ state and the suppression of Topology Change Notification. These features are represented by the parameters ‘pointtopoint’ and ‘edgeport’. MSTP is compatible to both RSTP and STP. It behaves appropriately to STP and RSTP bridges. A MSTP bridge can be configured to behave entirely as a RSTP bridge or a STP bridge.

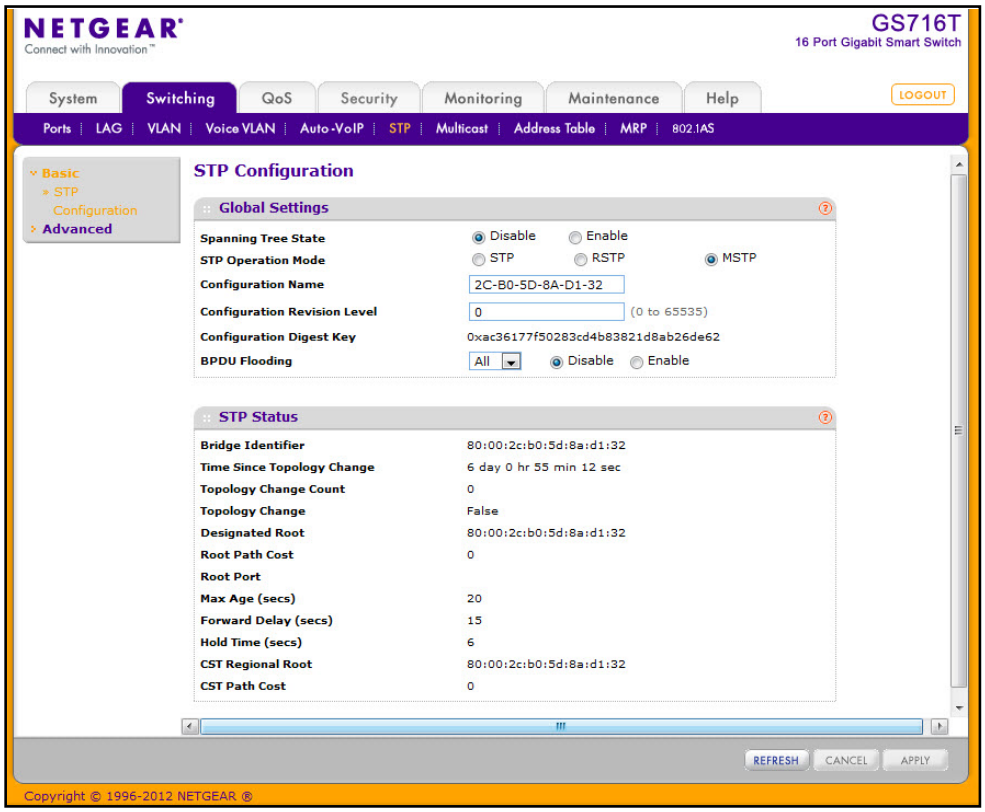
**Note:** For two bridges to be in the same region, the force version should be 802.1s and their configuration name, digest key, and revision level should match. For additional information about regions and their effect on network topology, refer to the IEEE 802.1Q standard.

The Spanning Tree folder contains links to the following features:

# STP Switch Configuration

The Spanning Tree Switch Configuration/Status page contains fields for enabling STP on the switch.

To display the Spanning Tree Switch Configuration/Status page, click **Switching > STP > Basic** > **STP Configuration**.




To configure STP settings on the switch:

1. From the **Spanning Tree State** field, specify whether to enable or disable Spanning Tree operation on the switch.
2. From the **STP Operation Mode** field, Specifies the Force Protocol Version parameter for the switch. Options are:
   - STP (Spanning Tree Protocol): IEEE 802.1D
   - RSTP (Rapid Spanning Tree Protocol): IEEE 802.1w
   - MSTP (Multiple Spanning Tree Protocol): IEEE 802.1s
3. Specify the configuration name and revision level.
   - **Configuration Name**. Name used to identify the configuration currently being used. It may be up to 32 alphanumeric characters.
   - **Configuration Revision Level**. Number used to identify the configuration currently being used. The values allowed are between 0 and 65535. The default value is 0.

4. Specify the BPDU Flooding status for all ports or for individual ports. When this feature is enabled, BPDU packets arriving at this port are flooded to other ports if STP is disabled.
5. Click **Cancel** to cancel the configuration on the screen and reset the data on the screen to the latest value of the switch
6. If you make any configuration changes, click **Apply** to send the updated configuration to the switch. Configuration changes occur immediately.

The following table describes the STP Status information displayed on the screen.

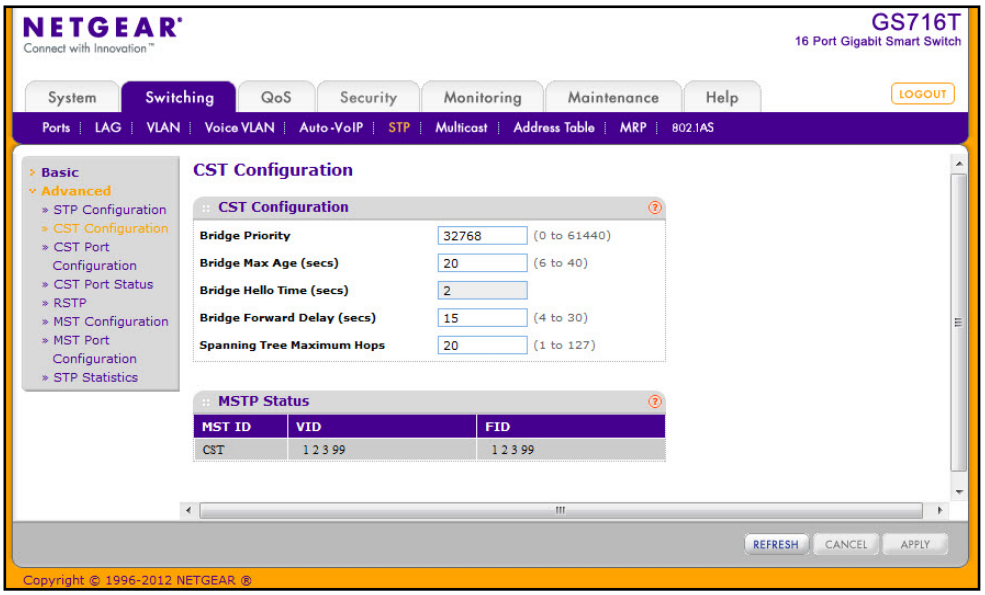
| Field | Description |
|---|---|
| Bridge Identifier | The bridge identifier for the CST. It is made up using the bridge priority and the base MAC address of the bridge. |
| Time Since Topology Change | The time in seconds since the topology of the CST last changed. |
| Topology Change Count | The number of times the topology has changed for the CST. |
| Topology Change | The value of the topology change parameter for the switch indicating if a topology change is in progress on any port assigned to the CST. The value is either **True** or **False**. |
| Designated Root | The bridge identifier of the root bridge. It is made up from the bridge priority and the base MAC address of the bridge. |
| Root Path Cost | Path cost to the Designated Root for the CST. |
| Root Port | Port to access the Designated Root for the CST. |
| Max Age (secs) | Specifies the bridge maximum age for CST. The value must be less than or equal to (2 X Bridge Forward Delay) – 1 and greater than or equal to 2 X (Bridge Hello Time +1). |
| Forward Delay (secs) | Derived value of the Root Port Bridge Forward Delay parameter. |
| Hold TIme (secs) | Minimum time between transmission of Configuration BPDUs. |
| CST Regional Root | Priority and base MAC address of the CST Regional Root. |
| CST Path Cost | Path Cost to the CST tree Regional Root. |

Click **Refresh** to update the information on the screen with the most current data.

# CST Configuration

Use the Spanning Tree CST Configuration page to configure Common Spanning Tree (CST) and Internal Spanning Tree on the switch.

To display the Spanning Tree CST Configuration page, click **Switching > STP > Advanced** > **CST Configuration**.




To configure CST settings:

1. Specify values for CST in the appropriate fields:
   - **Bridge Priority**. When switches or bridges are running STP, each is assigned a priority. After exchanging BPDUs, the switch with the lowest priority value becomes the root bridge. Specifies the bridge priority value for the Common and Internal Spanning Tree (CST). The valid range is 0–61440. The bridge priority is a multiple of 4096. If you specify a priority that is not a multiple of 4096, the priority is automatically set to the next lowest priority that is a multiple of 4096. For example, if the priority is attempted to be set to any value between 0 and 4095, it will be set to 0. The default priority is 32768.
   - **Bridge Max Age (secs)**. Specifies the bridge maximum age time for the Common and Internal Spanning Tree (CST), which indicates the amount of time in seconds a bridge waits before implementing a topological change. The valid range is 6–40, and the value must be less than or equal to (2 * Bridge Forward Delay) – 1 and greater than or equal to 2 * (Bridge Hello Time +1). The default value is 20.
   - **Bridge Hello Time (secs)**. Specifies the switch Hello time for the Common and Internal Spanning Tree (CST), which indicates the amount of time in seconds a root bridge waits between configuration messages. The value is fixed at 2 seconds.

- **Bridge Forward Delay (secs).** Specifies the switch forward delay time, which indicates the amount of time in seconds a bridge remains in a listening and learning state before forwarding packets. The value must be greater or equal to (Bridge Max Age / 2) + 1. The time range is from 4 seconds to 30 seconds. The default value is 15.
- **Spanning Tree Maximum Hops.** Specifies the maximum number of bridge hops the information for a particular CST instance can travel before being discarded. The valid range is 1–127.

2. Click **Cancel** to cancel the configuration on the screen and reset the data on the screen to the latest value of the switch
3. If you make any configuration changes, click **Apply** to send the updated configuration to the switch. Configuration changes take place immediately.

The following table describes the MSTP status information displayed on the Spanning Tree CST Configuration page.

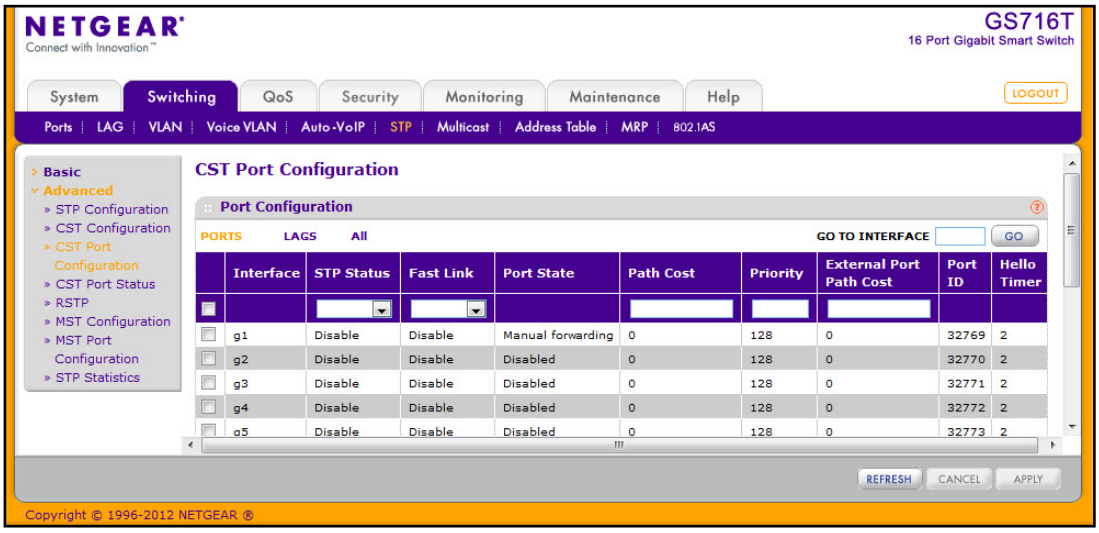
| Field | Description |
|---|---|
| MST ID | Table consisting of the MST instances (including the CST) and the corresponding VLAN IDs associated with each of them. |
| VID | Table consisting of the VLAN IDs and the corresponding FID associated with each of them |
| FID | Table consisting of the FIDs and the corresponding VLAN IDs associated with each of them. |

Click **Refresh** to update the information on the screen with the most current data.

# CST Port Configuration

Use the Spanning Tree CST Port Configuration page to configure Common Spanning Tree (CST) and Internal Spanning Tree on a specific port on the switch.

To display the Spanning Tree CST Port Configuration page, click **Switching** > **STP** > **Advanced** > **CST Port Configuration**.



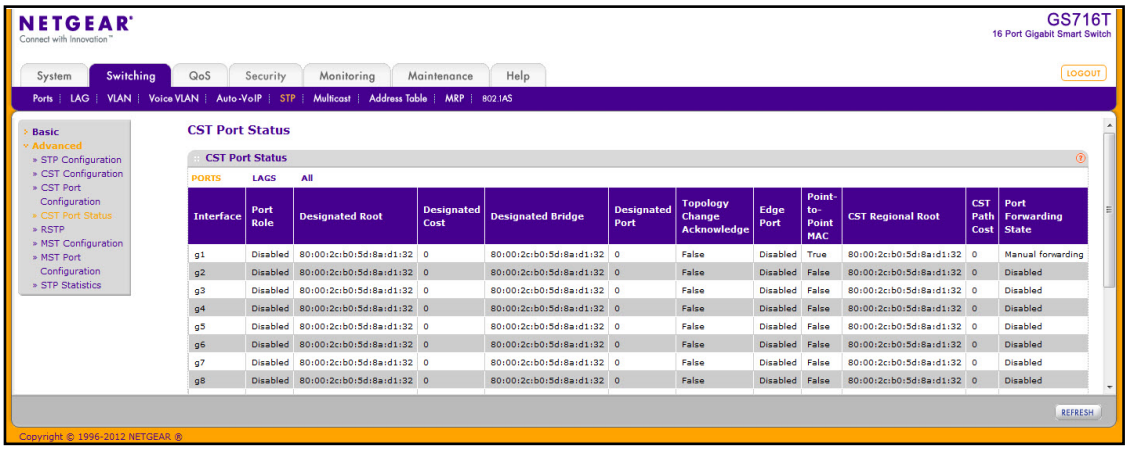
To configure CST port settings:

1. To configure CST settings for a physical port, click **PORTS**.
2. To configure CST settings for a Link Aggregation Group (LAG), click **LAGS**.
3. To configure CST settings for both physical ports and LAGs, click **ALL**.
4. Select the check box next to the port or LAG to configure. You can select multiple ports and LAGs to apply the same setting to the selected interfaces. Select the check box in the heading row to apply the same settings to all interfaces.
5. Configure the CST values for the selected port(s) or LAG(s):
   - **STP Status**. Enable or disable the Spanning Tree Protocol Administrative Mode associated with the port or port channel.
   - **Fast Link**. Specifies if the specified port is an Edge Port with the CST. Possible values are Enable or Disable. The default is Disable.
   - **Port State**. The Forwarding state of this port. This field is read-only.
   - **Path Cost**. Set the Path Cost to a new value for the specified port in the common and internal spanning tree. It takes a value in the range of 1–200000000.
   - **Priority**. The priority for a particular port within the CST. The port priority is set in multiples of 16. If you specify a value that is not a multiple of 16, the priority is set to the priority is automatically set to the next lowest priority that is a multiple of 16. For example, if you set a value between 0 and 15, the priority is set to 0. If you specify a number between 16 and 31, the priority is set to 16.
   - **External Port Path Cost**. Set the External Path Cost to a new value for the specified port in the spanning tree. It takes a value in the range of 1–200000000.
   - **Port ID**. The port identifier for the specified port within the CST. It is made up from the port priority and the interface number of the port.
   - **Hello Timer**. Specifies the switch Hello time, which indicates the amount of time in seconds a port waits between configuration messages. The value is fixed at 2 seconds.
6. Click **Cancel** to cancel the configuration on the screen and reset the data on the screen to the latest value of the switch.
7. If you make any configuration changes, click **Apply** to send the updated configuration to the switch. Configuration changes take place immediately.
8. Click **Refresh** to update the information on the screen with the most current data.

# CST Port Status

Use the Spanning Tree CST Port Status page to display Common Spanning Tree (CST) and Internal Spanning Tree on a specific port on the switch.

To display the Spanning Tree CST Port Status page, click **Switching** > **STP** > **Advanced** > **CST Port Status**.




The following table describes the CST Status information displayed on the screen.

| Field | Description |
|---|---|
| Interface | Select a physical or port channel interface to configure. The port is associated with the VLAN(s) associated with the CST. |
| Port Role | Each MST Bridge Port that is enabled is assigned a Port Role for each spanning tree. The port role will be one of the following values: **Root Port, Designated Port**, **Alternate Port, Backup Port**, **Master Port**, or **Disabled Port**. |
| Designated Root | Root Bridge for the CST. It is made up using the bridge priority and the base MAC address of the bridge. |
| Designated Cost | Displays cost of the port participating in the STP topology. Ports with a lower cost are less likely to be blocked if STP detects loops. |
| Designated Bridge | Bridge Identifier of the bridge with the Designated Port. It is made up using the bridge priority and the base MAC address of the bridge. |
| Designated Port | Port Identifier on the Designated Bridge that offers the lowest cost to the LAN. It is made up from the port priority and the interface number of the port. |
| Topology Change Acknowledge | Identifies whether the next BPDU to be transmitted for this port would have the topology change acknowledgement flag set. It is either *True* or *False*. |
| Edge Port | Indicates whether the port is enabled as an edge port. Possible values are **Enabled** or **Disabled**. |
| Point-to-point MAC | Derived value indicating whether the port is part of a point-to-point link. |

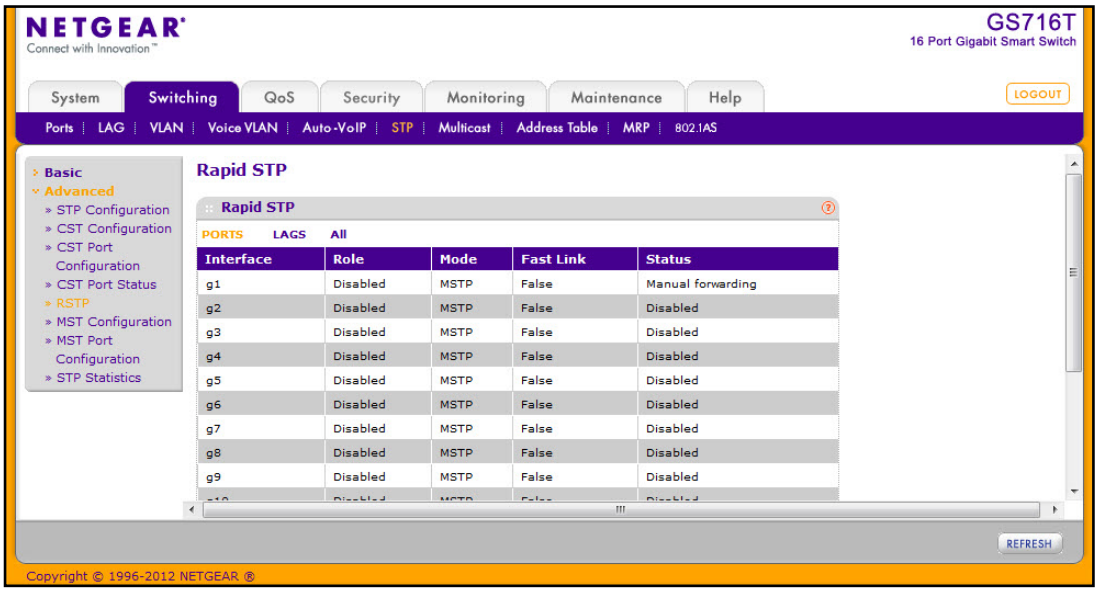
| Field | Description |
|---|---|
| CST Regional Root | Displays the bridge priority and base MAC address of the CST Regional Root. |
| CST Path Cost | Displays the path Cost to the CST tree Regional Root. |
| Port Forwarding State | Displays the Forwarding State of this port. |

Click **Refresh** to update the information on the screen with the most current data.

# Rapid STP

Use the Rapid STP page to view information about Rapid Spanning Tree (RSTP) port status.

To display the Rapid STP page, click **Switching** > **STP** > **Advanced** > **RSTP**.




The following table describes the Rapid STP Status information displayed on the screen.

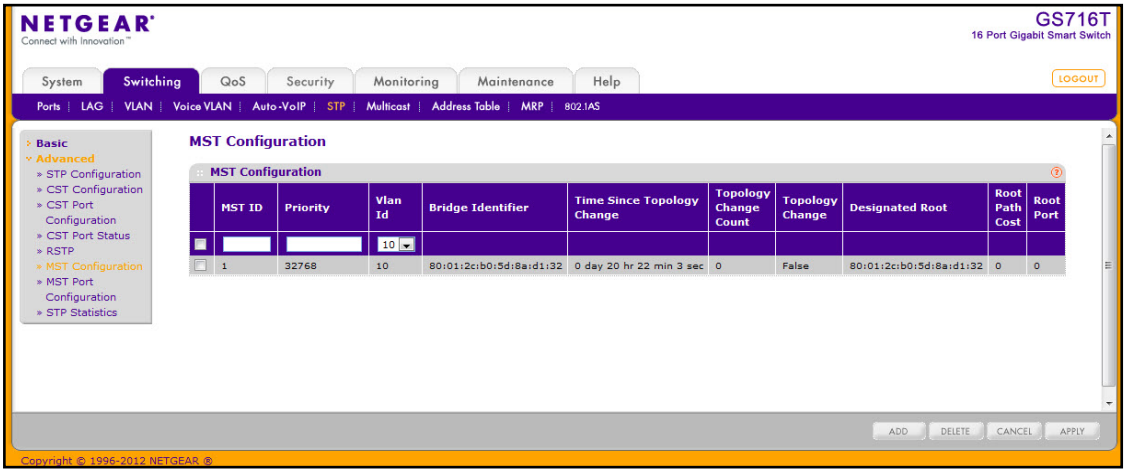
| Field | Description |
|---|---|
| Interface | The physical or port channel interfaces associated with VLANs associated with the CST. |
| Role | Each MST Bridge Port that is enabled is assigned a Port Role for each spanning tree. The port role will be one of the following values: Root Port, Designated Port, Alternate Port, Backup Port, Master Port, or Disabled Port. |
| Mode | Specifies the spanning tree operation mode. Different modes are **STP**, **RSTP**, and **MSTP**. |
| Fast Link | Indicates whether the port is enabled as an edge port. |
| Status | The Forwarding State of this port. |

Click **Refresh** to update the information on the screen with the most current data.

# MST Configuration

Use the Spanning Tree MST Configuration page to configure Multiple Spanning Tree (MST) on the switch.

To display the Spanning Tree MST Configuration page, click **Switching** > **STP** > **Advanced** > **MST Configuration**.



To configure an MST instance:

1. To add an MST instance, configure the MST values and click **Add**:
   - **MST ID**. Specify the ID of the MST to create. Valid values for this are between 1 and 4094.
   - **Priority**. Specifies the bridge priority value for the MST. When switches or bridges are running STP, each is assigned a priority. After exchanging BPDUs, the switch with the lowest priority value becomes the root bridge. The bridge priority is a multiple of 4096. If you specify a priority that is not a multiple of 4096, the priority is automatically set to the next lowest priority that is a multiple of 4096. For example, if the priority is attempted to be set to any value between 0 and 4095, it will be set to 0. The default priority is 32768.The valid range is 0–61440.
   - **VLAN ID**. The menu contains all VLANs configured on the switch. Select a VLAN to associate with the MST instance.
2. To delete an MST instance, select the check box next to the instance and click **Delete**.
3. To modify an MST instance, select the check box next to the instance to configure, update the values, and click **Apply**. You can select multiple check boxes to apply the same setting to all selected ports.
4. Click **Cancel** to cancel the configuration on the screen and reset the data on the screen to the latest value of the switch.

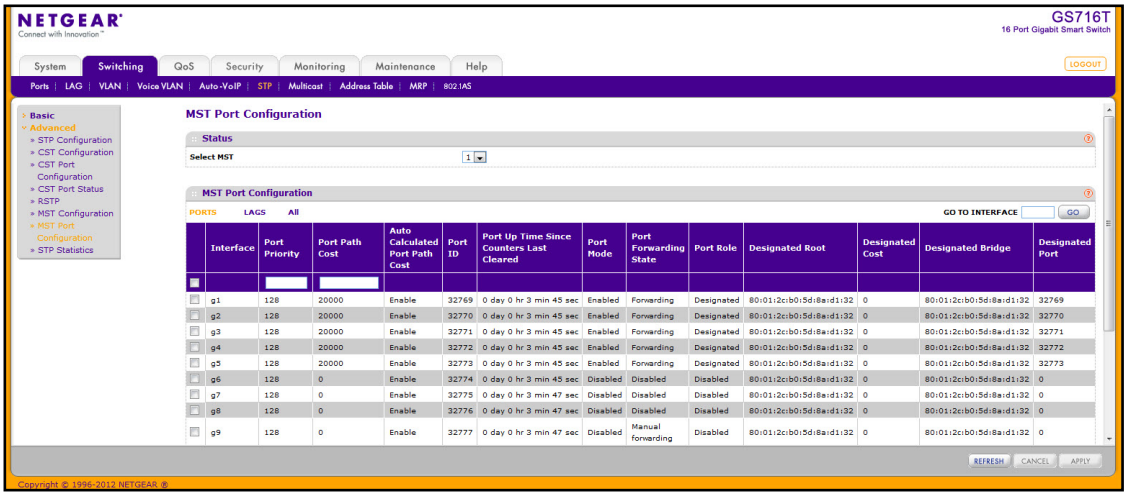
For each configured instance, the information described in the following table displays on the page.

| Field | Description |
|---|---|
| Bridge Identifier | The bridge identifier for the selected MST instance. It is made up using the bridge priority and the base MAC address of the bridge. |
| Time Since Topology Change | Displays the total amount of time since the topology of the selected MST instance last changed. The time is displayed in hour/minute/second format, for example, 5 hours, 10 minutes, and 4 seconds. |
| Topology Change Count | Displays the total number of times topology has changed for the selected MST instance. |
| Topology Change | Indicates whether a topology change is in progress on any port assigned to the selected MST instance. The possible values are **True** or **False**. |
| Designated Root | Displays the bridge identifier of the root bridge, which is made up from the bridge priority and the base MAC address of the bridge. |
| Root Path Cost | Displays the path cost to the Designated Root for this MST instance. |
| Root Port | Indicates the port to access the Designated Root for this MST instance. |

# MST Port Configuration

Use the Spanning Tree MST Port Configuration page to configure and display Multiple Spanning Tree (MST) settings on a specific port on the switch.

To display the Spanning Tree MST Port Status page, click **Switching** > **STP** > **Advanced** > **MST Port Configuration**.




**Note:** If no MST instances have been configured on the switch, the page displays a “No MSTs Available” message.

To configure MST port settings:

1. To configure MST settings for a physical port, click **PORTS**.
2. To configure MST settings for a Link Aggregation Group (LAG), click **LAGS**.
3. To configure MST settings for both physical ports and LAGs, click **ALL**.
4. Select the check box next to the port or LAG to configure. You can select multiple ports and LAGs to apply the same setting to the selected interfaces. Select the check box in the heading row to apply the same settings to all interfaces.
5. Configure the MST values for the selected port(s) or LAG(s):
   - **Port Priority**. The priority for a particular port within the selected MST instance. The port priority is set in multiples of 16. If you specify a value that is not a multiple of 16, the priority is set to the priority is automatically set to the next lowest priority that is a multiple of 16. For example, if you set a value between 0 and 15, the priority is set to 0. If you specify a number between 16 and 31, the priority is set to 16. It takes a value in the range of 0–240.
   - **Port Path Cost**. Set the Path Cost to a new value for the specified port in the selected MST instance. It takes a value in the range of 1–200000000.

6. Click **Cancel** to cancel the configuration on the screen and reset the data on the screen to the latest value of the switch
7. If you make any configuration changes, click **Apply** to send the updated configuration to the switch. Configuration changes take place immediately.

The following table describes the read-only MST port configuration information displayed on the Spanning Tree CST Configuration page

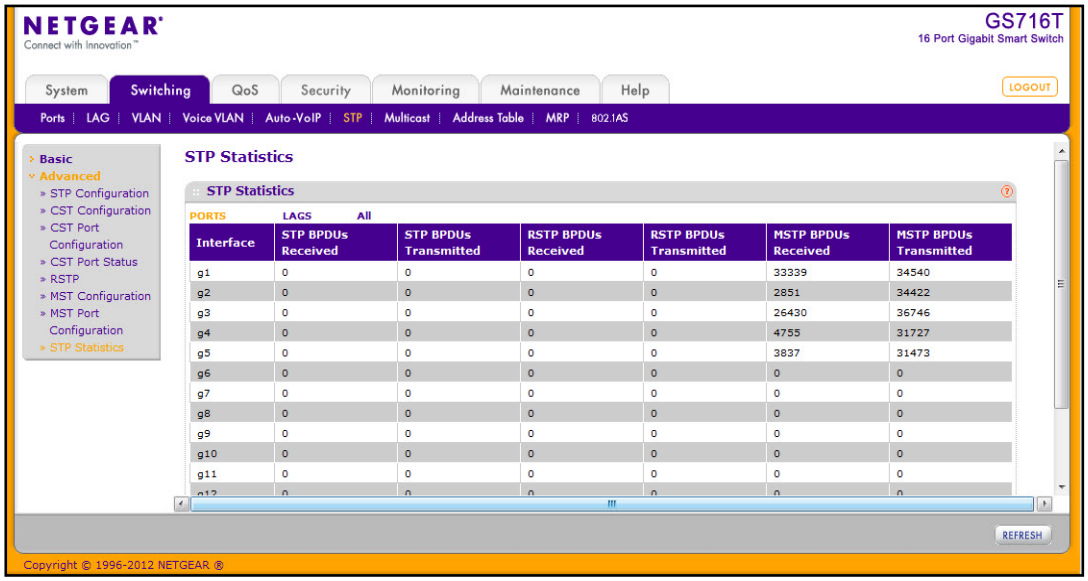
| Field | Description |
|---|---|
| Auto-calculated Port Path Cost | Displays whether the path cost is automatically calculated (Enabled) or not (Disabled). Path cost is calculated based on the link speed of the port if the configured value for Port Path Cost is zero. |
| Port ID | The port identifier for the specified port within the selected MST instance. It is made up from the port priority and the interface number of the port. |
| Port Up Time Since Counters Last Cleared | Time since the counters were last cleared, displayed in Days, Hours, Minutes, and Seconds. |
| Port Mode | Spanning Tree Protocol Administrative Mode associated with the port or port channel. Possible values are **Enable** or **Disable**. |
| Port Forwarding State | Indicates the current STP state of a port. If enabled, the port state determines what forwarding action is taken on traffic. Possible port states are:<br>• **Disabled**: STP is currently disabled on the port. The port forwards traffic while learning MAC addresses.<br>• **Blocking**: The port is currently blocked and cannot be used to forward traffic or learn MAC addresses.<br>• **Listening**: The port is currently in the listening mode. The port cannot forward traffic nor can it learn MAC addresses.<br>• **Learning**: The port is currently in the learning mode. The port cannot forward traffic, however, it can learn new MAC addresses.<br>• **Forwarding**: The port is currently in the forwarding mode. The port can forward traffic and learn new MAC addresses |
| Port Role | Each MST Bridge Port that is enabled is assigned a Port Role for each spanning tree. The port role will be one of the following values: **Root Port**, **Designated Port**, **Alternate Port**, **Backup Port**, **Master Port**, or **Disabled Port**. |
| Designated Root | Root Bridge for the selected MST instance. It is made up using the bridge priority and the base MAC address of the bridge. |
| Designated Cost | Displays cost of the port participating in the STP topology. Ports with a lower cost are less likely to be blocked if STP detects loops. |
| Designated Bridge | Bridge Identifier of the bridge with the Designated Port. It is made up using the bridge priority and the base MAC address of the bridge. |
| Designated Port | Port Identifier on the Designated Bridge that offers the lowest cost to the LAN. It is made up from the port priority and the interface number of the port. |

Click **Refresh** to update the screen with the latest MST information.

# STP Statistics

Use the Spanning Tree Statistics page to view information about the number and type of bridge protocol data units (BPDUs) transmitted and received on each port.

To display the Spanning Tree Statistics page, click **Switching** > **STP** > **Advanced** > **STP Statistics**.




The following table describes the information available on the STP Statistics page.

| Field | Description |
|---|---|
| Interface | Select a physical or port channel interface to view its statistics. |
| STP BPDUs Received | Number of STP BPDUs received at the selected port. |
| STP BPDUs Transmitted | Number of STP BPDUs transmitted from the selected port. |
| RSTP BPDUs Received | Number of RSTP BPDUs received at the selected port. |
| RSTP BPDUs Transmitted | Number of RSTP BPDUs transmitted from the selected port. |
| MSTP BPDUs Received | Number of MSTP BPDUs received at the selected port. |
| MSTP BPDUs Transmitted | Number of MSTP BPDUs transmitted from the selected port. |

Click **Refresh** to update the screen with the latest STP statistics information.

# Multicast

Multicast IP traffic is traffic that is destined to a host group. Host groups are identified by class D IP addresses, which range from 224.0.0.0 to 239.255.255.255.

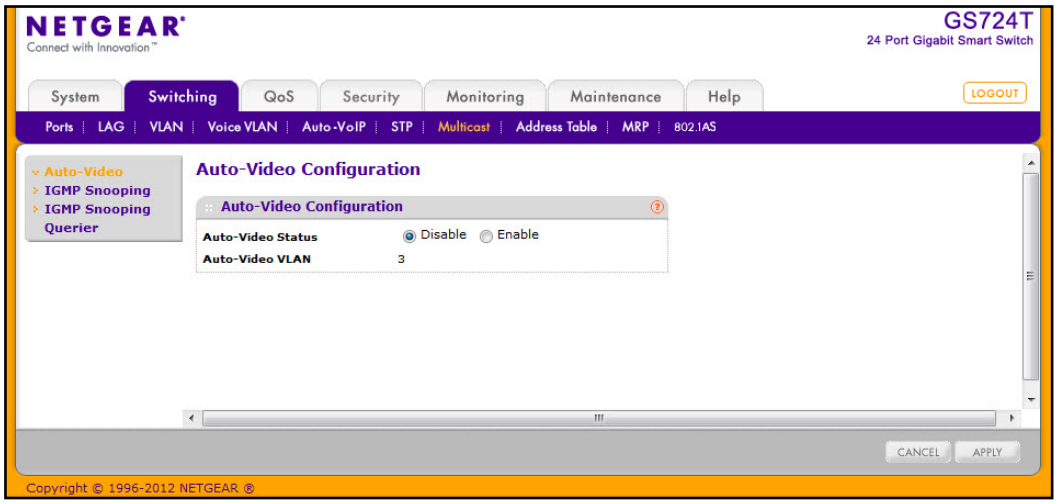
From the Multicast link, you can access the following pages:

- *Auto-Video Configuration* on page 112
- *IGMP Snooping* on page 113
- *IGMP Snooping Querier* on page 124

## Auto-Video Configuration

The Auto-Video Configuration feature is intended to support surveillance cameras and other applications running multicast traffic. Use this menu to configure the Auto-Video parameters. When the Auto-Video feature is being enabled, it configures the IGMP Snooping and IGMP Snooping Querier to operate in the Auto-Video VLAN by default. **Auto-Video** displays the auto-configured IGMP snooping VLAN.

To display the Auto-Video Configuration page, click **Switching** > **Multicast** > **Auto-Video**.




To enable Auto-Video Configuration:

1. **Auto-Video Status**. Select the Auto-Video administrative mode for the switch. This selector lists the two options for administrative mode: enable and disable.

   The **Auto-Video VLAN** field identifies the VLAN ID used for multicast video traffic.

2. Click **Cancel** to cancel the configuration on the screen and reset the data on the screen to the latest value of the switch.
3. If you make any configuration changes, click **Apply** to send the updated configuration to the switch. Configuration changes occur immediately.

# IGMP Snooping

Internet Group Management Protocol (IGMP) Snooping is a feature that allows a switch to forward multicast traffic intelligently on the switch. Multicast IP traffic is traffic that is destined to a host group. Host groups are identified by class D IP addresses, which range from 224.0.0.0 to 239.255.255.255. Based on the IGMP query and report messages, the switch forwards traffic only to the ports that request the multicast traffic. This prevents the switch from broadcasting the traffic to all ports and possibly affecting network performance.

A traditional Ethernet network may be separated into different network segments to prevent placing too many devices onto the same shared media. Bridges and switches connect these segments. When a packet with a broadcast or multicast destination address is received, the switch will forward a copy into each of the remaining network segments in accordance with the IEEE MAC Bridge standard. Eventually, the packet is made accessible to all nodes connected to the network.

This approach works well for broadcast packets that are intended to be seen or processed by all connected nodes. In the case of multicast packets, however, this approach could lead to less efficient use of network bandwidth, particularly when the packet is intended for only a small number of nodes. Packets will be flooded into network segments where no node has any interest in receiving the packet. While nodes will rarely incur any processing overhead to filter packets addressed to unrequested group addresses, they are unable to transmit new packets onto the shared media for the period of time that the multicast packet is flooded. The problem of wasting bandwidth is even worse when the LAN segment is not shared, for example in full-duplex links.

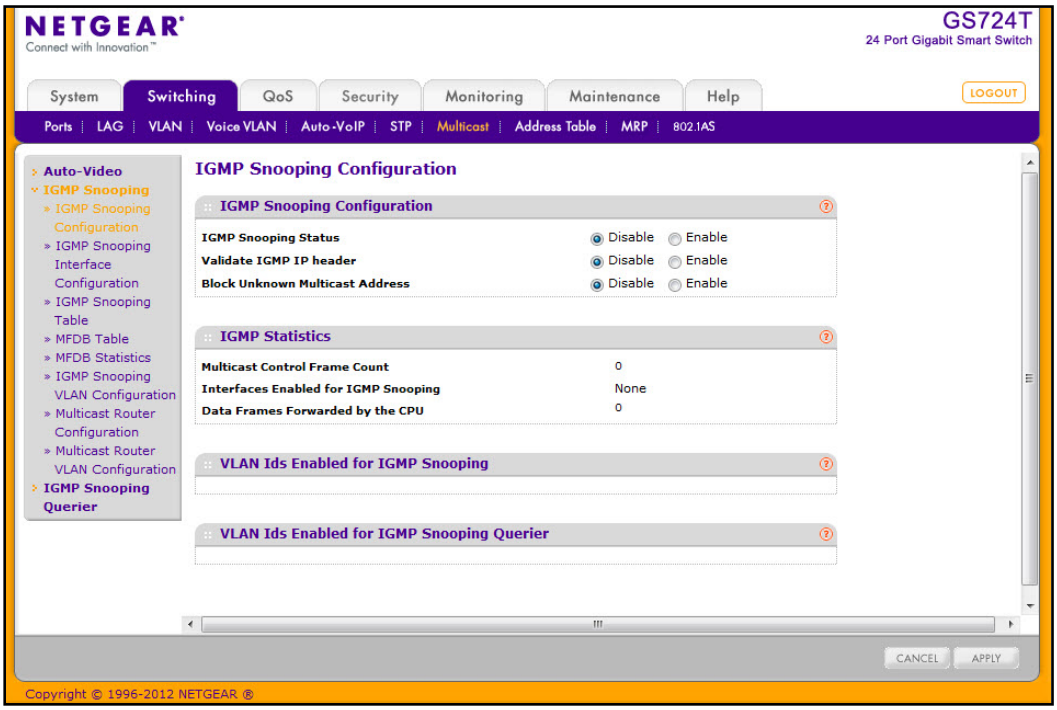
Allowing switches to snoop IGMP packets is a creative effort to solve this problem. The switch uses the information in the IGMP packets as they are being forwarded throughout the network to determine which segments should receive packets directed to the group address.

The IGMP Snooping feature contains links to the following pages:

## *IGMP Snooping Configuration*

Use the IGMP Snooping Configuration page to configure the parameters for IGMP snooping, which is used to build forwarding lists for multicast traffic.

To access the IGMP Snooping Configuration page, click **Switching** > **Multicast** > **IGMP Snooping** > **IGMP Snooping Configuration**.




To configure IGMP Snooping:

1. Enable or disable IGMP Snooping on the switch.
   - **Enable**. The switch snoops all IGMP packets it receives to determine which segments should receive packets directed to the group address.
   - **Disable**. The switch does not snoop IGMP packets.
2. Choose whether to validate the IGMP IP header.
   - **Enable**. The switch checks the IP header of all IGMP messages for the Router Alert option. If the option is not present, the packet is dropped.
   - **Disable**. The IGMP IP header is not checked for Router Alert option.
3. Choose whether to block unknown multicast addresses.
   - **Enable**. Packets with unknown multicast MAC address in the destination field will be dropped.
   - **Disable**. Packets with unknown destination multicast MAC addresses are processed.
4. Click **Apply** to send the updated configuration to the switch. Configuration changes take effect immediately.

5. Click **Cancel** to cancel the configuration on the screen and reset the data on the screen to the latest value of the switch

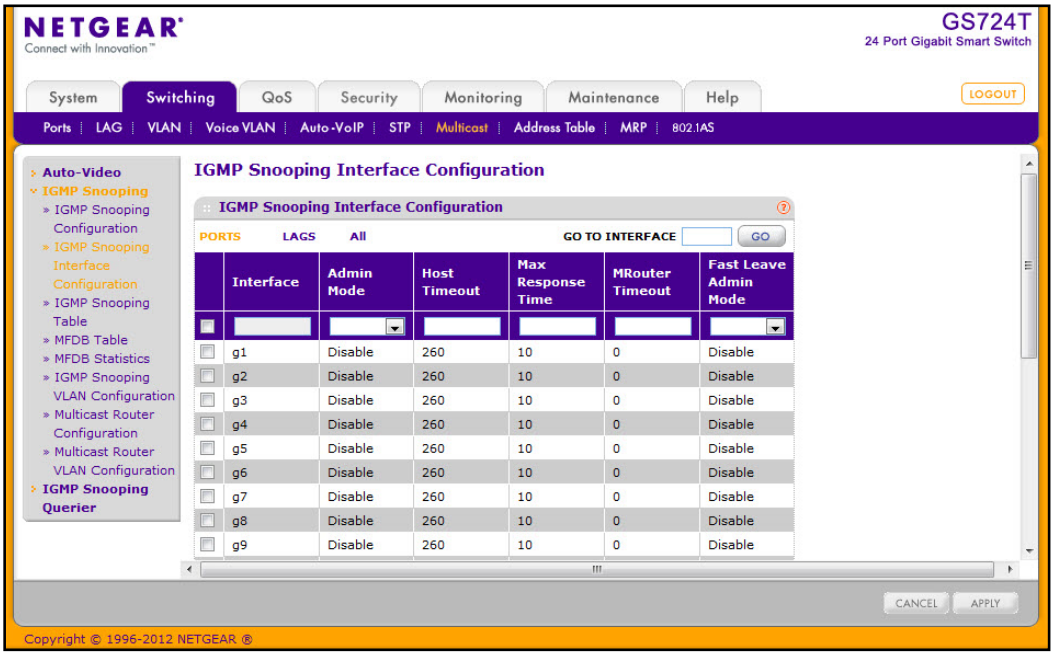
The following table displays information about the global IGMP snooping status and statistics on the page.

| Field | Description |
|---|---|
| Multicast Control Frame Count | Displays the number of multicast control frames that have been processed by the CPU. |
| Interfaces Enabled for IGMP Snooping | Lists the interfaces currently enabled for IGMP Snooping. To enable interfaces for IGMP snooping, see *IGMP Snooping Interface Configuration* on page 115. |
| Data Frames Forwarded by the CPU | Displays the number of data frames forwarded by the CPU. |
| VLAN Ids Enabled For IGMP Snooping | Displays VLAN IDs enabled for IGMP snooping. To enable VLANs for IGMP snooping, see *IGMP Snooping VLAN Configuration* on page 121. |
| VLAN Ids Enabled For IGMP Snooping Querier | Displays VLAN IDs enabled for IGMP snooping querier. |

## *IGMP Snooping Interface Configuration*

Use the IGMP Snooping Interface Configuration page to configure IGMP snooping settings on specific interfaces.

To access the IGMP Snooping Interface Configuration page, click **Switching** > **Multicast** > **IGMP Snooping** > **IGMP Snooping Interface Configuration**.



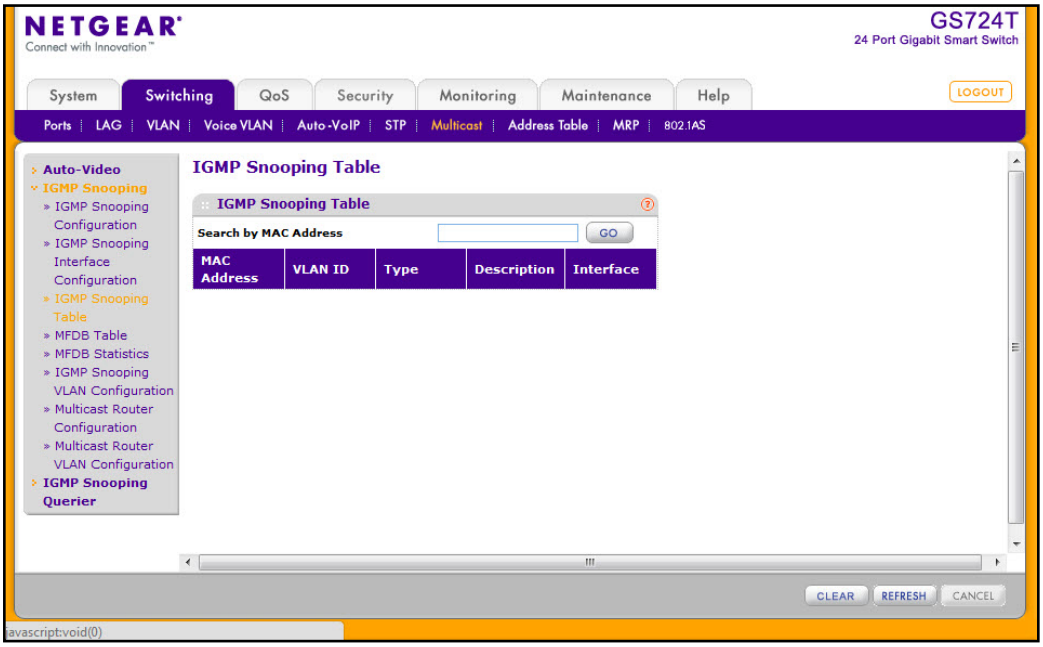
To configure IGMP Snooping interface settings:

1. To configure IGMP Snooping settings for a physical port, click **PORTS**.
2. To configure IGMP Snooping settings for a Link Aggregation Group (LAG), click **LAGS**.
3. To configure IGMP Snooping settings for both physical ports and LAGs, click **ALL**.
4. Select the check box next to the port or LAG to configure. You can select multiple ports and LAGs to apply the same setting to the selected interfaces. Select the check box in the heading row to apply the same settings to all interfaces.
5. Configure the IGMP Snooping values for the selected port(s) or LAG(s):
   - **Admin Mode**. Use the menu to enable or disable the administrative mode of IGMP snooping on the selected interface(s). The default is Disable.
   - **Host Timeout**. Specify the amount of time you want the switch to wait for a report for a particular group on a particular interface before it deletes that interface from the group. Enter a value between 2 and 3600 seconds. The default is 260 seconds.
   - **Max Response Time**. Specify the amount of time you want the switch to wait after sending a query on an interface because it did not receive a report for a particular group on that interface. Enter a value greater or equal to 1 and less than the Host Timeout, in seconds. The default is 10 seconds.
   - **MRouter Timeout**. Specify the amount of time you want the switch to wait to receive a query on an interface before removing it from the list of interfaces with multicast routers attached. Enter a value between 0 and 3600 seconds. The default is 0 seconds. A value of zero indicates an infinite timeout; no expiration.
   - **Fast Leave Admin Mode**. Select the Fast Leave mode for a particular interface from the menu. The default is Disable.
6. Click **Cancel** to cancel the configuration on the screen and reset the data on the screen to the latest value of the switch.
7. If you make any configuration changes, click **Apply** to apply the new settings to the switch. Configuration changes take effect immediately.

## *IGMP Snooping Table*

Use the IGMP Snooping Table page to view all of the entries in the Multicast Forwarding Database that were created for IGMP snooping.

To access the IGMP Snooping Table page, click **Switching** > **Multicast** > **IGMP Snooping** > **IGMP Snooping Table**.




The following table describes the fields in the IGMP Snooping Table.

| Field | Description |
|---|---|
| MAC Address | A multicast MAC address for which the switch has forwarding and/or filtering information. The format is 6 two-digit hexadecimal numbers that are separated by colons, for example, 01:00:5e:45:67:89. |
| VLAN ID | A VLAN ID for which the switch has forwarding and filtering information. |
| Type | This displays the type of the entry. Static entries are those that are configured by the end user. Dynamic entries are added to the table as a result of a learning process or protocol. |
| Description | The text description of this multicast table entry. Possible values are **Management Configured**, **Network Configured**, and **Network Assisted**. |
| Interface | The list of interfaces that are designated for forwarding (Fwd) and filtering (Flt) for the associated address. |

Use the buttons at the bottom of the page to perform the following actions:

- Click **Clear** to clear one or all of the IGMP Snooping entries.
- Click **Refresh** to reload the page and display the most current information.

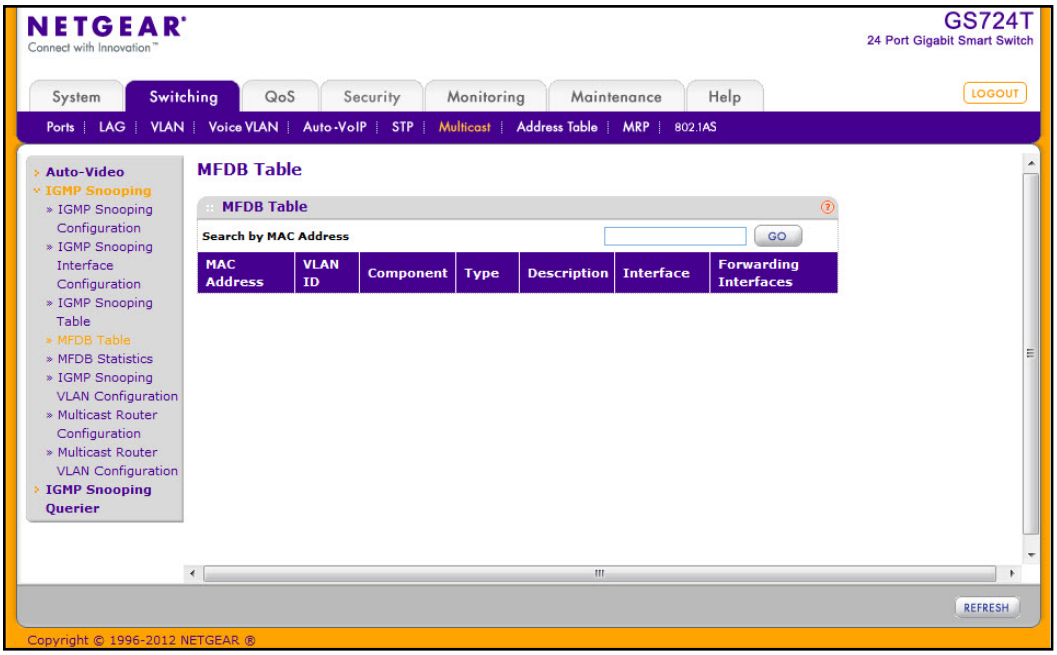
## *Multicast Forwarding Database Table*

The Layer 2 Multicast Forwarding Database (MFDB) is used by the switch to make forwarding decisions for packets that arrive with a multicast destination MAC address. By limiting multicasts to only certain ports in the switch, traffic is prevented from going to parts of the network where that traffic is unnecessary.

When a packet enters the switch, the destination MAC address is combined with the VLAN ID and a search is performed in the Layer 2 Multicast Forwarding Database. If no match is found, then the packet is either flooded to all ports in the VLAN or discarded, depending on the switch configuration. If a match is found, then the packet is forwarded only to the ports that are members of that multicast group.

Use the MFDB Table page to view the port membership information for all active multicast address entries. The key for an entry consists of a MAC address. Entries may contain data for more than one protocol.

To access the MFDB Table page, click **Switching** > **Multicast** > **IGMP Snooping** > **MFDB Table**.



The following table describes the fields in the MFDB Table.

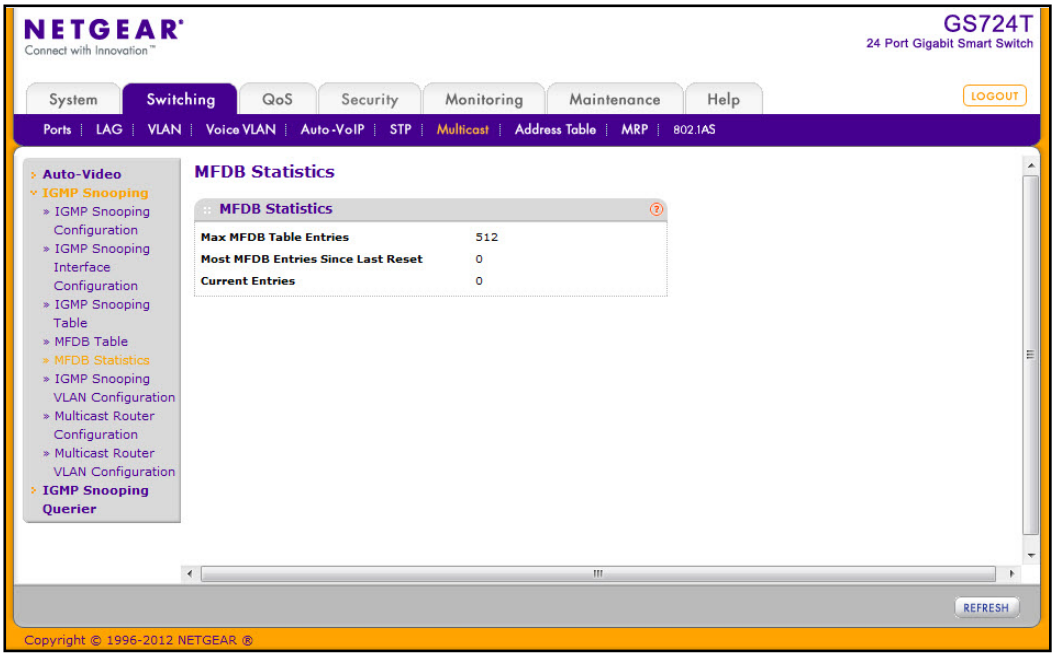
| Field | Description |
|---|---|
| MAC Address | The MAC Address to which the multicast MAC address is related.<br>To search by MAC address, enter the address with the MFDB table entry you want displayed. Enter six two-digit hexadecimal numbers separated by colons, for example 00:0f:43:67:89:AB, and then click **Go**. If the address exists, that entry will be displayed. An exact match is required. |
| VLAN ID | The VLAN ID to which the multicast MAC address is related. |
| Component | This is the component that is responsible for this entry in the Multicast Forwarding Database. Possible values are **IGMP Snooping** or **Static Filtering**. |
| Type | This displays the type of the entry. Static entries are those that are configured by the end user. Dynamic entries are added to the table as a result of a learning process or protocol. |
| Description | The text description of this multicast table entry. Possible values are **Management Configured**, **Network Configured**, and **Network Assisted**. |
| Interface | The list of interfaces that are designated for forwarding (Fwd) and filtering (Flt) for the selected address. |
| Forwarding Interfaces | The resultant forwarding list is derived from combining all the forwarding interfaces and removing the interfaces that are listed as the static filtering interfaces. |

Click **Refresh** to update the information on the screen with the most current data.

## *MFDB Statistics*

Use the multicast forwarding database Statistics page to view statistical information about the MFDB table.

To access the MFDB Statistics page, click **Switching** > **Multicast** > **IGMP Snooping** > **MFDB Statistics**.




The following table describes the information available on the MFDB Statistics page:

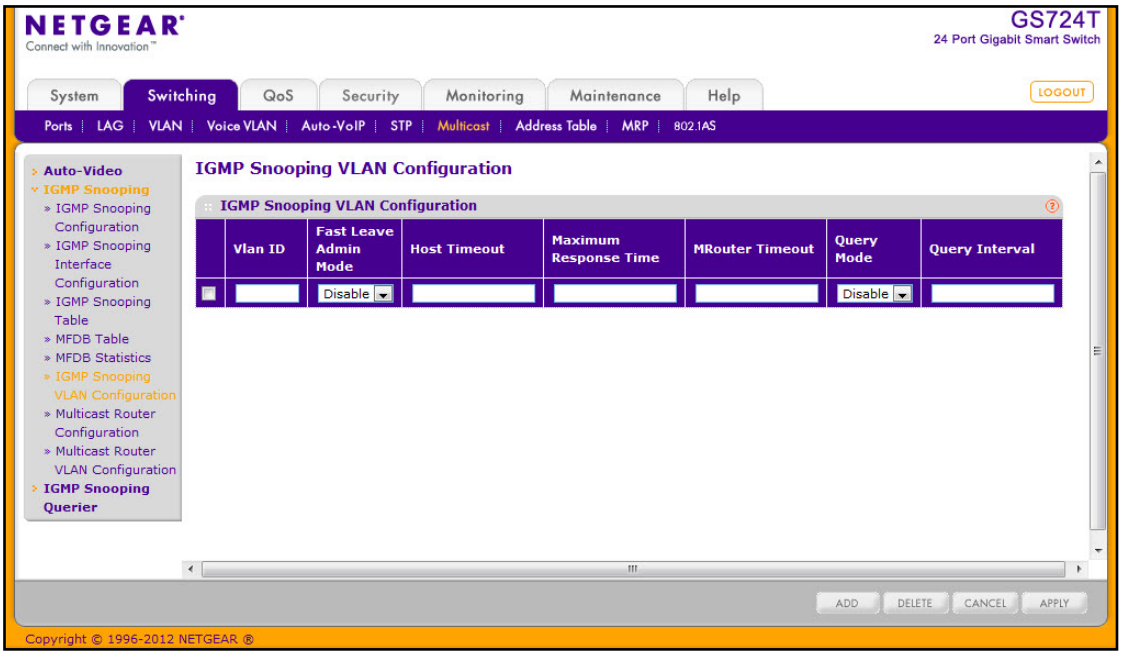
| Field | Description |
|---|---|
| Max MFDB Table Entries | Displays the maximum number of entries that the Multicast Forwarding Database table can hold. |
| Most MFDB Entries Since Last Reset | The largest number of entries that have been present in the Multicast Forwarding Database table since the system was last reset. This value is also known as the MFDB high-water mark. |
| Current Entries | Displays the current number of entries in the Multicast Forwarding Database table. |

Click **Refresh** to update the information on the screen with the most current data.

## IGMP Snooping VLAN Configuration

Use the IGMP Snooping VLAN Configuration page to configure IGMP snooping settings for VLANs on the system.

To access the IGMP Snooping VLAN Configuration page, click **Switching** > **Multicast** > **IGMP Snooping** > **IGMP Snooping VLAN Configuration**.




To configure IGMP snooping settings for VLANs:

1. To enable IGMP snooping on a VLAN, enter the VLAN ID in the appropriate field and configure the IGMP Snooping values:
   - **Fast Leave Admin Mode**. Enable or disable the IGMP Snooping Fast Leave Mode for the specified VLAN ID. Enabling fast-leave allows the switch to immediately remove the layer 2 LAN interface from its forwarding table entry upon receiving an IGMP leave message for that multicast group without first sending out MAC-based general queries to the interface.You should enable fast-leave admin mode only on VLANs where only one host is connected to each layer 2 LAN port. This prevents the inadvertent dropping of the other hosts that were connected to the same layer 2 LAN port but were still interested in receiving multicast traffic directed to that group. Also, fast-leave processing is supported only with IGMP version 2 hosts.
   - **Host Timeout**. Sets the value for group membership interval of IGMP snooping for the specified VLAN ID. The valid range is (Maximum Response Time + 1) to 3600 seconds.
   - **Maximum Response Time**. Enter the amount of time in seconds that a switch will wait after sending a query on the VLAN because it did not receive a report for a particular group in that interface. value. The valid range is 1 to 25 seconds. Its value must be less than the Host Timeout value.

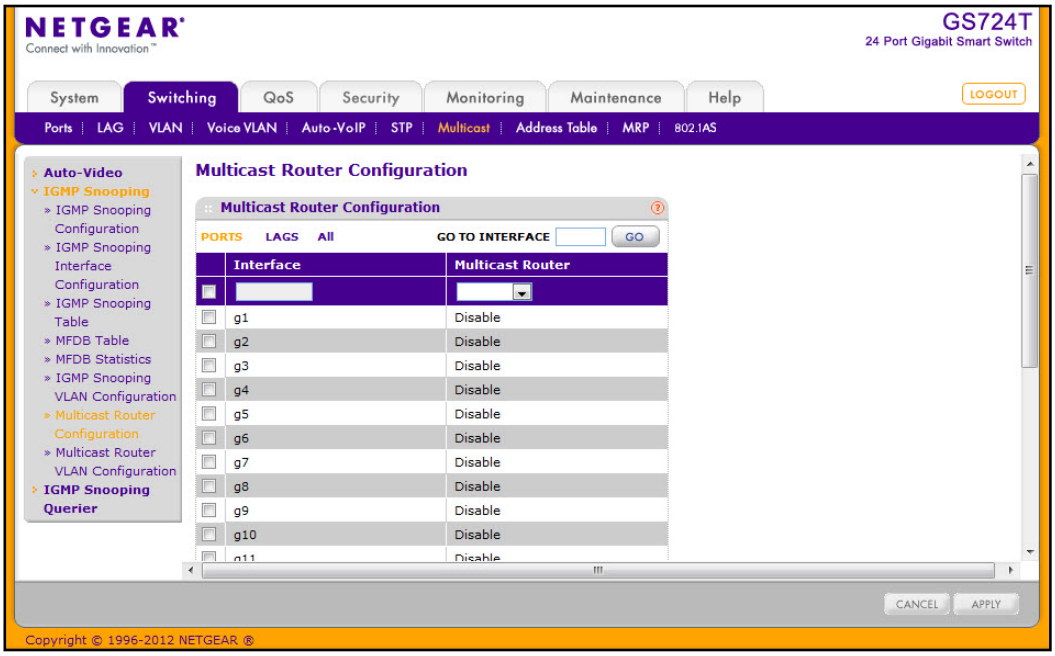
- **MRouter Timeout**. Enter the amount of time that a switch will wait to receive a query on the VLAN before removing it from the list of VLANs with multicast routers attached. Enter a value between 0 and 3600 seconds. The default is 0 seconds, which means there is no expiration.
- **Query Mode**. Enable or disable the IGMP Querier Mode for the specified VLAN ID.
- **Query Interval**. Enter the value for IGMP Query Interval for the specified VLAN ID. The valid range is 1–1800 seconds. The default is 60 seconds.

2. Click **Add** to enable IGMP snooping and the associated settings on the specified VLAN.
3. To disable IGMP snooping on a VLAN and remove it from the list, select the check box next to the VLAN ID and click **Delete**.
4. To modify IGMP snooping settings for a VLAN, select the check box next to the VLAN ID, update the desired values, and click **Apply**.
5. Click **Cancel** to cancel the configuration on the screen and reset the data on the screen to the latest value of the switch.

## *Multicast Router Configuration*

This page configures the interface as the one the multicast router is attached to. All IGMP packets snooped by the switch will be forwarded to the multicast router reachable from this interface. The configuration is not needed most of the time since the switch will automatically detect the presence of multicast router and forward IGMP packet accordingly. It is only needed when you want to make sure the multicast router always receives IGMP packets from the switch in a complex network.

To access the Multicast Router Configuration page, click **Switching** > **Multicast** > **IGMP Snooping** > **Multicast Router Configuration**.



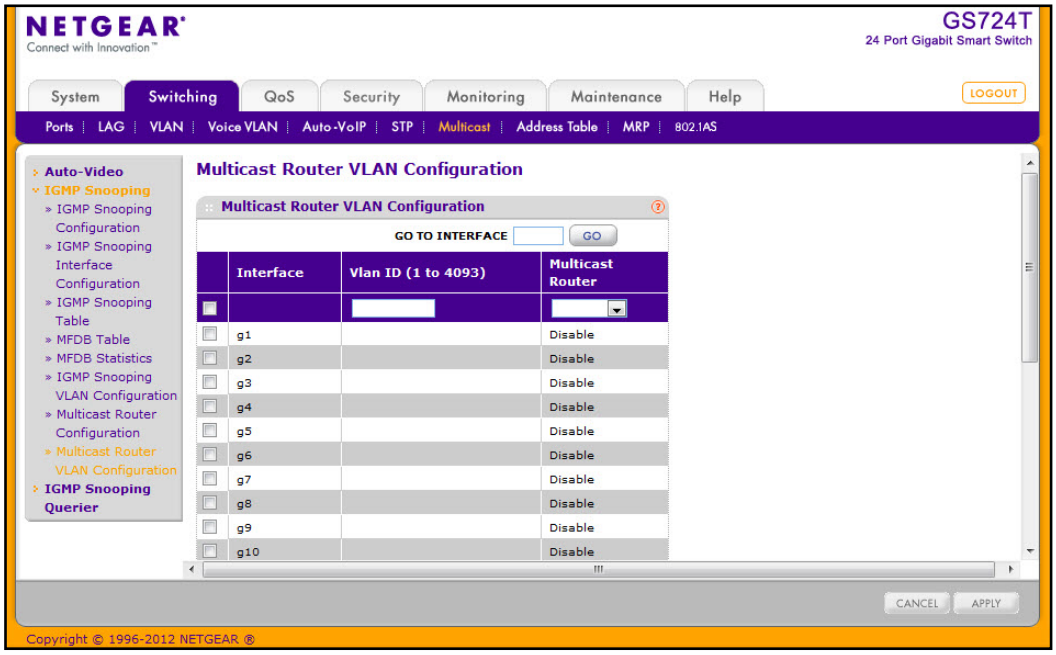
To configure the multicast router settings:

1. Select the check box associated with each interface you want to configure. Select the check box in the heading row to apply the same settings to all interfaces.
2. Use **Multicast Router** to enable or disable Multicast Router on the selected interfaces.
3. Click **APPLY** to update the switch with the changes.
4. Click **CANCEL** to abandon the changes.

## *Multicast Router VLAN Configuration*

This page configures the interface to only forward the snooped IGMP packets that come from the specified VLAN to the multicast router attached to this interface. The configuration is not needed most of the time since the switch will automatically detect the presence of a multicast router and forward IGMP packets accordingly. It is only needed when you want to make sure that the multicast router always receives IGMP packets from the switch in a complex network.

To access the Multicast Router VLAN Configuration page, click **Switching** > **Multicast** > **IGMP Snooping** > **Multicast Router VLAN Configuration**.




To configure the multicast router VLAN settings:

1. Select the check box associated with each interface you want to configure. Select the check box in the heading row to apply the same settings to all interfaces.
2. Use **VLAN ID** to select the VLAN ID for which the Multicast Router Mode is to be Enabled or Disabled.
3. Use **Multicast Router** to enable or disable multicast router for the VLAN ID.
4. Click **APPLY** to update the switch with the changes.
5. Click **CANCEL** to abandon the changes.

# IGMP Snooping Querier

IGMP snooping requires that one central switch or router periodically query all end-devices on the network to announce their multicast memberships. This central device is the IGMP querier. The IGMP query responses, known as IGMP reports, keep the switch updated with the current multicast group membership on a port-by-port basis. If the switch does not receive updated membership information in a timely fashion, it will stop forwarding multicasts to the port where the end device is located.

These pages enable you to configure and display information on IGMP snooping queriers on the network and, separately, on VLANs.

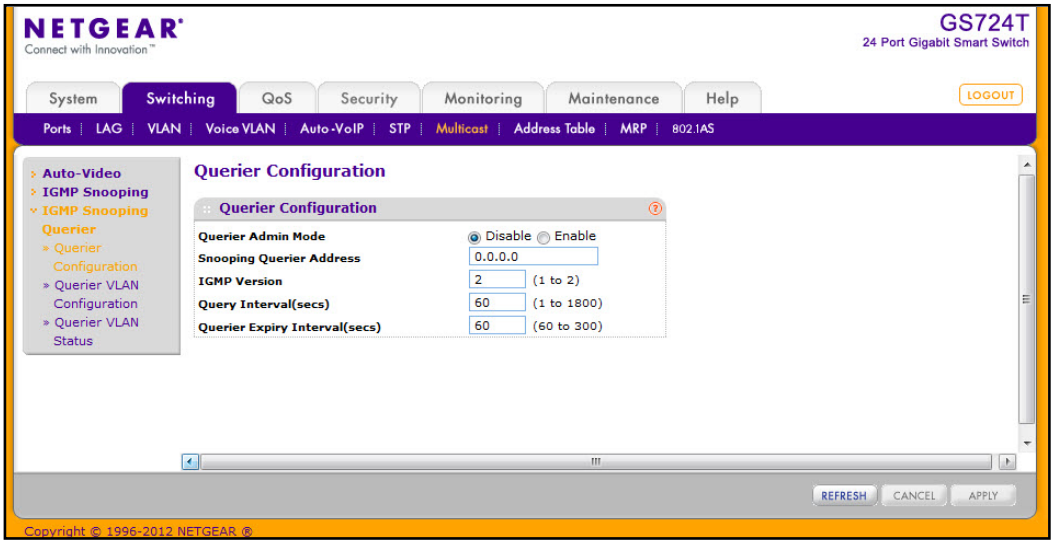
The IGMP Snooping Querier feature contains links to the following pages:

- *IGMP Snooping Querier Configuration* on page 124
- *IGMP Snooping Querier VLAN Configuration* on page 126
- *IGMP Snooping Querier VLAN Status* on page 127

## *IGMP Snooping Querier Configuration*

Use this page to enable or disable the IGMP Snooping Querier feature, specify the IP address of the router to perform the querying, and configure the related parameters.

To access this page, click **Switching** > **Multicast** > **IGMP Snooping Querier** > **IGMP Snooping** > **Querier Configuration**.




To configure IGMP Snooping Querier settings:

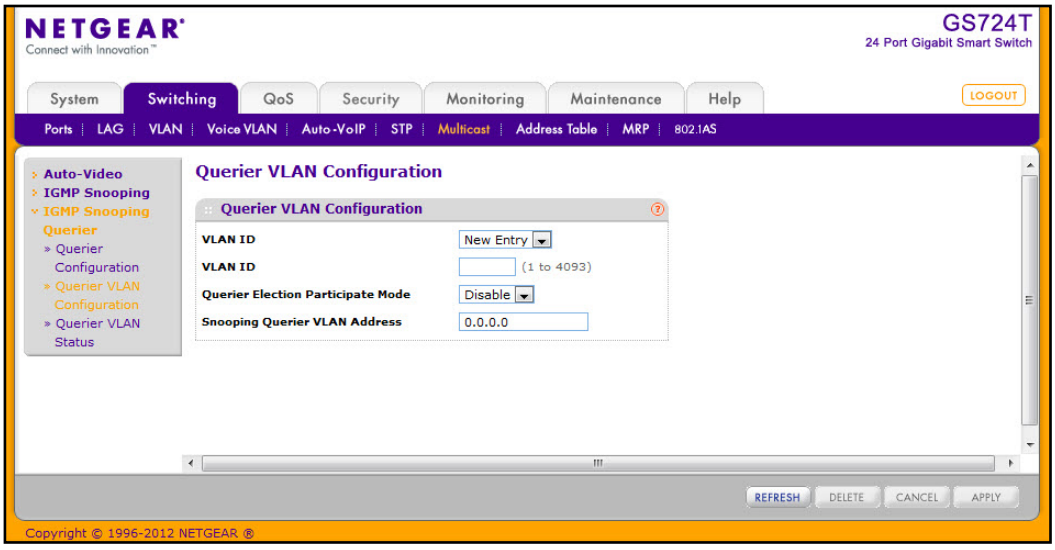
1. From the **Querier Admin Mode** field, enable or disable the administrative mode for IGMP Snooping Querier.

2. In the **Snooping Querier Address** field, specify the IP address to be used as source address in periodic IGMP queries. This address is used when no address is configured on the VLAN on which the query is being sent.
3. In the **IGMP Version** field, specify the IGMP protocol version used in periodic IGMP queries.
4. In the **Query Interval** field, specify the time interval in seconds between periodic queries sent by the snooping querier. The Query Interval must be a value in the range of 1–1800 seconds. The default value is 60.
5. In the **Querier Expiry Interval** field, specify the time interval in seconds after which the last querier information is removed. The Querier Expiry Interval must be a value in the range of 60–300 seconds. The default value is 60.
6. Click **Cancel** to cancel the configuration on the screen and reset the data on the screen to the latest value of the switch.
7. Click **Apply** to apply the new settings to the switch. Configuration changes take effect immediately
8. Click **Refresh** to update the page with the latest information from the switch.

## *IGMP Snooping Querier VLAN Configuration*

Use this page to configure IGMP queriers for use with VLANs on the network.

To access this page, click **Switching** > **Multicast** > **IGMP Snooping Querier** > **Querier VLAN Configuration**.



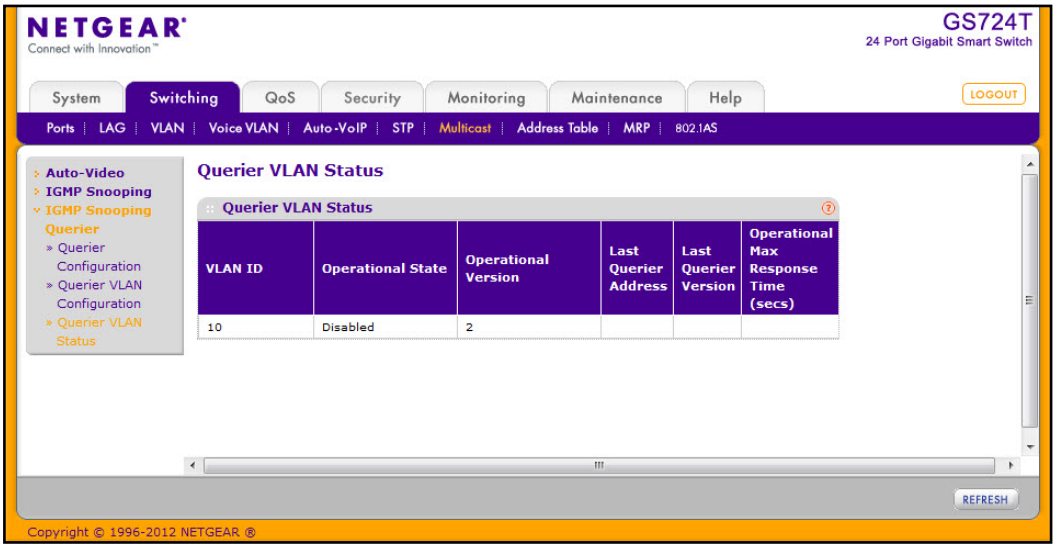

To configure Querier VLAN settings:

1. To create a new VLAN ID for IGMP Snooping, select New Entry from the VLAN ID field and complete the following fields:
   - **VLAN ID**. Specifies the VLAN ID for which the IGMP Snooping Querier is to be enabled.
   - **Querier Election Participate Mode.** Enable or disable Querier Participate Mode.
     - **Disabled**. Upon seeing another querier of the same version in the VLAN, the snooping querier moves to the non-querier state.
     - **Enabled**. The snooping querier participates in querier election, in which the least IP address operates as the querier in that VLAN. The other querier moves to non-querier state.
   - **Snooping Querier VLAN Address**. Specify the Snooping Querier IP Address to be used as the source address in periodic IGMP queries sent on the specified VLAN.
2. Click **Apply** to apply the new settings to the switch. Configuration changes take effect immediately
3. To disable Snooping Querier on a VLAN, select the VLAN ID and click **Delete**.
4. Click **Cancel** to cancel the configuration on the screen and reset the data on the screen to the latest value of the switch.
5. Click **Refresh** to update the page with the latest information from the switch.

## IGMP Snooping Querier VLAN Status

Use this page to view the operational state and other information for IGMP snooping queriers for VLANs on the network.

To access this page, click **Switching** > **Multicast** > **IGMP Snooping Querier** > **Querier VLAN Status**.




The following table describes the information available on the Querier VLAN Status page.

| Field | Description |
|---|---|
| VLAN ID | Specifies the VLAN ID on which the IGMP Snooping Querier is administratively enabled and for which VLAN exists in the VLAN database. |
| Operational State | Specifies the operational state of the IGMP Snooping Querier on a VLAN:<br>• **Querier**: The snooping switch is the querier in the VLAN. The snooping switch will send out periodic queries with a time interval equal to the configured querier query interval. If the snooping switch sees a better querier (numerically lower) in the VLAN, it moves to non-querier mode.<br>• **Non-Querier**: The snooping switch is in non-querier mode in the VLAN. If the querier expiry interval timer expires, the snooping switch moves into querier mode.<br>• **Disabled**: The snooping querier is not operational on the VLAN. The snooping querier moves to disabled mode when IGMP snooping is not operational on the VLAN, when the querier address is not configured, or the network management address is not configured. |
| Operational Version | Displays the IGMP protocol version of the operational querier. |
| Last Querier Address | Displays the IP address of the last querier from which a query was snooped on the VLAN. |

| Field | Description |
|---|---|
| Last Querier Version | Displays the IGMP protocol version of the last querier from which a query was snooped on the VLAN. |
| Operational Max Response Time | Displays the maximum response time to be used in the queries that are sent by the snooping querier. |

Click **Refresh** to redisplay the page with the latest information from the switch.

# Address Table

The address table, also know as the forwarding database, maintains a list of MAC addresses after having received a packet from this MAC address. The transparent bridging function uses the forwarding database entries to determine how to forward a received frame.

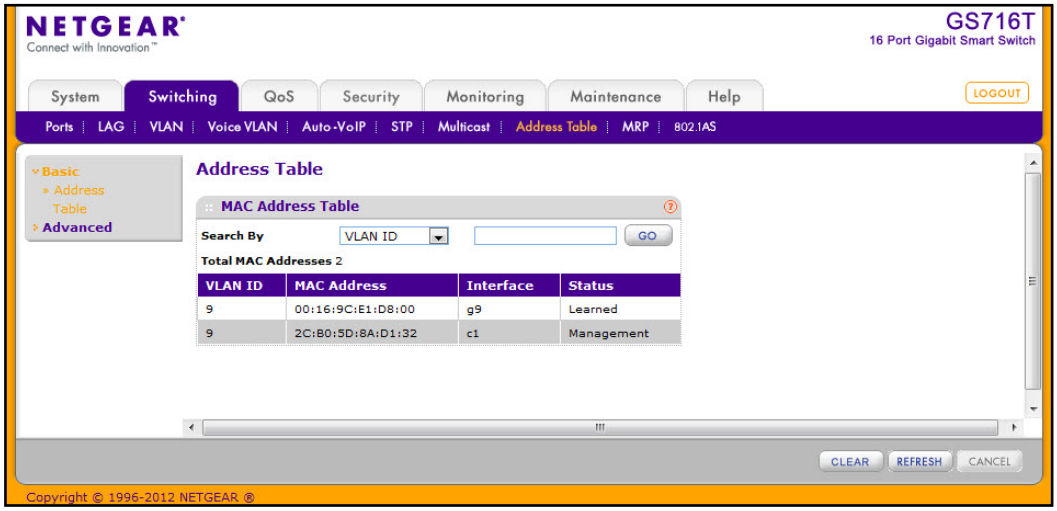
The **Address Table** folder contains links to the following features:

- *MAC Address Table* on page 128
- *Dynamic Address Configuration* on page 130
- *Static MAC Address* on page 131

## MAC Address Table

The MAC Address Table contains information about unicast entries for which the switch has forwarding and/or filtering information. This information is used by the transparent bridging function in determining how to propagate a received frame. Use the search function of the MAC Address Table page to display information about the entries in the table.

To access this page, click **Switching** > **Address Table** > **Basic** > **Address Table**.



To search for an entry in the MAC Address Table:

1. Use the **Search By** field to search for MAC Addresses by **MAC Address**, **VLAN ID**, or **Interface**.
   - **MAC Address**: Select **MAC Address** from the menu and enter a six-byte hexadecimal MAC address in two-digit groups separated by colons, then click **Go**. If the address exists, that entry will be displayed. An exact match is required.
   - **VLAN ID**: Select **VLAN ID** from the menu, enter the VLAN ID, for example, 100. Then click **Go**. If any entries with that VLAN ID exist they are displayed.
   - **Interface**: Select **Interface** from the menu, enter the interface ID in g1, g2... format, then, click **Go**. If any entries learned on that interface exist, they are displayed.
2. Click **Clear** to clear Dynamic MAC Addresses in the table.
3. Click **Refresh** to redisplay the page to show the latest MAC Addresses.
4. Click **Cancel** to cancel the configuration on the screen and reset the data on the screen to the latest value of the switch.

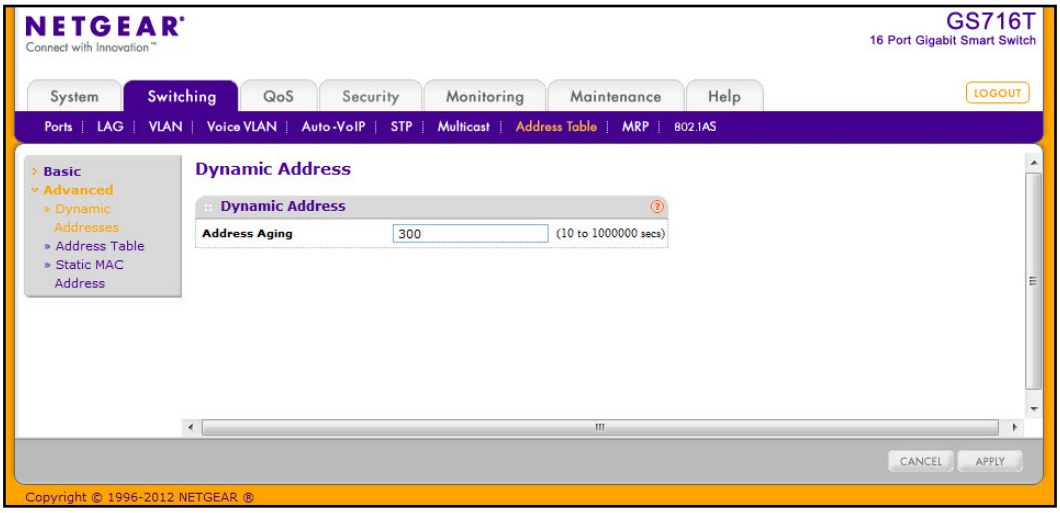
The following table describes the information available for each entry in the address table.

| Field | Description |
|---|---|
| VLAN ID | Specifies the VLAN ID on which the IGMP Snooping Querier is administratively enabled and for which VLAN exists in the VLAN database. |
| MAC Address | A unicast MAC address for which the switch has forwarding and/or filtering information. The format is a six-byte MAC address with each byte separated by colons. For example, 00:0F:89:AB:CD:EF. |
| Interface | The port where this address was learned: that is, this field displays the port through which the MAC address can be reached. |
| Status | The status of this entry. The possible values are:<br>• **Static**: The entry was added when a static MAC filter was defined.<br>• **Learned**: The entry was learned by observing the source MAC addresses of incoming traffic, and is currently in use.<br>• **Management**: The system MAC address, which is identified with interface c1. |

# Dynamic Address Configuration

Use the Dynamic Addresses page to set the amount of time to keep a learned MAC address entry in the forwarding database. The forwarding database contains static entries, which are never aged out, and dynamically learned entries, which are removed if they are not updated within a given time.

To access the Configuration page, click **Switching** > **Address Table** > **Advanced** > **Dynamic Addresses**.




To configure the Dynamic Address setting:

1. Specify the number of seconds the forwarding database should wait before deleting a learned entry that has not been updated. IEEE 802.1D-1990 recommends a default of 300 seconds. You may enter any number of seconds between 10 and 1000000. The factory default is 300.

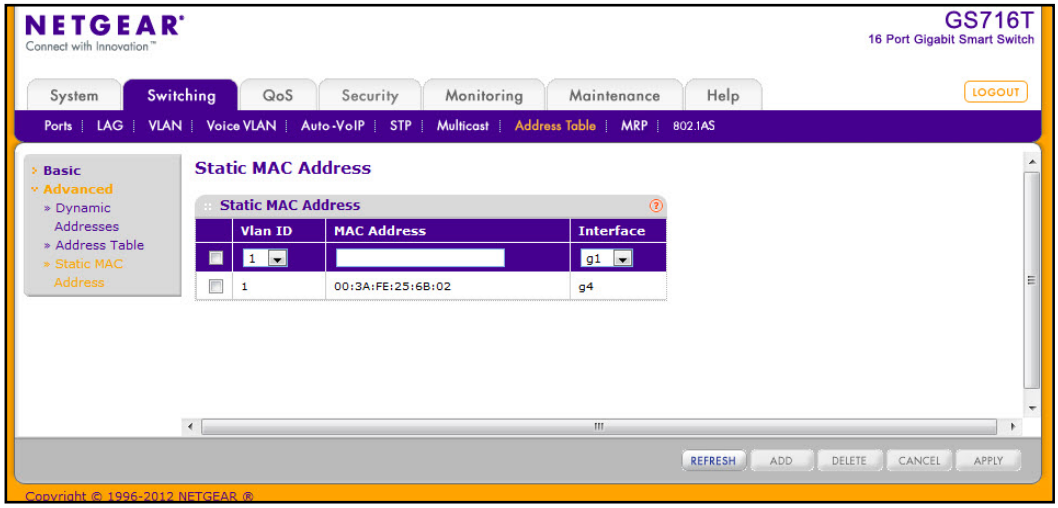
   **Note:** IEEE 802.1D recommends a default of 300 seconds, which is the factory default.

2. Click **Cancel** to cancel the configuration on the screen and reset the data on the screen to the latest value of the switch.
3. Click **Apply** to apply to send the updated configuration to the switch. Configuration changes take effect immediately.

# Static MAC Address

Use the Static MAC Address Configuration page to configure and view static MAC addresses on an interface.

To access the Static MAC Address Configuration page, click **Switching** > **Address Table** > **Advanced** > **Static MAC Address**.




To configure a static MAC address:

1. To add a static MAC address entry
   a. From the Interface menu, select the port or LAG on which to configure the static MAC address.
   b. Specify the MAC address to add.
   c. Select the VLAN ID corresponding to the MAC address to add.
   d. Click **Add**.
2. To delete a static MAC address, select the check box next to the entry and click **Delete**.
3. To modify the settings for a static MAC address, select the check box next to the entry, update the desired values, and click **Apply**.
4. Click **Refresh** to reload the page and display the latest MAC address learned on a specific port.
5. Click **Cancel** to cancel the configuration on the screen and reset the data on the screen to the latest value of the switch.

# Multiple Registration Protocol Configuration[1]

Multiple Registration Protocol (MRP) is a base registration protocol that enables devices running an MRP application to register attributes to other devices in a network. MRP provides an application to register attributes such as bandwidth requirement for a given AV stream and MAC address information. It is used by various applications to propagate the registration. GS716T and GS724T Smart Switches support the following MRP applications:

- Multiple MAC Reservation Protocol (MMRP)
- Multiple Stream Reservation Protocol (MSRP)

**MMRP** allows for the propagation MAC address information in the network, and allows for the registration and deregistration of both individual MAC address information and group MAC address membership. End stations may request to join or leave a multicast group, or to register an individual MAC address with a specific VLAN. MAC address entries can be dynamically registered and deregistered if MMRP is administratively enabled on GS716T and GS724T Smart Switches.

**MSRP** reserves necessary resources in the network to facilitate time sensitive traffic to flow end to end. In a typical network, there are multiple Talkers (those who transmit streams) and multiple Listeners (those who receive streams from one or many Talkers). Each flow has specific bandwidth, frame rate, and time sync requirements. With the use of MSRP these resources are guaranteed through all intermediate devices that are between any talker and listener.

**Note:** MRP framework must be available and enabled in all intermediate devices to ensure that the propagation of the attributes occurs throughout the network.

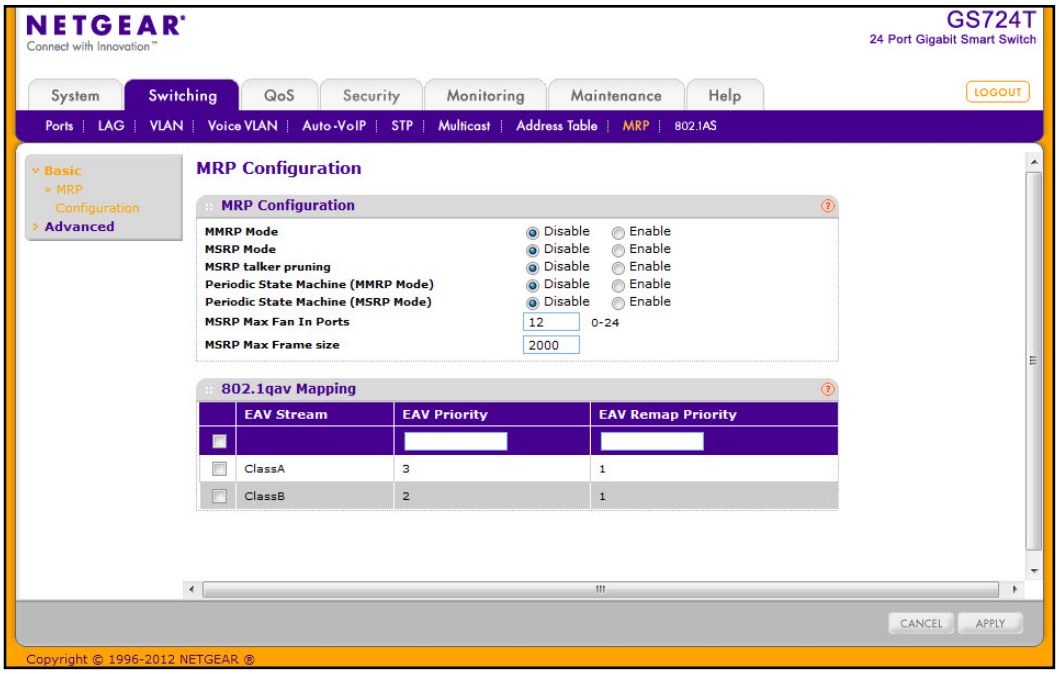
With MRP, network attributes are declared, registered, withdrawn, and removed completely dynamically without any user intervention. This dynamic nature is especially useful in networks where:

- Network attributes are likely to change frequently, requiring reconfiguration of the intermediate devices.
- Recipients of these attributes frequently increase or decrease in number.
- Each of these changes without a dynamic self-adjusting framework would require constant attention from the network administrator.

*1. The Multiple Registration Protocol (MRP) feature is available only with a valid license. To activate this feature, you must purchase a license.*

# MRP Configuration

Use the MRP Configuration page to configure global MRP settings for the switch. To access the basic MRP Configuration page click the **Switching** tab, then click **MRP** > **Basic** > **MRP Configuration**.




To configure the MRP settings:

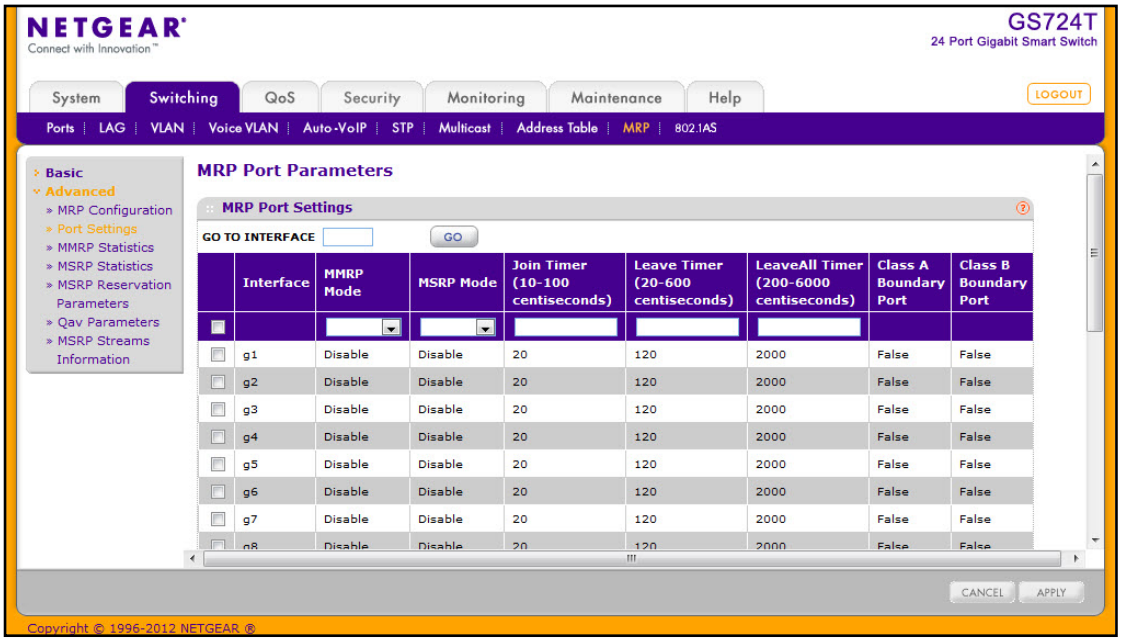
1. Use the **MMRP Mode** field to enable or disable MMRP globally on the switch. MMRP provides an application to register MAC address information. The default mode is Disable.
2. Use the **MSRP Mode** field to enable or disable MSRP globally on the switch. MSRP provides an application to register bandwidth requirement for a given AV stream. The default mode is Disable.
3. If you enable MSRP, configure the following MSRP settings:
   a. Enable or disable MSRP talker pruning. The MSRP talker is the source of an AV stream. Default mode is Disable.
   b. Enable or disable the MRP Periodic State Machine for MSRP on the system. Default mode is Disable.
   c. In the MSRP Max Fan In Ports field, specify the maximum number of the ports where MSRP registrations are allowed.
   d. In the MSRP Max Frame Size field, specify the maximum frame size allowed for an MSRP frame. The valid range for the frame size is 64–9216 octets.
4. If you enable MMRP, enable or disable the MRP Periodic State Machine for MMRP on the system. Default mode is Disable. For this setting to take effect, MMRP must be enabled, but MSRP does not need to be enabled.

5. Configure the 802.1Qav mapping for the Class A and/or Class B EAV streams. Class A streams have a higher transmission priority than Class B traffic.
   - In the **EAV Priority** field, specify the priority for each EAV stream class. The range is 0–7.
   - In the **EAV Remap Priority** field, specify the remap priority for non-EAV traffic. The range is 0–7.
6. Click **Cancel** to cancel the configuration on the screen and reset the data on the screen to the latest value of the switch.
7. If you make any changes to the page, click **Apply** to apply the change to the system.

# MRP Port Settings

Use the MRP Port Settings page to configure the per-port MRP mode and timer settings. The timers control when and how often various messages are transmitted on each interface.

To access the Port Settings page click **Switching** > **MRP** > **Advanced** > **Port Settings** in the navigation tree. In the following image, the MMRP mode on ports g4 and g5 is being enabled.




To configure the MRP port parameters:

1. Select the check box next to the port to configure. You can select multiple ports to apply the same settings to the selected interfaces. Select the check box in the heading row to apply the same settings to all interfaces.
2. Configure the following MRP port settings:
   a. Enable or disable MMRP on the interface. The default mode is Disable.
   b. Enable or disable MSRP on the interface. The default mode is Disable.

c. Specify the value, in centiseconds, of the MRP Join Timer. The range is 10 to 100 centiseconds, and the default value is 20.

d. Specify the value, in centiseconds, of the MRP Leave Timer. The range is 10 to 600 centiseconds, and the default value is 120.

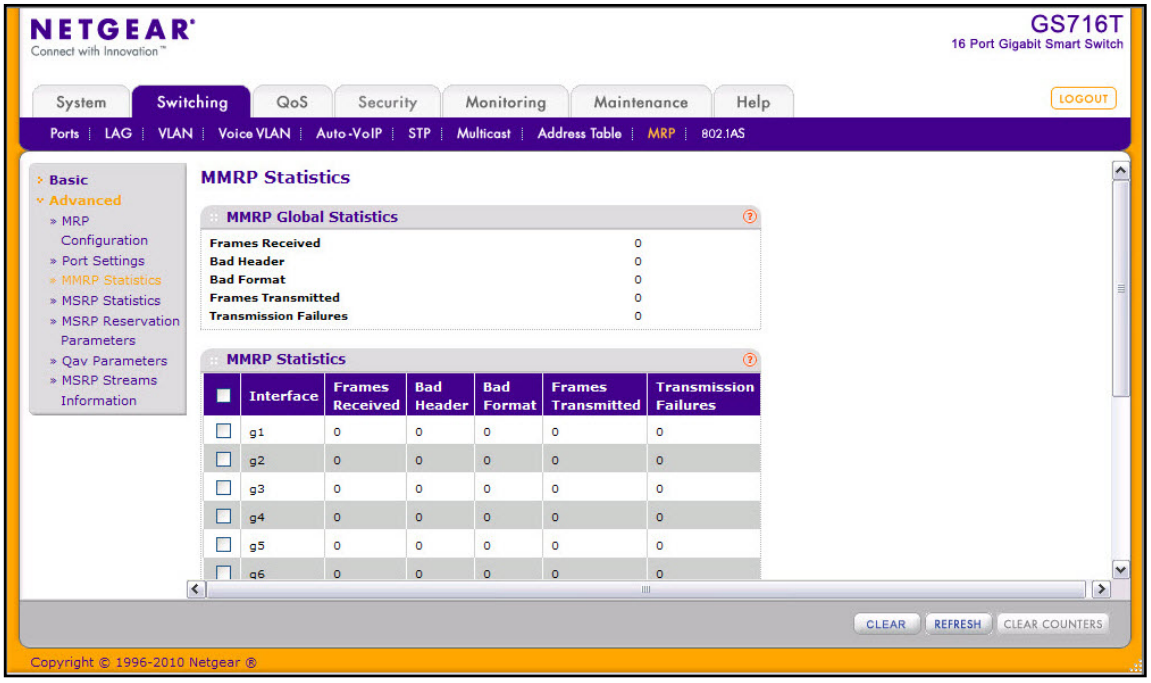
e. Specify the value, in centiseconds, of the MRP LeaveAll Timer. The range is 200 to 6000 centiseconds, and the default value is 2000.

ClassA/ClassB Boundary Port fields are not configurable and show whether the interface is a boundary port.

3. Click **Cancel** to cancel the configuration on the screen and reset the data on the screen to the latest value of the switch.
4. If you make any changes to the page, click **Apply** to apply the change to the system.

## MMRP Statistics

The MMRP Statistics page displays information regarding the MMRP frames transmitted and received by the switch and by each interface. To access the MMRP Statistics page click the **Switching** tab, then click **MRP** > **Advanced** > **MMRP Statistics**.



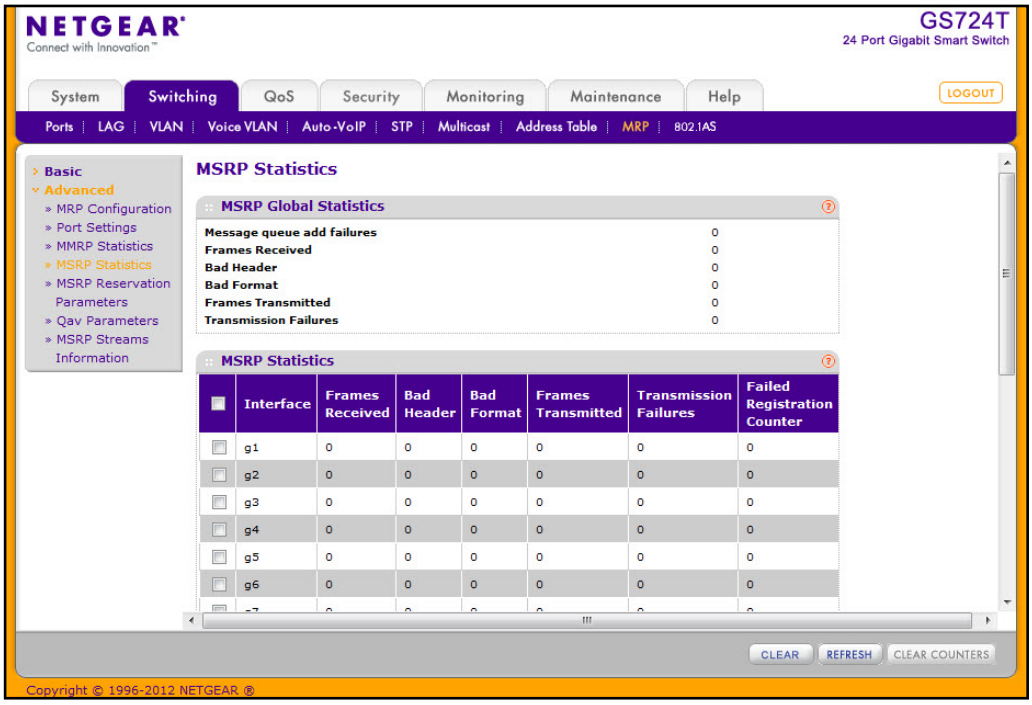
The following table describes the fields on the MMRP Statistics page.

| Field | Description |
|---|---|
| **Global MMRP Statistics** | |
| Frames Received | Shows the number of MMRP frames which were received on the switch. |
| Bad Header | Shows number of MMRP frames with bad headers which were received on the switch. |
| Bad Format | Shows number of MMRP frames with bad PDUs body formats which were received on the switch. |
| Frames Transmitted | Shows number of MMRP frames which were transmitted on the switch. |
| Transmission Failures | Shows number of MMRP frames that the switch failed to transmit. |
| **Per-Interface MMRP Statistics** | |
| Interface | Identifies the interface associated with the rest of the MMRP statistics in the row. |
| Frames Received | Shows number of MMRP frames which were received on particular interface. |
| Bad Header | Shows number of MMRP frames with bad headers which were received on the particular interface. |
| Bad Format | Shows number of MMRP frames with bad PDUs body formats which were received on the particular interface. |
| Frames Transmitted | Shows number of MMRP frames which were transmitted on the interface. |
| Transmission Failures | Shows number of MMRP frames transmitting of which were failed on particular interface. |

To reload the page, click **Refresh**. To clear the statistics for one or more ports, select the check box next to the interface or interfaces, and click **Clear**. To clear the statistics for all interfaces, select the check box in the heading row, and click **Clear Counters**.

# MSRP Statistics

The MSRP Statistics page displays information about the MSRP frames transmitted and received by the switch and by each interface. To access the MSRP Statistics page click the **Switching** tab, then click **MRP** > **Advanced** > **MSRP Statistics**.




The following table describes the fields on the MSRP Statistics page.

| Field | Description |
|---|---|
| **Global MSRP Statistics** | |
| Message Queue Add Failures | Shows the number of messages that failed to be added to the queue. |
| Frames Received | Shows number of MSRP frames that have been received on the switch. |
| Bad Header | Shows number of MSRP frames with bad headers that have been received on the switch. |
| Bad Format | Shows number of MSRP frames with bad PDUs body formats that have been received on the switch. |
| Frames Transmitted | Shows number of MSRP frames which that have been transmitted on the switch. |
| Transmission Failures | Shows number of MSRP frames the switch failed to transmit. |

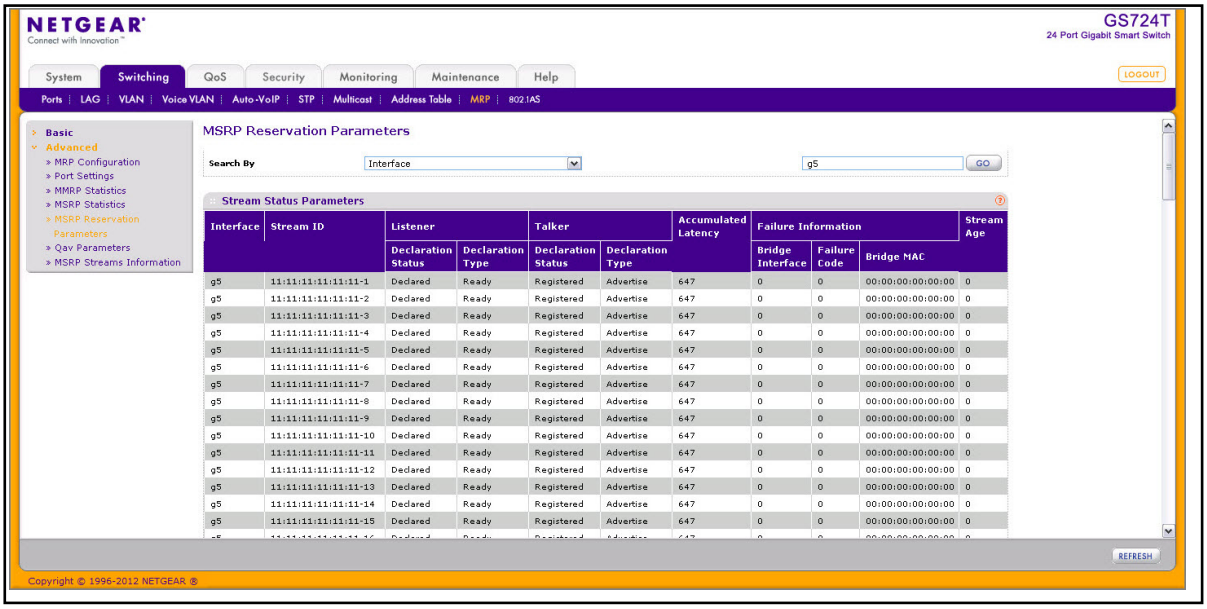
| Field | Description |
|---|---|
| **Per-Interface MSRP Statistics** | |
| Interface | Identifies the interface associated with the rest of the MSRP statistics in the row. |
| Frames Received | Displays the number of MSRP frames which were received the interface. |
| Bad Header | Displays the number of MSRP frames with bad header which were received on the interface. |
| Bad Format | Displays the number of MSRP frames with bad PDUs body format which were received on the interface. |
| Frames Transmitted | Displays the number of MSRP frames which were transmitted on the interface. |
| Transmission Failures | Displays the number of MSRP frames that an interface attempted to transmit but failed. |
| Failed Registration Counter | Shows the number of MSRP frames that failed to register on a device or particular interface. |

To reload the page, click **Refresh**. To clear the statistics for one or more ports, select the check box next to the interface or interfaces, and click **Clear**. To clear the statistics for all interfaces, select the check box in the heading row, and click **Clear Counters**.

# MSRP Reservation Parameters

Use the MSRP Reservation Parameters page to view information about the talker, listener, and intermediate device status for the devices involved in each MSRP stream flowing through the switch.

To display the MSRP Reservation Parameters page, click the **Switching** tab, then click **MRP** > **Advanced** > **MSRP Reservation Parameters**.




To search for a specific entry in the Stream Status Parameters table:

1. To search for stream status by interface, select Interface from the drop-down menu and enter the port ID (for example, g5) in the available field.
2. To search for stream status by Stream ID, select Stream ID from the drop-down menu, and enter the Stream ID (for example, 43000) in the available field.
3. Click **Go**.

The following table describes the non-configurable fields on the MSRP Reservation Parameters page.

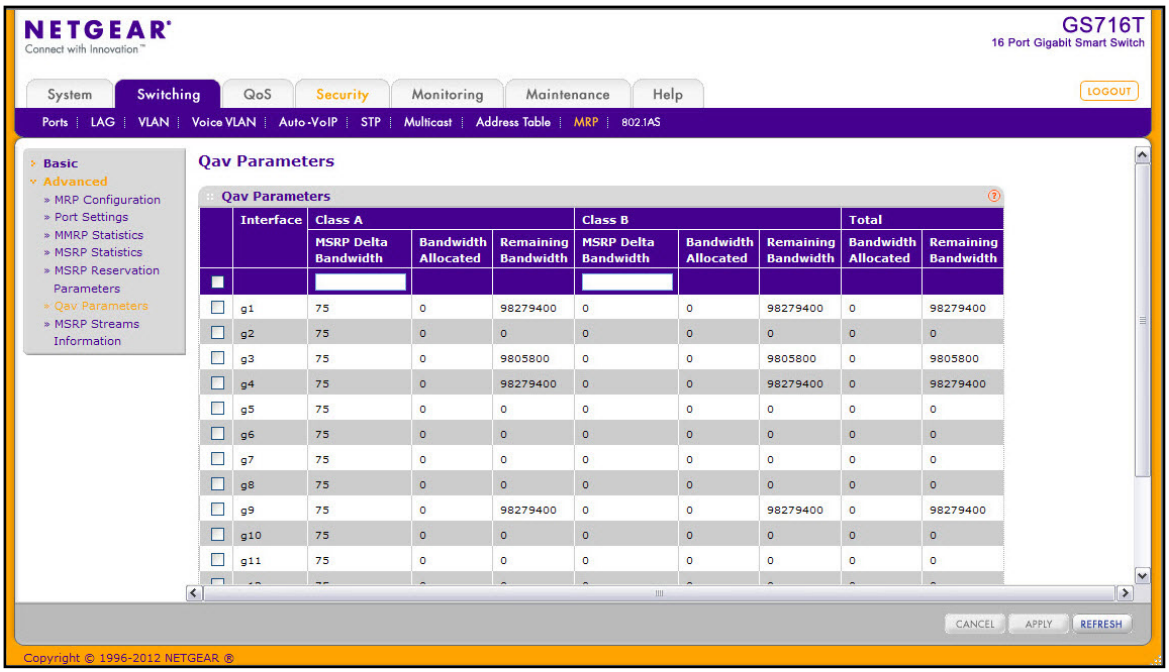
| Field | Description |
|---|---|
| Interface | Identifies the interface associated with the rest of the information in the row. |
| Stream ID | A 16-bit unsigned integer value, Unique ID, used to distinguish among multiple streams sourced by the same system. |
| Listener Declaration Status | Identifies the MSRP declaration status of the listener attribute. |
| Listener Declaration Type | Identifies the MSRP declaration type of the listener attribute. |
| Talker Declaration Status | Identifies the MSRP declaration status of the talker attribute. |

| Field | Description |
|---|---|
| Talker Declaration Type | Identifies the MSRP declaration type of the talker attribute. |
| Accumulated Latency | Identifies how much latency, in nanoseconds, the stream has suffered in its path from the Talker to a given Listener. It starts as a 0 in a Talker Advertise Declaration at the Talker, and its value is increased by one for each bridge as the Talker Advertise Declaration propagates through the network. |
| Failure Bridge Interface | Identifies the interface on the Bridge where the failure occurred. |
| Failure Code | Shows the number that represents the reason for the failure. The switch supports the following codes:<br>• 1—Insufficient bandwidth<br>• 3—Insufficient bandwidth for the traffic class<br>• 5—Stream destination_address is already in use<br>• 7—Reported latency has changed<br>• 8—Egress port is not Audio/Video Bridging (AVB) capable<br>• 9—Use a different destination_address (i.e. MAC DA hash table full)<br>• 12—Cannot store destination_address (i.e., Bridge is out of MAC DA resources)<br>• 13—Requested priority is not an SR Class priority<br>• 14—MaxFrameSize is too large for media<br>• 15—msrpMaxFanInPorts limit has been reached<br>• 16—Changes in FirstValue for a registered StreamID<br>• 17—VLAN is blocked on this egress port (Registration Forbidden) |
| Failure Bridge MAC | Identifies the MAC address of the switch where the failure occurred. |
| Stream Age | The time, in seconds, since the stream destination address was added to the Dynamic Reservations Entries table. A value of zero indicates the destination address has not been added to the table. |

# Qav Parameters

Use the Qav Parameters page to configure and view the per-port IEEE 802.1Qav settings. The IEEE 802.1Qav standard supports time-sensitive traffic streams by pacing all switch traffic, including legacy asynchronous Ethernet traffic, through queuing and forwarding. When a Talker declares a stream, it identifies whether the stream is Class A or Class B and specifies the stream's bandwidth requirements. Class A traffic has a higher transmission priority than Class B traffic.

On the Qav Parameters page, you can view and configure selected bandwidth allocations for Class A and Class B traffic. To display the Qav Statistics page click the **Switching** tab, then click **MRP** > **Advanced** > **Qav Parameters**.




To configure the Qav parameters:

1. Select the check box next to the port to configure. You can select multiple ports to apply the same settings to the selected interfaces. Select the check box in the heading row to apply the same settings to all interfaces.
2. Configure the Class A MSRP delta bandwidth.

   Class A Delta bandwidth is the additional bandwidth represented as a percentage of port transmit rate which can be reserved for the traffic class A and traffic class B. Class A traffic has a higher priority. The range is 0–100.

   The following Class A fields are read-only:

   - The Bandwidth Allocated field shows the current rate of the class A traffic on interface (in Bps).
   - The Class A Remaining Bandwidth field shows the maximum rate of the class A traffic available on interface (in Bps).

3. Configure the Class B MSRP delta bandwidth.

   Class B Delta bandwidth is the additional bandwidth represented as a percentage of port transmit rate which can be reserved for the traffic class B. The range is 0–100.

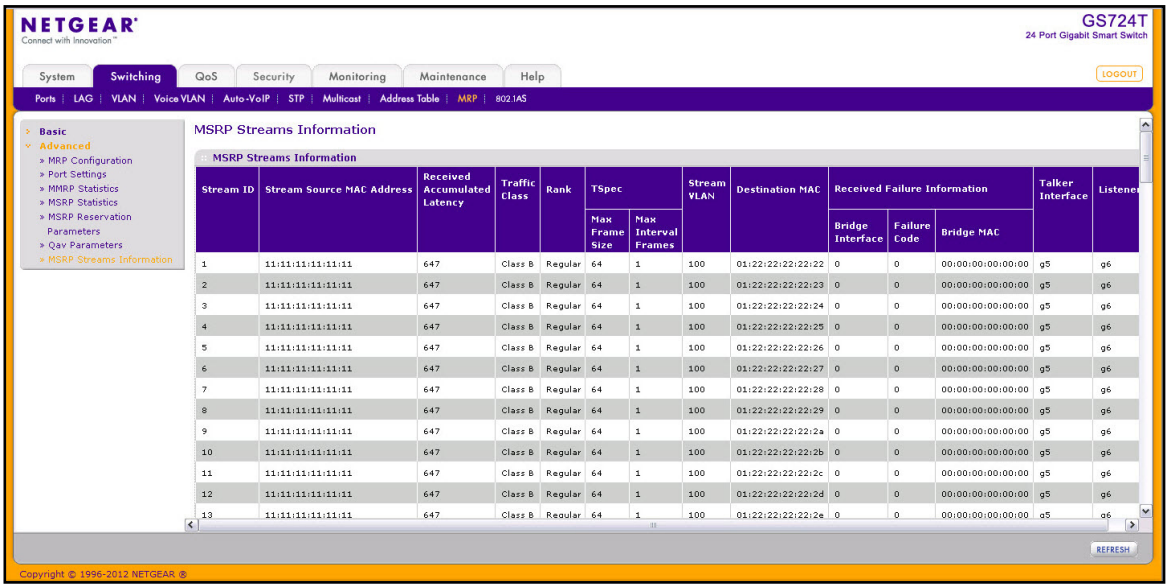
   The following Class B fields are read-only:

   - The Bandwidth Allocated field shows the current rate of the class B traffic on interface (in Bps).
   - The Class B Remaining Bandwidth field shows the maximum rate of the class B traffic available on interface (in Bps).

4. View the following information about the total bandwidth:
   - The Total Bandwidth Allocated Sum of the allocated Class A and Class B traffic rates on interface (in Bps).
   - Total Remaining Bandwidth, which is 75% of the interface speed minus total allocated bandwidth (in Bps/sec).
5. Click **Cancel** to cancel the configuration on the screen and reset the data on the screen to the latest value of the switch.
6. If you make any changes to the page, click **Apply** to apply the change to the system.
7. Click **Refresh** to reload the page and update it with the most current information.

# MSRP Streams Information

Use the MSRP Stream Information page to view information about MSRP streams flowing through each interface. To display the MSRP Stream Information page click the **Switching** tab, then click **MRP** > **Advanced** > **MSRP Stream Information**.




The following table describes the fields on the MSRP Stream Information page.

| *Field* | *Description* |
|---|---|
| Stream ID | A 16-bit unsigned integer value, Unique ID, used to distinguish among multiple streams sourced by the same system. |
| Stream Source MAC Address | Identifies the MAC address of the traffic stream's source. |
| Received Accumulated Latency | The 32-bit unsigned Accumulated Latency component is used to determine the worst-case latency that a Stream can suffer in its path from the Talker to a given Listener. It starts as a 0 in a Talker Advertise Declaration at the Talker, and its value is increased by each Bridge as the Talker Advertise Declaration propagates through the network. |
| Traffic Class | Identifies whether the stream is Class A or Class B. Class A traffic has a higher priority than Class B traffic. |
| Rank | The 5-bit unsigned Rank component is used by systems to decide which streams can and cannot be served, when the MSRP registrations exceed the capacity of a Port to carry the corresponding data streams. If a Bridge becomes oversubscribed (e.g. network reconfiguration, 802.11 bandwidth reduction) the Rank will also be used to help determine which Stream or Streams can be dropped. A lower numeric value is more important than a higher numeric value. |

| *Field* | *Description* |
|---|---|
| TSpec Max Frame Size | The 32-bit unsigned Bandwidth component is used to allocate resources and adjust queue selection parameters in order to supply the quality of service requested by an MSRP Talker Declaration. It represents the maximum rate, in units of 1024 octets per second, at which frames in the Stream referenced by the Talker Declaration may be transmitted. |
| TSpec Max Interval Frames | The 32-bit unsigned Frame Rate component is used to allocate resources and adjust queue selection parameters in order to supply the quality of service requested by an MSRP Talker Declaration. It represents the maximum number of frames that the Talker may transmit in one second. |
| Stream VLAN | Identifies the VLAN ID of the traffic stream. |
| Destination MAC | Identifies the MAC address of the traffic stream's destination. |
| Received Failure Bridge Interface | Identifies the interface on the Bridge where the failure occurred. |
| Received Failure Code | Identifies the code value of the failure. For more information about the failure codes, see ***Failure Code*** on page 140. |
| Received Failure Bridge MAC | Identifies the MAC address of the switch where the failure occurred. |
| Talker Interface | Identifies the interface on which the Talker is present. |
| Listeners | Identifies the interface on which Listeners are present. |

Click **Refresh** to reload the page.

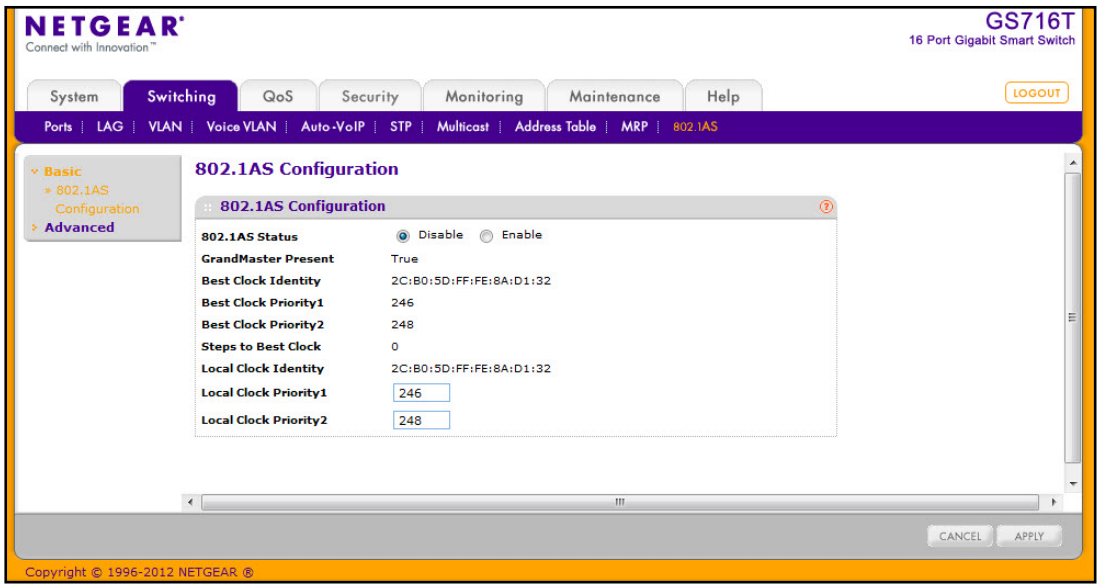
# 802.1AS[1]

The IEEE 802.1AS standard specifies the protocol and procedures used to ensure that the QoS requirements are guaranteed for time-sensitive applications, such as audio and video. The IEEE 1588 Precision Time Protocol (PTP) forms the basis of the IEEE 802.1AS standard. PTP specifies a precise clock synchronization protocol that relies on time-stamped packets. The PTP protocol is applicable to distributed systems consisting of one or more nodes communicating over some set of communication media. The distribution of synchronous time information is performed in a hierarchical manner with a grandmaster clock at the root of the hierarchy. The grandmaster provides a common and precise time reference for one or more directly-attached slave devices by periodically exchanging timing information. In other words, all slave devices synchronize their clocks with the grandmaster clock. The slave devices can, in-turn, act as master devices for further hierarchical layers of slave devices.

## 802.1AS Configuration

Use the 802.1AS Configuration page to enable the 802.1AS mode on the switch and configure local clock priorities. The 802.1AS feature calculates the time delay between devices on a given link and maintains an accurate view of a network clock.The page also displays various global 802.1AS information.

To display the 802.1AS Configuration page click the **Switching** tab, then click **802.1AS** > **Basic** > **802.1AS Configuration**.




1. *The 802.1AS feature is available only with a valid license. To activate this feature, you must purchase a license.*

To configure the global 802.1AS settings on the switch:

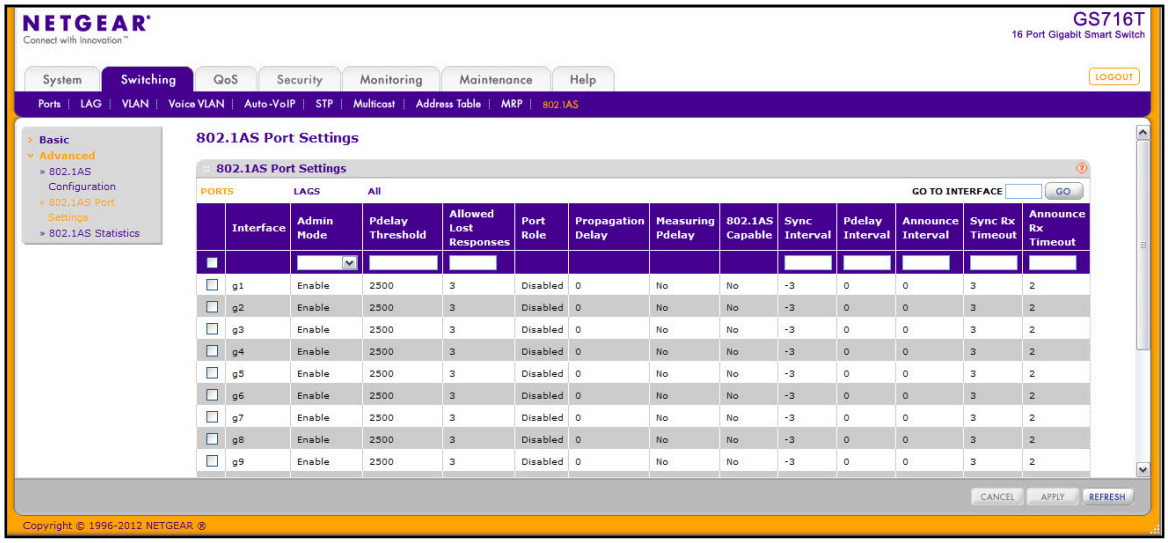
1. Enable or disable 802.1AS globally on the switch. The default mode is Enable.
2. Configure the Priority1 value of the local clock (this time-aware bridge).
3. Configure the Priority2 value of the local clock (this time-aware bridge).
4. Click **Cancel** to cancel the configuration on the screen and reset the data on the screen to the latest value of the switch.
5. If you make any changes to the page, click **Apply** to retain the changes to the system.

The following table shows the non-configurable information on the 802.1AS Configuration page.

| Field | Description |
|---|---|
| GrandMaster Present | Identifies whether Grand Master Clock is present. The default is **False**. |
| Best Clock Identity | Shows the Best Clock Identity detected by this time-aware bridge. |
| Best Clock Priority1 | Shows the Priority1 value of the best clock on the switch. |
| Best Clock Priority2 | Shows the Priority2 value of the best clock on the switch. |
| Steps to Best Clock | Shows the number of links in the path from the Best Clock to this time-aware bridge. If this time-aware bridge is the best, the value is zero. |
| Local Clock Identity | Shows the Clock Identity of this time-aware bridge. |

# 802.1AS Port Settings

Use the 802.1AS Port Settings page to configure and view per-port 802.1AS settings. To display the 802.1AS Port Settings page click the **Switching** tab, then click **802.1AS** > **Advanced** > **802.1AS Port Settings**.




To configure the 802.1AS port settings:

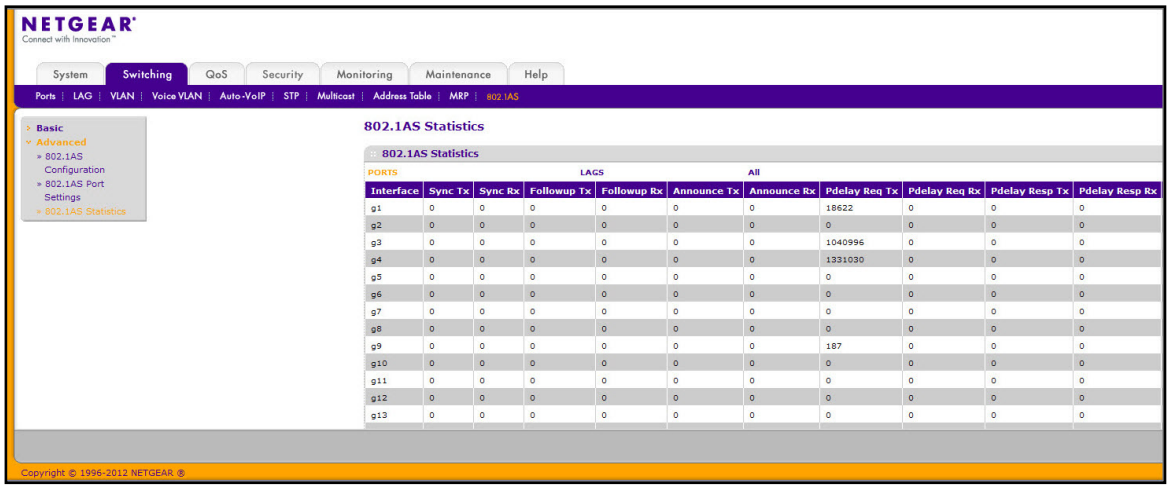
1. To configure 802.1AS settings for one or more ports, click PORTS. To configure 802.1AS settings for one or more LAGs, click LAGs. To configure 802.1AS settings for both ports and LAGs, click ALL.
2. Select the check box next to the port or LAG to configure. You can select multiple ports or LAGs to apply the same settings to the selected interfaces. Select the check box in the heading row to apply the same settings to all interfaces.
3. Enable or disable 802.1AS on the interface.
4. Set the Pdelay threshold. This value specifies the propagation delay threshold on the interface. The threshold determines whether the port is capable of participating in the 802.1AS protocol. If the propagation delay on the interface is above the threshold you configure, the interface is not considered capable of participating in the 802.1AS protocol. The peer delay must be less than the threshold value configured on the interface. The default value is 2500 nanoseconds. The range is 0–1,000,000,000 ns.
5. Set the value for Allowed Lost Responses. If the interface does not receive valid responses to PDELAY_REQ messages above the value of the allowed lost responses, a port is considered to not be exchanging peer delay messages with its neighbor. The default value is 3. The range is 0–65535.

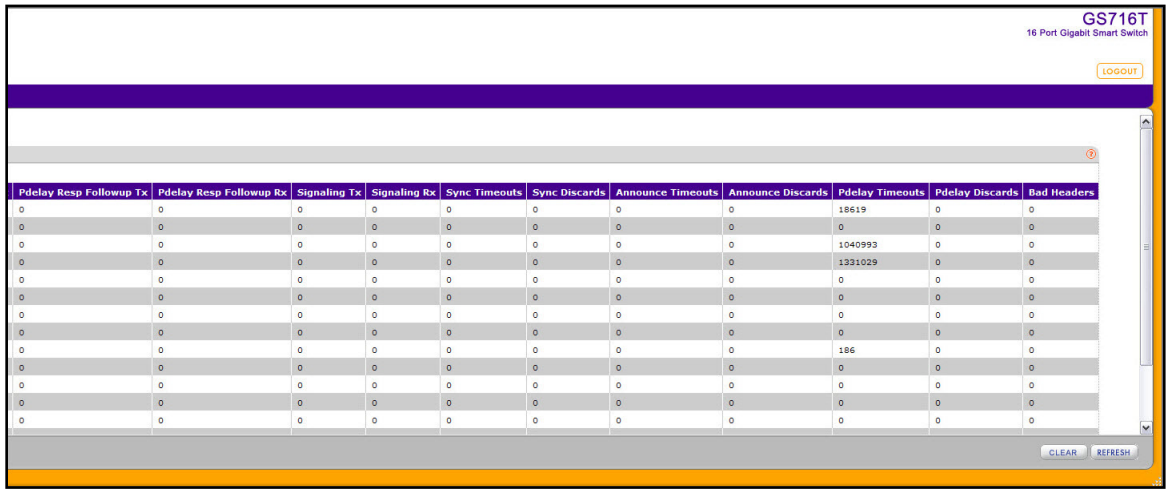
6. View the following non-configurable fields:
   - The Port Role specifies the 802.1AS role of the interface. The possible roles are as follows:
     - Disabled (default)
     - Master
     - Slave
     - Passive
   - The Propagation Delay field shows the mean propagation delay on the interface.
   - The Measuring Pdelay field shows whether the interface is receiving PDELAY response messages from other end of the link.
   - The 802.1AS Capable field shows whether the interface is 802.1AS capable or not. By default, the interface is not 802.1AS Capable.
7. Configure the Sync Interval. This value is the logarithm to the base 2 of the mean-time interval between successive SYNC messages sent on this interface. The default value is –3. The range is –5 to 5.
8. Configure the Pdelay Interval. This value is the logarithm to the base 2 of the mean time interval between successive PDELAY_REQ messages sent on this interface. The default value is 0. The range is –5 to 5.
9. Configure the Announce Interval. This value is the logarithm to the base 2 of the mean time interval between successive ANNOUNCE messages sent on this interface. The default value is 0. The range is –5 to 5.
10. Configure the SyncRx Timeout. This value sets the number of SYNC intervals that have to pass without receipt of SYNC information before considering that the master is no longer transmitting. The default value is 3. The range is 2 to 255.
11. Configure the AnnounceRx Timeout. This value sets the number of ANNOUNCE intervals that have to pass without receipt of ANNOUNCE PDU before considering that the master is no longer transmitting. The default value is 2. The range is 2 to 255.
12. Click **Cancel** to cancel the configuration on the screen and reset the data on the screen to the latest value of the switch.
13. If you make any changes to the page, click **Apply** to retain the changes to the system.
14. Click **Refresh** to reload the page and update it with the most current information.

# 802.1AS Statistics

The 802.1AS Statistics page displays information regarding the 802.1AS messages transmitted and received by each interface.To display the 802.1AS Statistics page click the **Switching** tab, then click **802.1AS** > **Advanced** > **802.1AS Statistics**.

If all 802.1AS statistics do not fit on the page, use the horizontal scroll bar to view additional settings. Together, the following two figures show all fields on the page.




The following table describes the information the 802.1AS Statistics page displays.

| Field | Description |
|---|---|
| Interface | Identifies the interface associated with the rest of the 802.1AS statistics in the row. |
| Sync Tx | Displays the total number of SYNC packets transmitted without error. |
| Sync Rx | Displays the total number of SYNC packets received without error. |

| Field | Description |
|---|---|
| Followup Tx | Displays the total number of FOLLOWUP packets transmitted without error. |
| Followup Rx | Displays the total number of FOLLOWUP packets received without error. |
| Announce Tx | Displays the total number of ANNOUNCE packets transmitted without error. |
| Announce Rx | Displays the total number of ANNOUNCE packets received without error. |
| Pdelay Req Tx | Displays the total number of PDELAY_REQ packets transmitted without error. |
| Pdelay Req Rx | Displays the total number of PDELAY_REQ packets received without error. |
| Pdelay Resp Tx | Displays the total number of PDELAY_RESP packets transmitted without error. |
| Pdelay Resp Rx | Displays the total number of PDELAY_RESP packets received without error. |
| Pdelay Resp Followup Tx | Displays the total number of PDELAY_RESP_FOLLOWUP packets transmitted without error. |
| Pdelay Resp Followup Rx | Displays the total number of PDELAY_RESP_FOLLOWUP packets received without error. |
| Signaling Tx | Displays the total number of SIGNALING packets transmitted without error. |
| Signaling Rx | Displays the total number of SIGNALING packets received without error. |
| Sync Timeouts | Displays the total number of SYNC receipt timeouts occurred. |
| Sync Discards | Displays the total number of SYNC packets discarded. |
| Announce Timeouts | Displays the total number of ANNOUNCE receipt timeouts occurred. |
| Announce Discards | Displays the total number of ANNOUNCE packets discarded. |
| Pdelay Timeouts | Displays the total number of PDELAY receipt timeouts occurred. |
| Pdelay Discards | Displays the total number of PDELAY packets discarded. |
| Bad Headers | Displays the total number of packets received with bad header. |

To reload the page, click **Refresh**. To reset the statistics for all interfaces, click **Clear**.

# Quality of Service Features

# 4

Use the features in the QoS tab to configure Quality of Service (QoS) settings on the switch. The QoS tab contains links to the following features:

- *Class of Service* on page 151
- *Differentiated Services* on page 159

In a typical switch, each physical port consists of one or more queues for transmitting packets on the attached network. Multiple queues per port are often provided to give preference to certain packets over others based on user-defined criteria. When a packet is queued for transmission in a port, the rate at which it is serviced depends on how the queue is configured and possibly the amount of traffic present in the other queues of the port. If a delay is necessary, packets get held in the queue until the scheduler authorizes the queue for transmission. As queues become full, packets have no place to be held for transmission and get dropped by the switch.

QoS is a means of providing consistent, predictable data delivery by distinguishing between packets that have strict timing requirements from those that are more tolerant of delay. Packets with strict timing requirements are given special treatment in a QoS-capable network. With this in mind, all elements of the network must be QoS-capable. The presence of at least one node which is not QoS-capable creates a deficiency in the network path and the performance of the entire packet flow is compromised.

## Class of Service

The Class of Service (CoS) queueing feature lets you directly configure certain aspects of switch queueing. This provides the desired QoS behavior for different types of network traffic when the complexities of DiffServ are not required. The priority of a packet arriving at an interface can be used to steer the packet to the appropriate outbound CoS queue through a mapping table. CoS queue characteristics that affect queue mapping, such as minimum guaranteed bandwidth, or transmission rate shaping are user-configurable at the queue (or port) level.

Eight queues per port are supported.

From the Class of Service link under the QoS tab, you can access the following pages:

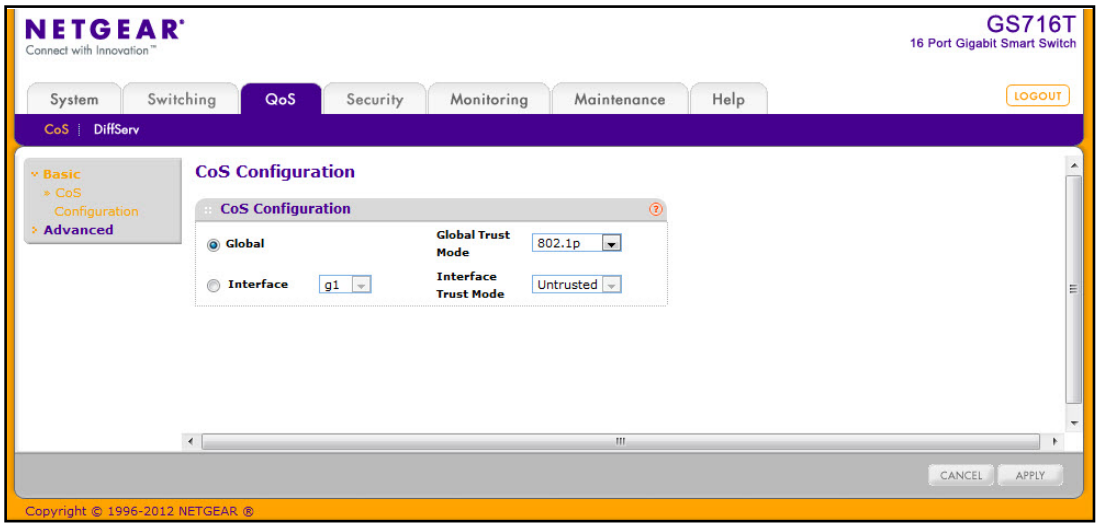


# Basic CoS Configuration

Use the Trust Mode Configuration page to set the class of service trust mode of an interface. Each port in the switch can be configured to trust one of the packet fields (802.1p or IP DSCP), or to not trust any packet's priority designation (untrusted mode). If the port is set to a trusted mode, it uses a mapping table appropriate for the trusted field being used. This mapping table indicates the CoS queue to which the packet should be forwarded on the appropriate egress port(s). Of course, the trusted field must exist in the packet for the mapping table to be of any use, so there are default actions performed when this is not the case. These actions involve directing the packet to a specific CoS level configured for the ingress port as a whole, based on the existing port default priority as mapped to a traffic class by the current 802.1p mapping table.

Alternatively, when a port is configured as untrusted, it does not trust any incoming packet priority designation and uses the port default priority value instead. All packets arriving at the ingress of an untrusted port are directed to a specific CoS queue on the appropriate egress port(s), in accordance with the configured default priority of the ingress port. This process is also used for cases where a trusted port mapping is unable to be honored, such as when a non-IP packet arrives at a port configured to trust the IP DSCP value.

To display the Basic CoS Configuration page, click **QoS** > **Basic** > **CoS Configuration**.



To configure global CoS settings:

1. Select the **Global** radio button to configure the trust mode settings that apply to all interfaces.

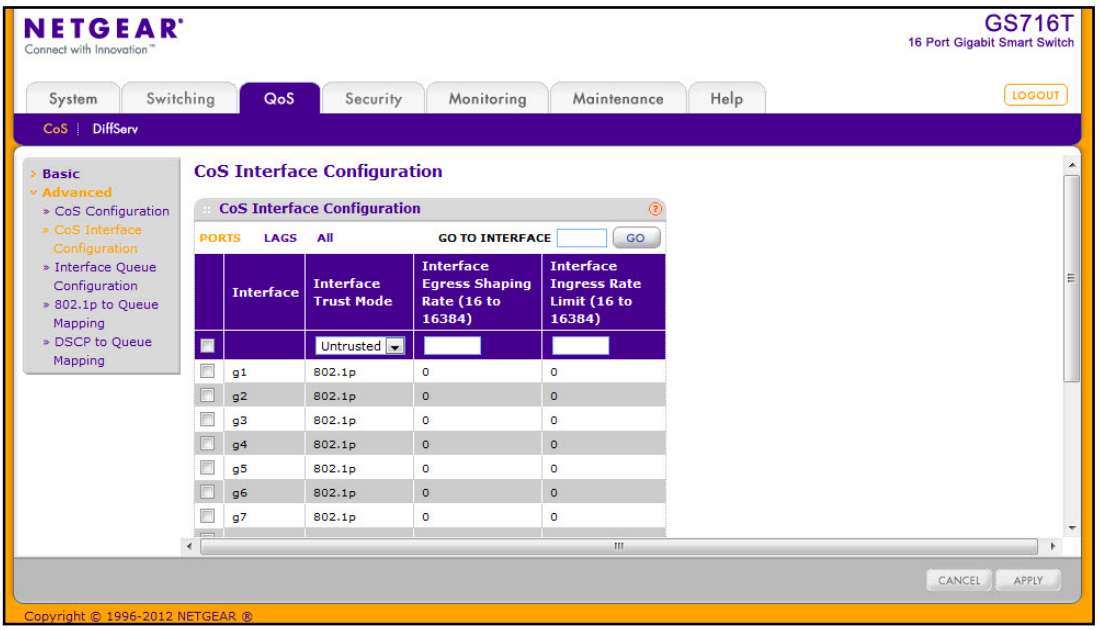
   Alternatively, you can select the **Interface** radio button to apply trust mode settings to individual interfaces. The per-interface setting overrides the global settings.

2. Select the trust mode for all interfaces (**Global Trust Mode**) or the selected interface (**Interface Trust Mode**). This setting determines the type of CoS marking to trust when the frame enters the port.
   - **Untrusted**. Do not trust any CoS packet marking at ingress.
   - **802.1p**. The eight priority tags that are specified in IEEE 802.1p are p0 to p7. The QoS setting lets you map each of the eight priority levels to one of eight internal hardware priority queues.
   - **DSCP**. The six most significant bits of the DiffServ field are called the Differentiated Services Code Point (DSCP) bits.
3. Click **Cancel** to cancel the configuration on the screen and reset the data on the screen to the latest value of the switch.
4. If you change any of the settings on the page, click **Apply** to send the updated configuration to the switch.

# CoS Interface Configuration

Use the CoS Interface Configuration page to apply an interface shaping rate to all interfaces or to a specific interface.

To display the CoS Interface Configuration page, click the **QoS** > **CoS** tab, and then click the **Advanced** > **CoS Interface Configuration** link.



To configure CoS settings for an interface:

1. To configure CoS settings for a physical port, click **PORTS**.
2. To configure CoS settings for a Link Aggregation Group (LAG), click **LAGS**.
3. To configure CoS settings for both physical ports and LAGs, click **ALL**.
4. Select the check box next to the port or LAG to configure. You can select multiple ports and LAGs to apply the same setting to the selected interfaces.
5. From the **Interface Trust Mode** field, specify whether or not the selected interface(s) trust a particular packet marking when the packet enters the port.
   - **Untrusted**. Do not trust any CoS packet marking at ingress.
   - **802.1p**. The eight priority tags that are specified in IEEE 802.1p are p0 to p7. The QoS setting lets you map each of the eight priority levels to one of eight internal hardware priority queues.
   - **DSCP**. The six most significant bits of the DiffServ field are called the Differentiated Services Code Point (DSCP) bits.
6. From the **Interface Shaping Rate** field, specify the maximum bandwidth allowed on the selected interface(s). This setting is typically used to shape the outbound transmission rate in increments of 64 kbps. This value is controlled independently of any per-queue maximum bandwidth configuration. It is effectively a second-level shaping mechanism. The default value is 0, in increments of 16. A value of 0 means the maximum is unlimited.

   The expected shaping at egress interface is calculated as:

   (*frameSize* × *shaping* × 64) ÷ (*frameSize* + *IFG*), where *IFG* (Inter frame gap) is 20 bytes, *frameSize* is the configured frame size of the traffic, and *shaping* is the configured traffic shaping in the **Interface Shaping Rate** field.

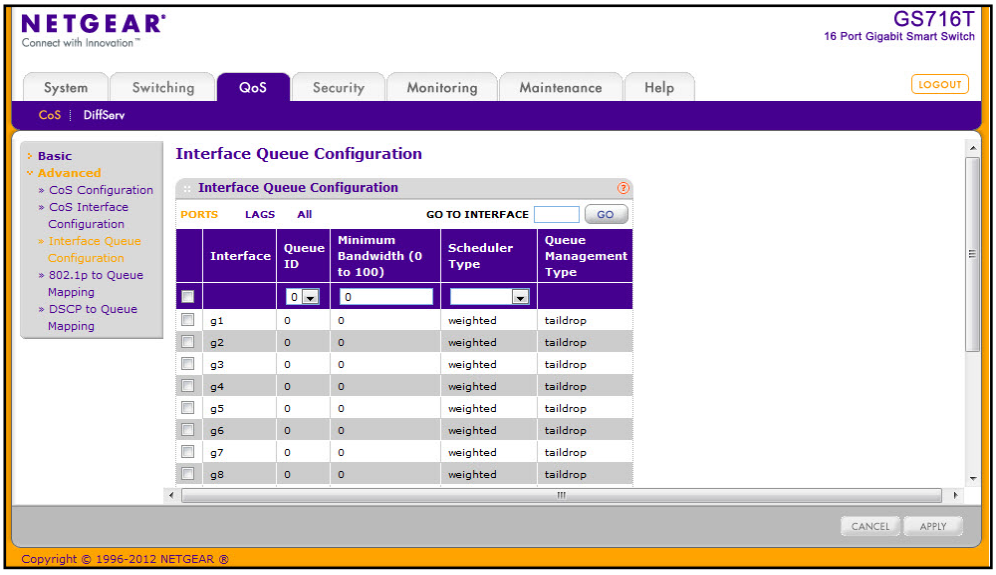
   For example, when a 64 byte frame size and 64 kbps interface shaping rate are configured, the expected shaping will be approximately 3121 kbps.
7. Click **Cancel** to cancel the configuration on the screen and reset the data on the screen to the latest value of the switch.
8. If you make changes to the page, click **Apply** to apply the changes to the system.

# Interface Queue Configuration

Use the Interface Queue Configuration page to define what a particular queue does by configuring switch egress queues. User-configurable parameters control the amount of bandwidth used by the queue, the queue depth during times of congestion, and the scheduling of packet transmission from the set of all queues on a port. Each port has its own CoS queue-related configuration.

The configuration process is simplified by allowing each CoS queue parameter to be configured globally or per-port. A global configuration change is automatically applied to all ports in the system.

To display the Interface Queue Configuration page, click the **QoS** > **CoS** tab, and then click the **Advanced** > **Interface Queue Configuration** link.




To configure CoS queue settings for an interface:

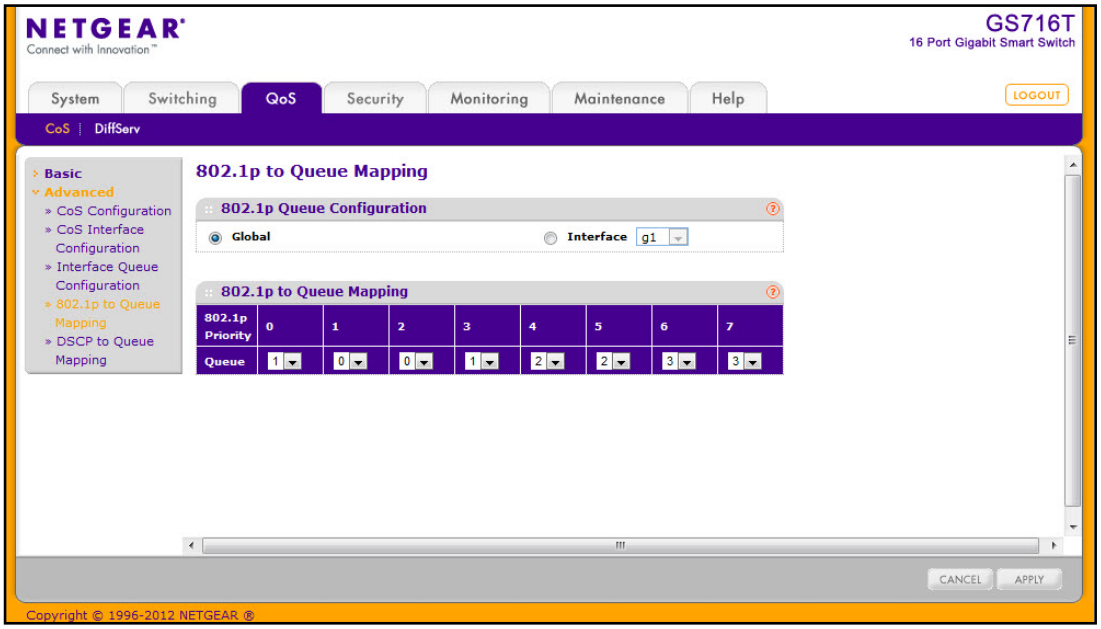
1. To configure CoS queue settings for a physical port, click **PORTS**.
2. To configure CoS queue settings for a Link Aggregation Group (LAG), click **LAGS**.
3. To configure CoS queue settings for both physical ports and LAGs, click **ALL**.
4. Select the check box next to the port or LAG to configure. You can select multiple ports and LAGs to apply the same setting to the selected interfaces. Select the check box in the heading row to apply a trust mode or rate to all interfaces.
5. Configure any of the following settings:
   - **Queue ID**. Use the menu to select the queue to be configured.
   - **Minimum Bandwidth**. Enter a percentage of the maximum negotiated bandwidth for the selected queue on the interface. Specify a percentage from 0–100, in increments of 1.

- **Scheduler Type**. Selects the type of queue processing from the drop down menu. Options are Weighted and Strict. Defining on a per-queue basis allows the user to create the desired service characteristics for different types of traffic.
  - **Weighted**: Weighted round robin associates a weight to each queue. This is the default.
  - **Strict**: Services traffic with the highest priority on a queue first.
- **Queue Management Type**. Displays the type of packet management used for all packets, which is Taildrop. All packets on a queue are safe until congestion occurs. At this point, any additional packets queued are dropped.

6. Click **Cancel** to cancel the configuration on the screen and reset the data on the screen to the latest value of the switch.
7. If you make changes to the page, click **Apply** to apply the changes to the system.

## 802.1p to Queue Mapping

The 802.1p to Queue Mapping page also displays the Current 802.1p Priority Mapping table. To display the 801.p to Queue Mapping page, click **QoS** > **CoS** > **Advanced** > **802.1p to Queue Mapping**.



To map 802.1p priorities to queues:

1. Select the Global radio button to apply the same 802.1p priority mapping to all CoS configurable interfaces or select the Interface radio button to apply 802.1p priority mapping to on a per-interface basis.

   If you map 802.1p priorities to individual interfaces, select the Interface radio button and then select the interface from the drop-down menu. The interface settings override the global settings for 802.1p priority mapping.

2. Select the queue to map to the predefined 802.1p priority values.

   The 802.1p Priority row contains traffic class selectors for each of the eight 802.1p priorities to be mapped. The priority goes from low (0) to high (7). For example, traffic with a priority of 0 is for most data traffic and is sent using “best effort.” Traffic with a higher priority, such as 7, might be time-sensitive traffic, such as voice or video.

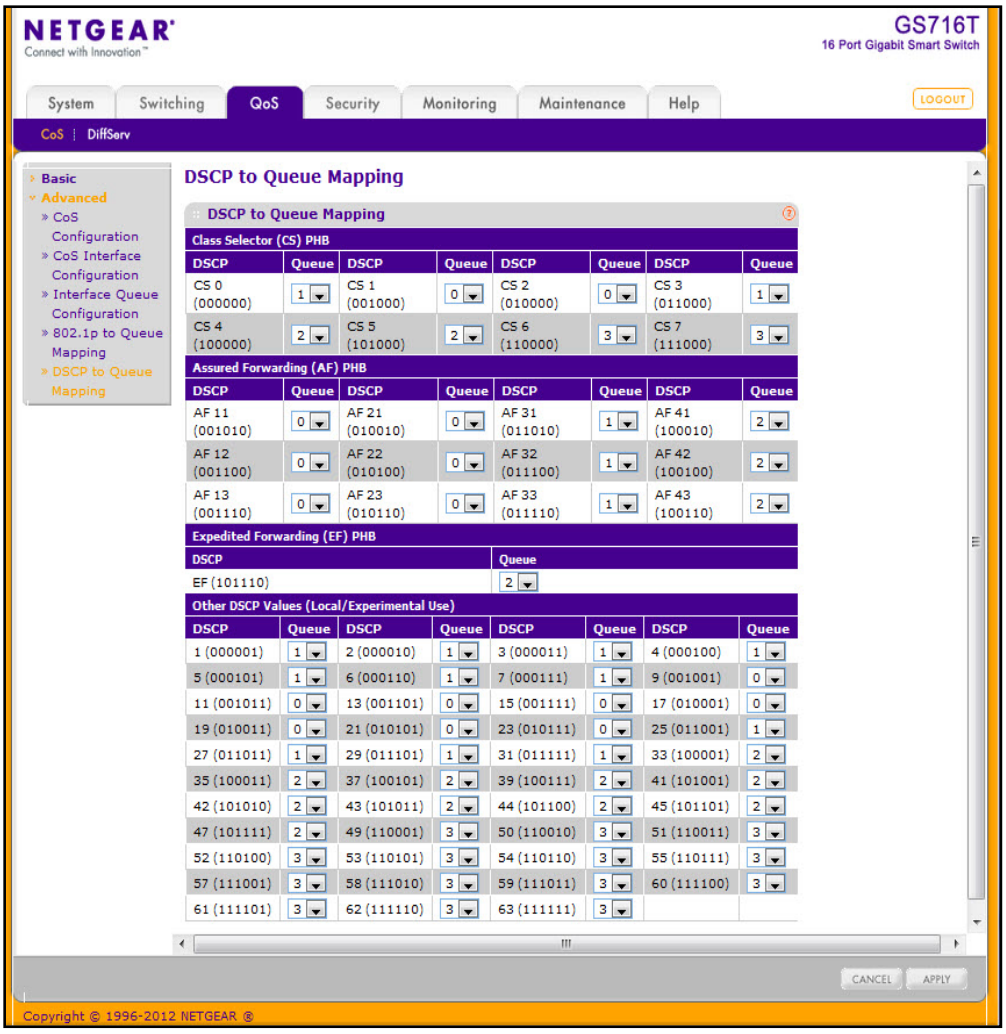
   The values in each drop down menu represent the traffic class. The traffic class is the hardware queue for a port. Higher traffic class values indicate a higher queue position. Before traffic in a lower queue is sent, it must wait for traffic in higher queues to be sent.

3. Click **Cancel** to cancel the configuration on the screen and reset the data on the screen to the latest value of the switch.
4. If you make changes to the page, click **Apply** to apply the changes to the system.

# DSCP to Queue Mapping

Use the DSCP to Queue Mapping page to specify which internal traffic class to map the corresponding DSCP value.

To display the IP DSCP Mapping page, click **QoS** > **CoS** > **Advanced** > **DSCP to Queue Mapping**.




To map DSCP values to queues:

1. For each DSCP value, select a hardware queue to associate with the value.

   The traffic class is the hardware queue for a port. Higher traffic class values indicate a higher queue position. Before traffic in a lower queue is sent, it must wait for traffic in higher queues to be sent. Valid range is 0–7.

2. Click **Cancel** to cancel the configuration on the screen and reset the data on the screen to the latest value of the switch.
3. If you make changes to the page, click **Apply** to apply the changes to the system.

# Differentiated Services

The QoS feature contains Differentiated Services (DiffServ) support that allows traffic to be classified into streams and given certain QoS treatment in accordance with defined per-hop behaviors.

Standard IP-based networks are designed to provide “best effort” data delivery service. “Best effort” service implies that the network delivers the data in a timely fashion, although there is no guarantee that it will. During times of congestion, packets may be delayed, sent sporadically, or dropped. For typical Internet applications, such as e-mail and file transfer, a slight degradation in service is acceptable and in many cases unnoticeable. Conversely, any degradation of service has undesirable effects on applications with strict timing requirements, such as voice or multimedia.

## Defining DiffServ

To use DiffServ for QoS, the Web pages accessible from the Differentiated Services menu page must first be used to define the following categories and their criteria:

1. Class: Create classes and define class criteria.
2. Policy: Create policies, associate classes with policies, and define policy statements.
3. Service: Add a policy to an inbound interface

Packets are classified and processed based on defined criteria. The classification criteria is defined by a class. The processing is defined by a policy's attributes. Policy attributes may be defined on a per-class instance basis, and it is these attributes that are applied when a match occurs. A policy can contain multiples classes. When the policy is active, the actions taken depend on which class matches the packet.

Packet processing begins by testing the class match criteria for a packet. A policy is applied to a packet when a class match within that policy is found.

The Differentiated Services menu page contains links to the various DiffServ configuration and display features.

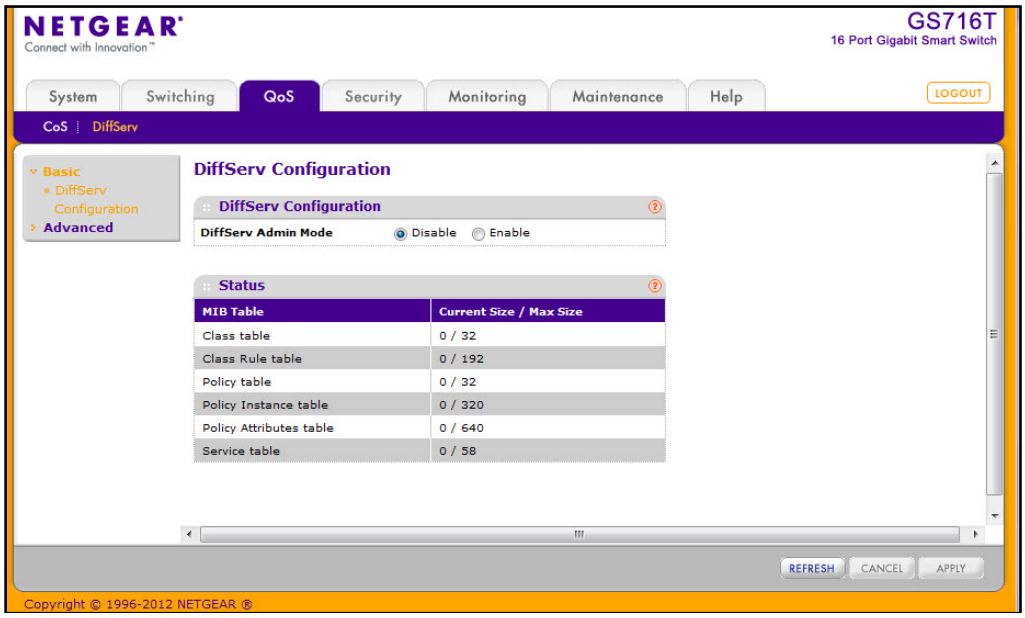
To display the page, click **QoS** > **DiffServ**. The Differentiated Services menu page contains links to the following features:

- *DiffServ Configuration*
- *Class Configuration*
- *IPv6 Class Configuration*
- *Policy Configuration*
- *Service Configuration*
- *Service Statistics*

# DiffServ Configuration

Use the DiffServ Configuration page to display DiffServ General Status Group information, which includes the current administrative mode setting as well as the current and maximum number of rows in each of the main DiffServ private MIB tables.

To display the page, click **QoS** > **DiffServ** > **Advanced** > **DiffServ Configuration**.




To configure the global DiffServ mode:

1. Select the administrative mode for DiffServ:
   - **Enable**. Differentiated Services are active.
   - **Disable**. The DiffServ configuration is retained and can be changed, but it is not active.
2. Click **Cancel** to cancel the configuration on the screen and reset the data on the screen to the latest value of the switch.
3. If you make changes to the page, click **Apply** to apply the changes to the system.

The following table describes the information displayed in the Status table on the DiffServ Configuration page:

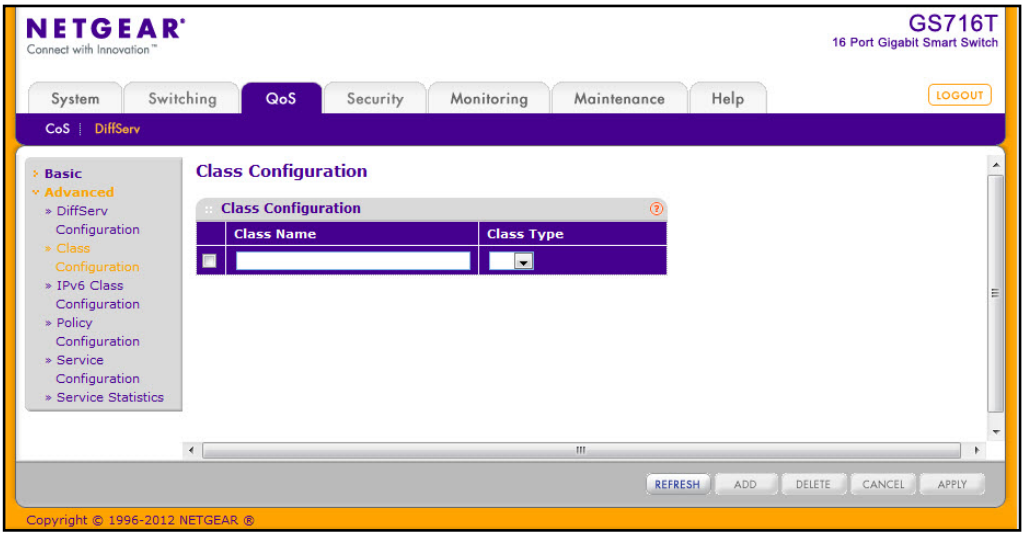
| Field | Description |
|---|---|
| Class Table | Displays the current and maximum number of rows of the class table. |
| Class Rule Table | Displays the current and maximum number of rows of the class rule table. |
| Policy Table | Displays the current and maximum number of rows of the policy table. |
| Policy Instance Table | Displays the current and maximum number of rows of the policy instance table. |

| Field | Description |
|---|---|
| Policy Attributes Table | Displays the current and maximum number of rows of the policy attributes table. |
| Service Table | Displays the current and maximum number of rows of the service table. |

# Class Configuration

Use the Class Configuration page to add a new DiffServ class name, or to rename or delete an existing class. The page also allows you to define the criteria to associate with a DiffServ class. As packets are received, these DiffServ classes are used to prioritize packets. You can have multiple match criteria in a class. The logic is a Boolean logical-and for this criteria. After creating a Class, click the class link to the Class page.

To display the page, click **QoS** > **DiffServ** > **Advanced** > **Class Configuration**.




To configure a DiffServ class:

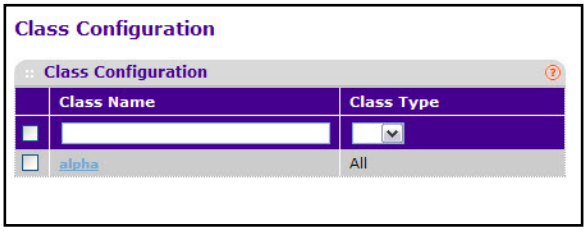
1. To create a new class, enter a class name, select the class type, and click **Add**.

   The switch supports only the Class Type value All, which means all the various match criteria defined for the class should be satisfied for a packet match. All signifies the logical AND of all the match criteria.

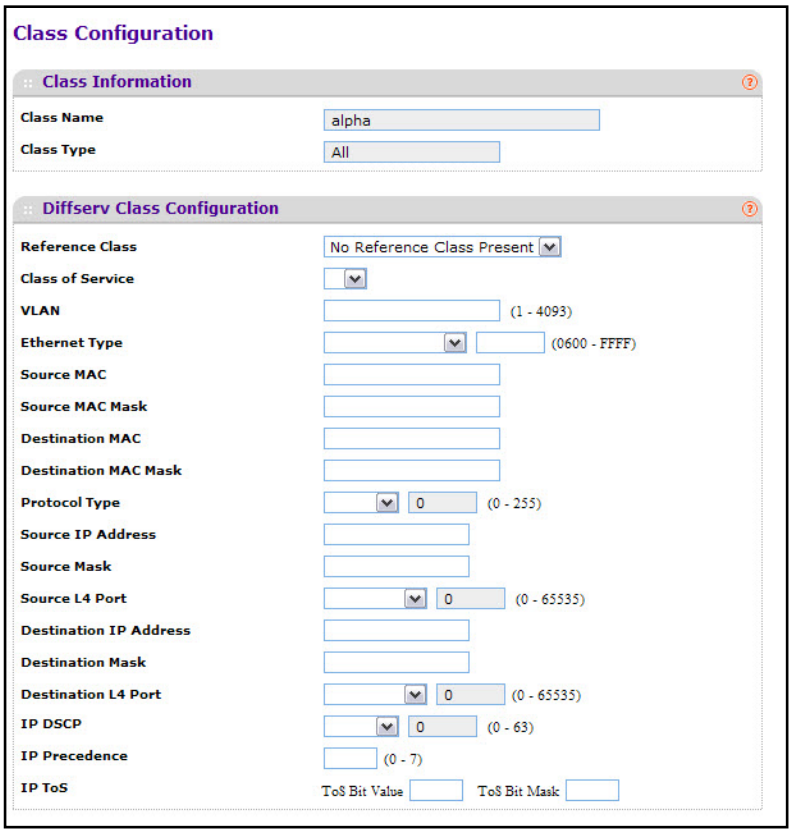
2. To rename an existing class, select the check box next to the configured class, update the name, and click **Apply**.
3. To remove a class, click the check box beside the Class Name, then click **Delete**.
4. Click **Refresh** to refresh the page with the most current data from the switch.
5. Click **Cancel** to cancel the configuration on the screen and reset the data on the screen to the latest value of the switch. After creating a Class, click the class link to the Class page.

To configure the class match criteria:

1. Click the class name for an existing class.




The class name is a hyperlink. The following figure shows the configuration fields for the class.




2. Define the criteria to associate with a DiffServ class:
   - **Reference Class**. Selects a class to start referencing for criteria. A specified class can reference at most one other class of the same type.
   - **Class of Service**. Select the field and enter a class of service 802.1p user priority value to be matched for the packets. The valid range is 0–7.
   - **VLAN**. Select the field and enter a VLAN ID to be matched for packets. The VLAN ID range is 1–4093.

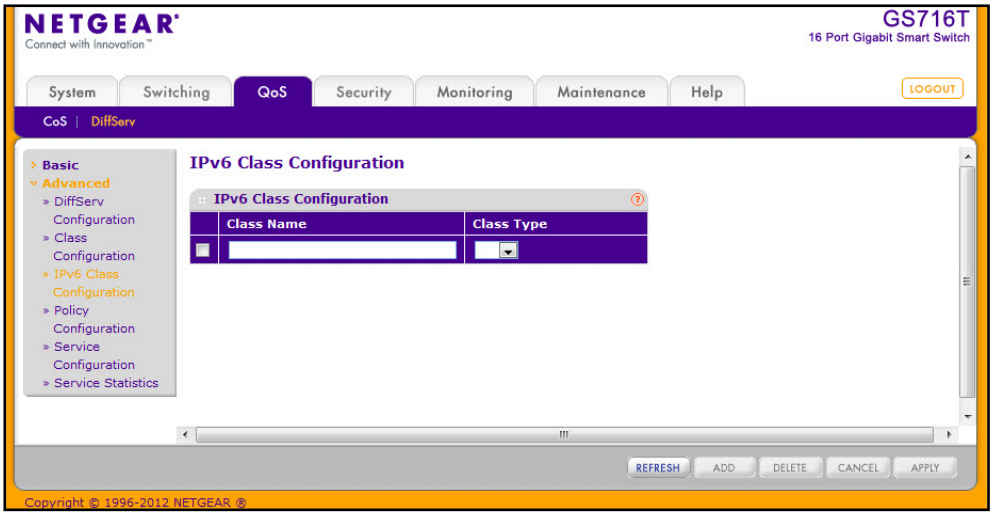
- **Ethernet Type**. Select an EtherType keyword or enter an EtherType value to add a match condition based on the EtherType value.
- **Source MAC**. Requires a packet's source MAC address to match the address specified here.
- **Source MAC Mask**. Indicates which bits in the source MAC address are significant and which are ignored. An F indicates that the bit is significant, while a 0 indicates that the bit is ignored. For example, a MAC mask of FF:FF:FF:FF:FF:FF indicates that all bits in the source MAC address are used as match criteria.
- **Destination MAC**. Requires a packet's destination MAC address to match the address specified here.
- **Destination MAC Mask**. Indicates which bits in the destination MAC address are significant and which are ignored. An F indicates that the bit is significant, while a 0 indicates that the bit is ignored. For example, a MAC mask of FF:FF:FF:FF:FF:FF indicates that all bits in the destination MAC address are used as match criteria.
- **Protocol Type**. Select a layer 4 protocol to use for the match criteria in the packet or select *Other* and enter the value to match in the Protocol field of the IP packet.
- **Source IP Address**. Requires a packet's source port IP address to match the address listed here. In the IP Address field, enter a valid source IP address in dotted decimal format.
- **Source Mask**. Enter a valid subnet mask to determine which bits in the IP address are significant. Note that this is not a wildcard mask.
- **Source L4 Port**. Requires a packet's TCP/UDP source port to match the port you select. Select the desired L4 keyword from the list on which the rule can be based. If you select Other, the screen refreshes and a Port ID field appears. Enter a user-defined Port ID by which packets are matched to the rule.
- **Destination IP Address.** Requires a packet's destination port IP address to match the address listed here. In the IP Address field, enter a valid destination IP address in dotted decimal format.
- **Destination Mask**. Enter a valid subnet mask to determine which bits in the IP address are significant. This is not a wildcard mask.
- **Destination L4 Por**t. Requires a packet's TCP/UDP destination port to match the port you select. Select the desired L4 keyword from the list on which the rule can be based. If you select Other, the screen refreshes and a Port ID field appears. Enter a user-defined Port ID by which packets are matched to the rule.
- **IP DSCP**. Matches the packet's DSCP to the class criteria's when selected. Select the DSCP type from the menu or enter a DSCP value to match. If you select Other, enter a custom value in the DSCP Value field that appears.
- **IP Precedence**. Matches the packet's IP Precedence value to the class criteria's when Enter a value in the range of 0–7.
- **IP ToS**. Matches the packet's Type of Service bits in the IP header to the class criteria's when selected and a value is entered. In the ToS Bits field, enter a two-digit hexadecimal number to match the bits in a packet's ToS field. In the ToS Mask field, specify the bit positions that are used for comparison against the IP ToS field in a packet.

3. Click **Cancel** to cancel the configuration on the screen and reset the data on the screen to the latest value of the switch.
4. If you change any of the settings on the page, click **Apply** to send the updated configuration to the switch. Configuration changes occur immediately.
5. Click **Refresh** to refresh the page with the most current data from the switch.

# IPv6 Class Configuration

Use the IPv6 Class Configuration page to add a new IPv6 DiffServ class name, or to rename or delete an existing class. The page also allows you to define the criteria to associate with a DiffServ class. As packets are received, these DiffServ classes are used to prioritize packets. You can have multiple match criteria in a class. The logic is a Boolean logical-and for this criteria. After creating a Class, click the class link to the Class page.

To display the page, click **QoS** > **DiffServ** > **Advanced** > **IPv6 Class Configuration**.



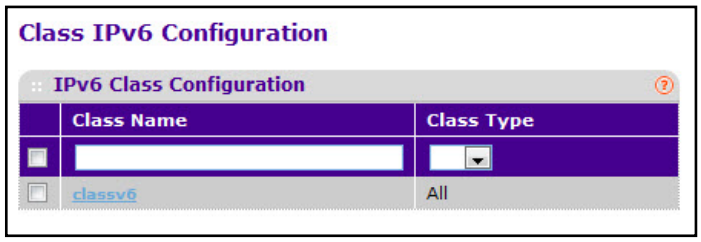

To configure a DiffServ class:

1. To create a new class, enter a **class name**, select the **class type**, and click **ADD**. This field also lists all the existing DiffServ class names, from which one can be selected.

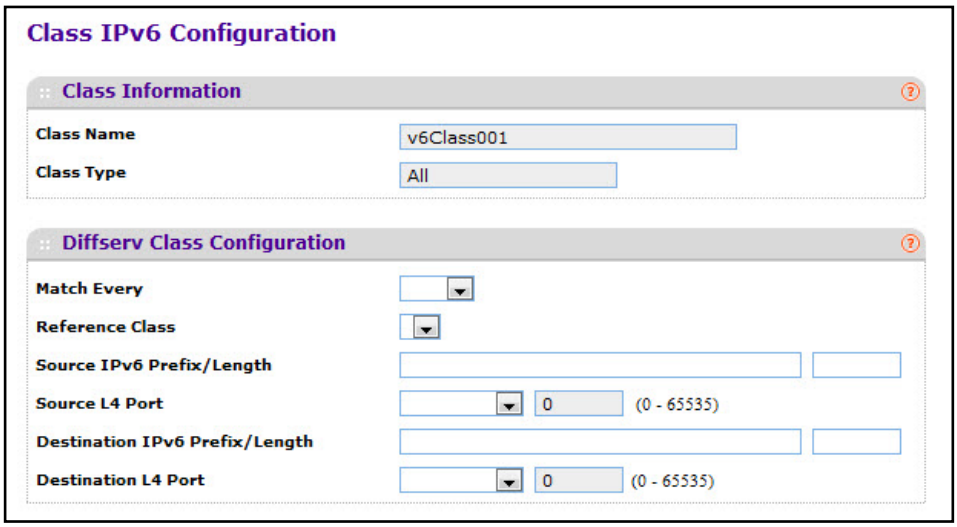
   The switch supports only the **Class Type** value **All**, which means all the various match criteria defined for the class should be satisfied for a packet match. All signifies the logical AND of all the match criteria. Only when a new class is created, this field is a selector field. After class creation this becomes a non-configurable field displaying the configured class type.
2. To rename an existing class, select the check box next to the configured class, update the name, and click **APPLY**.
3. To remove a class, click the check box beside the Class Name, then click **DELETE**.
4. Click **REFRESH** to refresh the page with the most current data from the switch.
5. Click **CANCEL** to cancel the configuration on the screen and reset the data on the screen to the latest value of the switch. After creating a Class, click the class link to the Class page.

To configure the class match criteria:

1. Click the **class name** for an existing class.




The class name is a hyperlink. The following figure shows the configuration fields for the class.




2. **Class Name** - Displays the name for the configured DiffServ class.
3. **Class Type** - Displays the DiffServ class type. Options:
   - All

   Only when a new class is created, this field is a selector field. After class creation this becomes a non-configurable field displaying the configured class type.
4. Define the criteria to associate with a DiffServ class:
   - **Match Every** - This adds to the specified class definition a match condition whereby all packets are considered to belong to the class.
   - **Reference Class** - This lists the class(es) that can be assigned as reference class(es) to the current class.
   - **Source IPv6 Prefix/Length** - This is a valid Source IPv6 Prefix to compare against an IPv6 Packet. Prefix is always specified with the Prefix Length. Prefix can be entered in the range of ::0 to FFFF:FFFF:FFFF:FFFF:FFFF:FFFF:FFFF:FFFF and Prefix Length can be entered in the range of 0 to 128.

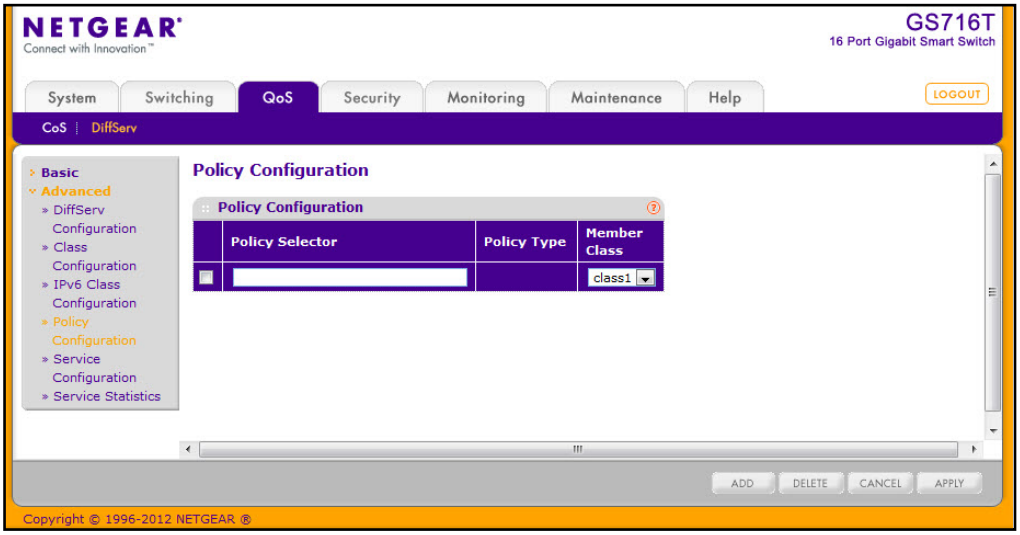
- **Source L4 Port** - This lists the keywords for the known source layer 4 ports from which one can be selected. The list includes 'other' as an option for the unnamed ports.
- **Destination IPv6 Prefix/Length** - This is a valid Destination IPv6 Prefix to compare against an IPv6 Packet. Prefix is always specified with the Prefix Length. Prefix can be entered in the range of ::0 to FFFF:FFFF:FFFF:FFFF:FFFF:FFFF:FFFF:FFFF and Prefix Length can be entered in the range of 0 to 128.
- **Destination L4 Port** - This lists the keywords for the known destination layer 4 ports from which one can be selected. The list includes 'other' as an option for the unnamed ports.

5. Click **CANCEL** to cancel the configuration on the screen. Resets the data on the screen to the latest value of the switch.
6. Click **APPLY** to send the updated configuration to the switch. Configuration changes take effect immediately.

# Policy Configuration

Use the Policy Configuration page to associate a collection of classes with one or more policy statements. After creating a Policy, click the policy link to the Policy page.

To display the page, click **QoS** > **DiffServ** > **Advanced** > **Policy Configuration**.




To configure a DiffServ policy:

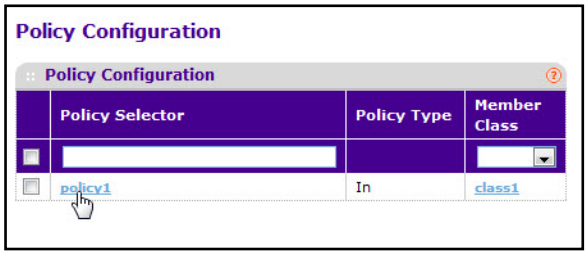
1. To create a new policy, enter a policy name in the Policy Selector field, select the existing DiffServ class to associate with the policy, and click **Add**.

   The available policy type is In, which indicates the type is specific to inbound traffic. This field is not configurable.

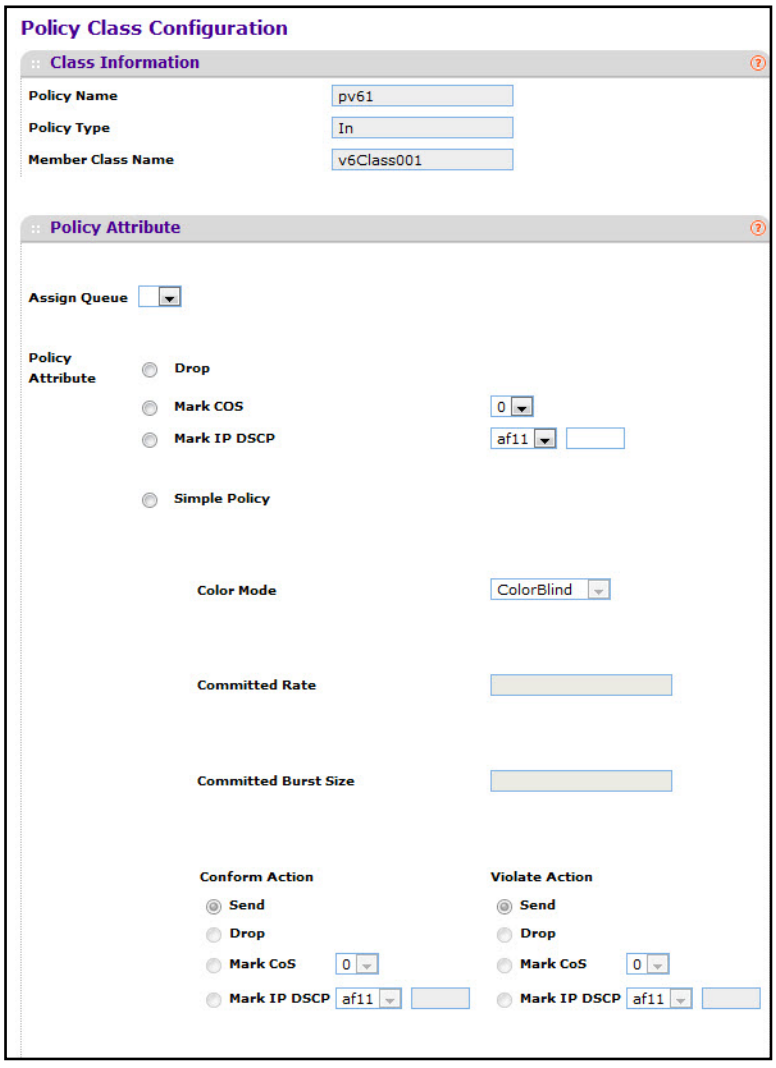
2. To rename an existing policy or add a new member class to the policy, select the check box next to the configured class, update the fields, and click **Apply**.
3. To remove a policy, click the check box beside the policy, then click **Delete**.
4. Click **Refresh** to refresh the page with the most current data from the switch.
5. Click **Cancel** to cancel the configuration on the screen and reset the data on the screen to the latest value of the switch. After creating a Class, click the class link to the Class page.

To configure the policy attributes:

1. Click the name of the policy.




The policy name is a hyperlink. The following figure shows the configuration fields for the policy.




2. Select the queue to which packets will of this policy-class will be assigned.

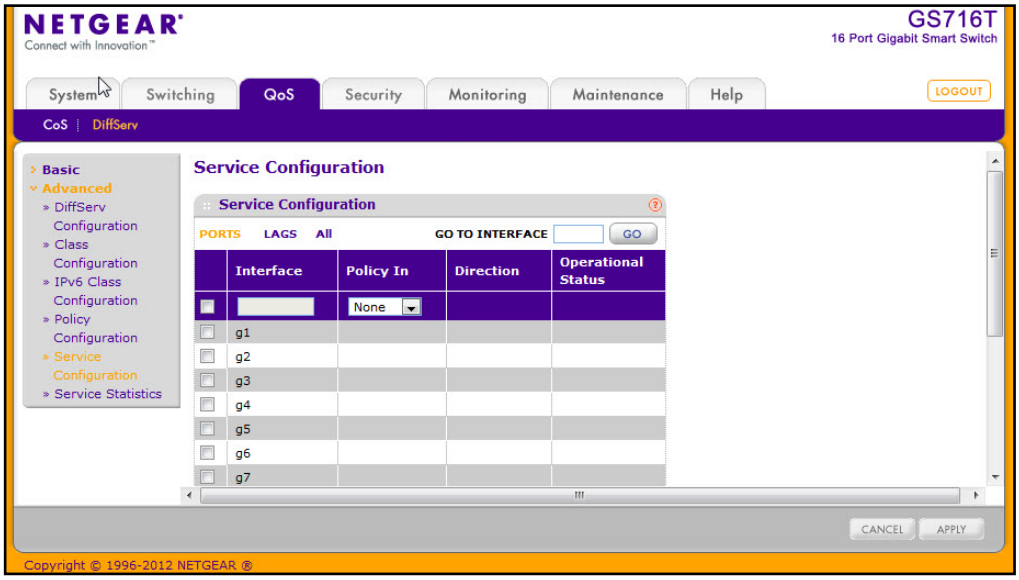
3. Configure the policy attributes:.
   - **Drop**. Select this option to drop packets for this policy-class.
   - **Mark CoS**. Enter the specified Class of Service queue number to mark all packets for the associated traffic stream with the specified class of service value in the priority field of the 802.1p header. If the packet does not already contain this header, one is inserted. The CoS value is an integer from 0–7.
   - **Mark IP DSCP**. Use this attribute to mark all packets for the associated traffic stream with IP DSCP value you choose from the menu. If you select **Other**, enter a custom value in the DSCP Value field that appears.
   - **Simple Policy**. Use this attribute to establish the traffic policing style for the specified class. The simple form of the policy command uses a single data rate and burst size, resulting in two outcomes: confirm and violate.
4. If you select the Simple Policy attribute, you can configure the following fields:
   - **Color Mode**. Color Blind is the supported color mode.
   - **Committed Rate**. The committed rate is specified in kilobits-per-second (Kbps) and is an integer from 1–4294967295.
   - **Committed Burst Size**. The committed burst size is specified in kilobytes (KB) and is an integer from 1–128.
   - **Conform Action**. Determines what happens to packets that are considered conforming (below the police rate). Select one of the following actions:
     - **Send**. (default) These packets are presented unmodified by DiffServ to the system forwarding element.
     - **Drop**. These packets are immediately dropped.
     - **Mark CoS**. These packets are marked by DiffServ with the specified CoS value before being presented to the system forwarding element. This selection requires that the Mark CoS value field be set.
     - **Mark IP DSCP**. These packets are marked by DiffServ with the specified DSCP value before being presented to the system forwarding element. This selection requires that the DSCP value field be set. If you select **Other**, enter a custom value in the DSCP Value field that appears.
   - **Violate Action**. Determines what happens to packets that are considered non-conforming (above the police rate). Select one of the following actions:
     - **Send**. (default) These packets are presented unmodified by DiffServ to the system forwarding element.
     - **Drop**. (default) These packets are immediately dropped.
     - **Mark CoS**. These packets are marked by DiffServ with the specified CoS value before being presented to the system forwarding element. This selection requires that the Mark CoS value field be set.
     - **Mark IP DSCP**. These packets are marked by DiffServ with the specified DSCP value before being presented to the system forwarding element. This selection requires that the DSCP value field be set. If you select **Other**, enter a custom value in the DSCP Value field that appears.

5. Click **Cancel** to cancel the configuration on the screen and reset the data on the screen to the latest value of the switch.
6. If you change any of the settings on the page, click **Apply** to send the updated configuration to the switch. Configuration changes take effect immediately.
7. Click **Refresh** to refresh the page with the most current data from the switch.

# Service Configuration

Use the Service Configuration page to activate a policy on an interface.

To display the page, click **QoS** > **DiffServ** > **Advanced** > **Service Configuration**.



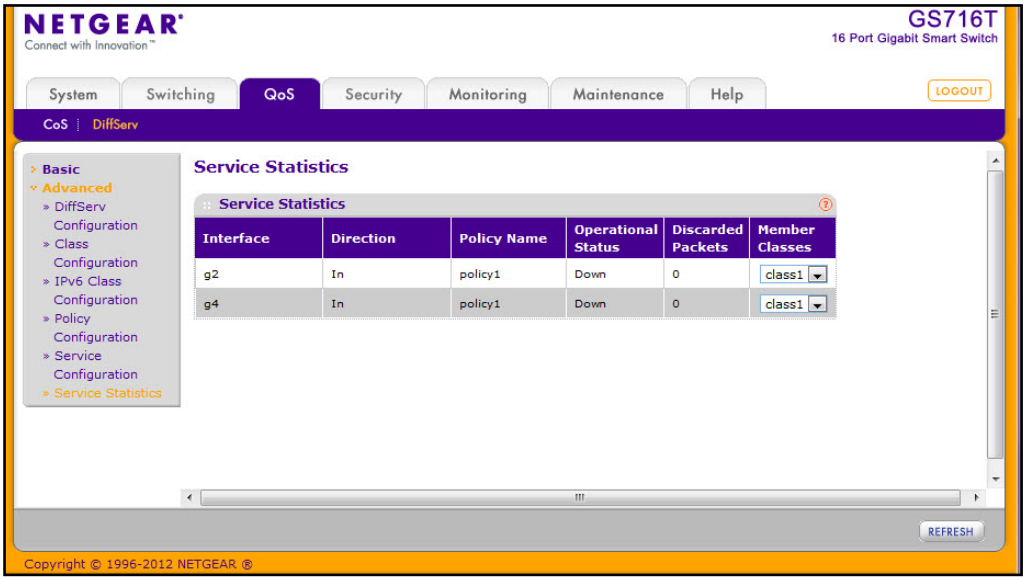
To configure DiffServ policy settings on an interface:

1. To configure DiffServ policy settings for a physical port, click **PORTS**.
2. To configure DiffServ policy settings for a Link Aggregation Group (LAG), click **LAGS**.
3. To configure DiffServ policy settings for both physical ports and LAGs, click **ALL**.
4. Select the check box next to the port or LAG to configure. You can select multiple ports and LAGs to apply the same setting to the selected interfaces. Select the check box in the heading row to apply the same settings to all interfaces.
5. To activate a policy for the selected interface(s) select the policy from the **Policy In** menu, and then click **Apply**.
6. To remove a policy from the selected interface(s) select None from the **Policy In** menu, and then click **Apply**.
7. Click **Cancel** to cancel the configuration on the screen and reset the data on the screen to the latest value of the switch.

## Service Statistics

Use the Service Statistics page to display service-level statistical information about all interfaces that have DiffServ policies attached.

To display the page, click the **QoS** > **DiffServ** tab and then click the **Advanced** > **Service Statistics** link.



The following table describes the information available on the Service Statistics page.

| Field | Description |
|---|---|
| Interface | Displays the interface for which service statistics are to display. |
| Direction | Displays the direction of packets for which service statistics display, which is always *In*. |
| Policy Name | Displays the policy associated with the selected interface. |
| Operational Status | Displays the operational status of this service interface, which is either Up or Down. |
| Discarded Packets | Displays the total number of packets discarded for all class instances in this service policy for any reason due to DiffServ treatment. This is the overall count per-interface, per-direction. |
| Member Classes | Selects the member class for which octet statistics are to display. |

Click **Refresh** to update the page with the most current information.

# Device Security

5

Use the features available from the Security tab to configure management security settings for port, user, and server security. The Security tab contains links to the following features:



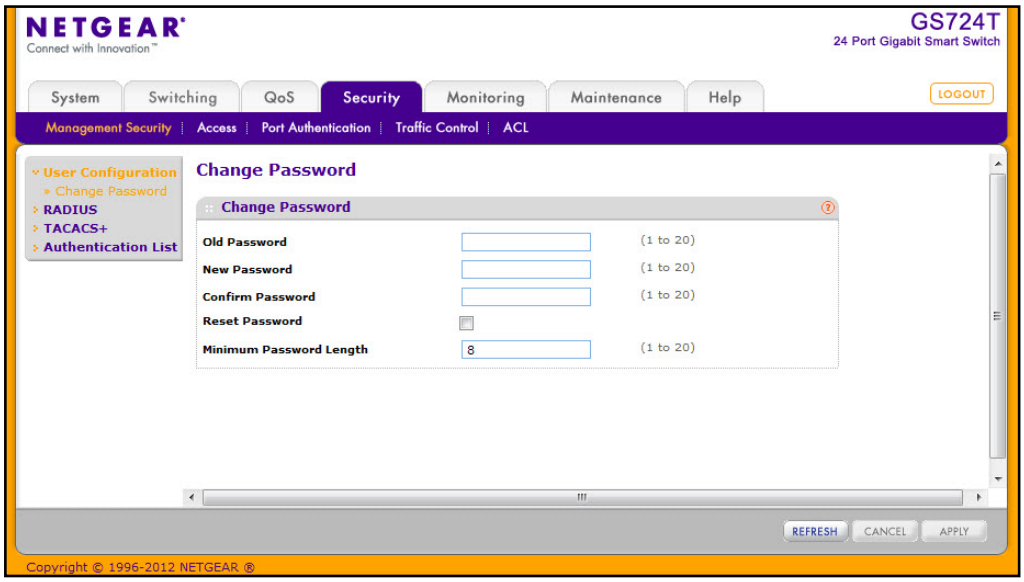
## Management Security Settings

From the **Management Security Settings** page, you can configure the login password, Remote Authorization Dial-In User Service (RADIUS) settings, Terminal Access Controller Access Control System (TACACS+) settings, and authentication lists.

To display the page, click the **Security** > **Management Security** tab. The Management Security folder contains links to the following features:

# Change Password

Use the page to change the login password. To display the page, click **Security** > **Management Security** > **User Configuration** > **Change Password**.




To change the login password for the management interface:

1. Specify the current password in the **Old Password** field. The entered password will be displayed in asterisks (*). Passwords are 1–20 alphanumeric characters in length and are case sensitive.
2. In the **New Password** field, enter the new password. It will not display as it is typed, and only asterisks (*) will show on the screen. Passwords are 1–20 alphanumeric characters in length and are case sensitive.
3. To confirm the password, enter it again in the **Confirm Password** field to make sure you entered it correctly. This field will not display, but will show asterisks (*)
4. Use the **Reset Password** field to reset the password to the default value.
5. In the **Minimum Password Length** field, specify the minimum number of characters required for a valid password.
6. Click **Cancel** to cancel the configuration on the screen and reset the data on the screen to the latest value of the switch.
7. If you make changes to the page, click **Apply** to apply the changes to the system.
8. Click **Refresh** to update the screen with the current information.

**Note:** In the case of a lost password, press the Factory Default Reset button on the front panel for more than one second to restore the factory default. The reset button will only reboot the device.

# RADIUS Configuration

RADIUS servers provide additional security for networks. The RADIUS server maintains a user database, which contains per-user authentication information. The switch passes information to the configured RADIUS server, which can authenticate a user name and password before authorizing use of the network. RADIUS servers provide a centralized authentication method for:

- Web Access
- Access Control Port (802.1X)

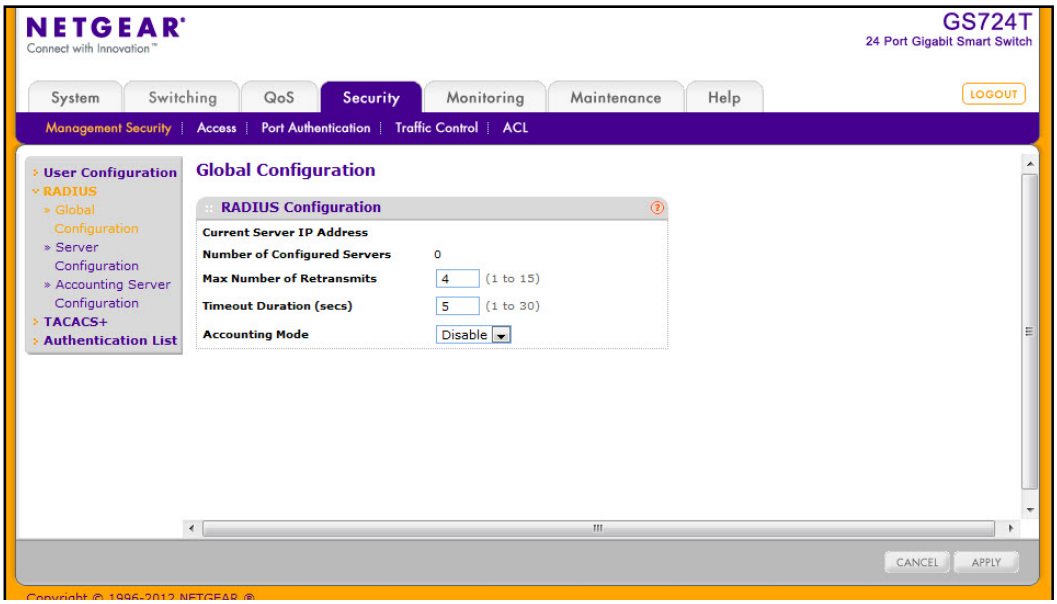
The RADIUS folder contains links to the following features:

- *Global Configuration* on page 175
- *RADIUS Server Configuration* on page 177
- *Accounting Server Configuration* on page 179

## Global Configuration

Use the RADIUS Configuration page to add information about one or more RADIUS servers on the network.

To access the RADIUS **Configuration** page, click **Security** > **Management Security** > **RADIUS** > **Global Configuration.**




The Current Server IP Address field is blank if no servers are configured (see *RADIUS Server Configuration* on page 177). The switch supports up to three configured RADIUS servers. If more than one RADIUS servers are configured, the current server is the server configured as the primary server. If no servers are configured as the primary server, the current server is the most recently added RADIUS server.

To configure global RADIUS server settings:

1. In the **Max Number of Retransmits** field, specify the value of the maximum number of times a request packet is retransmitted to the RADIUS server.

   Consideration to maximum delay time should be given when configuring RADIUS max retransmit and RADIUS timeout. If multiple RADIUS servers are configured, the max retransmit value on each will be exhausted before the next server is attempted. A retransmit will not occur until the configured timeout value on that server has passed without a response from the RADIUS server. Therefore, the maximum delay in receiving a response from the RADIUS application equals the sum of (retransmit times timeout) for all configured servers. If the RADIUS request was generated by a user login attempt, all user interfaces will be blocked until the RADIUS application returns a response.

2. In the **Timeout Duration** field, specify the timeout value, in seconds, for request retransmissions.

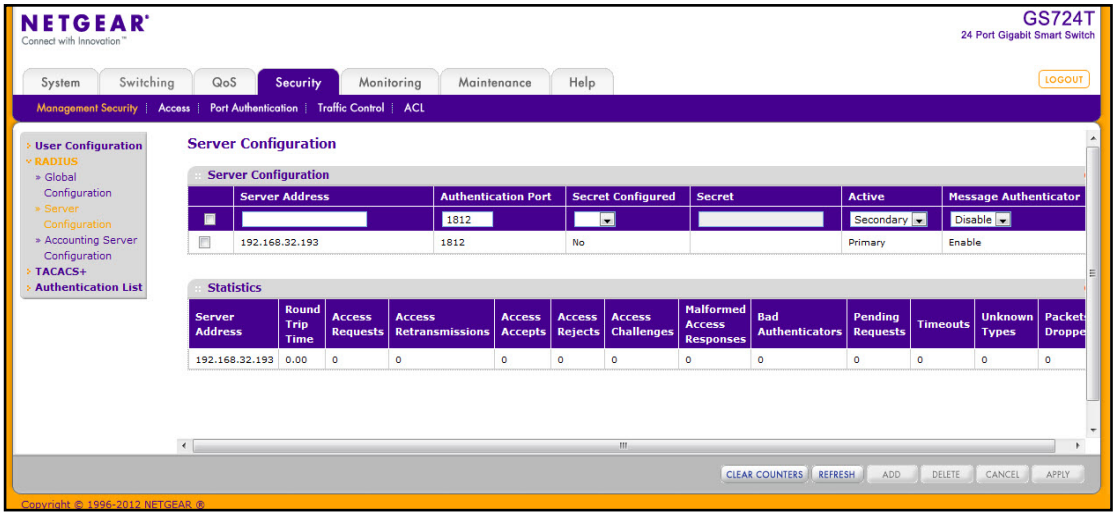
   Consideration to maximum delay time should be given when configuring RADIUS max retransmit and RADIUS timeout. If multiple RADIUS servers are configured, the max retransmit value on each will be exhausted before the next server is attempted. A retransmit will not occur until the configured timeout value on that server has passed without a response from the RADIUS server. Therefore, the maximum delay in receiving a response from the RADIUS application equals the sum of (retransmit times timeout) for all configured servers. If the RADIUS request was generated by a user login attempt, all user interfaces will be blocked until the RADIUS application returns a response.

3. From the **Accounting Mode** menu, select whether the RADIUS accounting mode is enabled or disabled on the current server.
4. Click **Cancel** to cancel the configuration on the screen and reset the data on the screen to the latest value of the switch.
5. If you make changes to the page, click **Apply** to apply the changes to the system.

## *RADIUS Server Configuration*

Use the RADIUS Server Configuration page to view and configure various settings for the current RADIUS server configured on the system.

To access the RADIUS Server **Configuration** page, click **Security** > **Management Security**, and then click the **RADIUS** > **Server Configuration** link.




To configure a RADIUS server:

1. To add a RADIUS server, specify the settings the following list describes, and click **Add**.
   - In the **Server Address** field, specify the IP address of the RADIUS server to add.
   - In the **Authentication Port** field, specify the UDP port number the server uses to verify the RADIUS server authentication. The valid range is 0–65535.
   - From the **Secret Configured** menu, select Yes to add a RADIUS secret in the next field. You must select Yes before you can configure the RADIUS secret. After you add the RADIUS server, this field indicates whether the shared secret for this server has been configured.
   - In the **Secret** field, type the shared secret text string used for authenticating and encrypting all RADIUS communications between the switch and the RADIUS server. This secret must match the RADIUS encryption.
   - From the **Active** menu, specify whether the server is a Primary or Secondary server.
   - From the **Message Authenticator** menu, enable or disable the message authenticator attribute for the selected server.
2. To modify settings for a RADIUS server that is already configured on the switch, select the check box next to the server address, update the desired fields, and click **Apply**.
3. Click **Refresh** to update the page with the most current information.
4. To delete a configured RADIUS server, select the check box next to the server address, and then click **Delete**.
5. Click **Cancel** to cancel the configuration on the screen and reset the data on the screen to the latest value of the switch.

The following table describes the RADIUS server statistics available on the page.

| Field | Description |
|---|---|
| Server Address | This displays all configured RADIUS servers. |
| Round Trip Time | The time interval, in hundredths of a second, between the most recent Access-Reply/Access-Challenge and the Access-Request that matched it from this RADIUS authentication server. |
| Access Requests | The number of RADIUS Access-Request packets sent to this server. This number does not include retransmissions. |
| Access Retransmissions | The number of RADIUS Access-Request packets retransmitted to this server. |
| Access Accepts | The number of RADIUS Access-Accept packets, including both valid and invalid packets, that were received from this server. |
| Access Rejects | The number of RADIUS Access-Reject packets, including both valid and invalid packets, that were received from this server. |
| Access Challenges | The number of RADIUS Access-Challenge packets, including both valid and invalid packets, that were received from this server. |
| Malformed Access Responses | The number of malformed RADIUS Access-Response packets received from this server. Malformed packets include packets with an invalid length. Bad authenticators or signature attributes or unknown types are not included as malformed access-responses. |
| Bad Authenticators | The number of RADIUS Access-Response packets containing invalid authenticators or signature attributes received from this server. |
| Pending Requests | The number of RADIUS Access-Request packets destined for this server that have not yet timed out or received a response. |
| Timeouts | The number of authentication timeouts to this server. |
| Unknown Types | The number of RADIUS packets of unknown type which were received from this server on the authentication port. |
| Packets Dropped | The number of RADIUS packets received from this server on the authentication port and dropped for some other reason. |

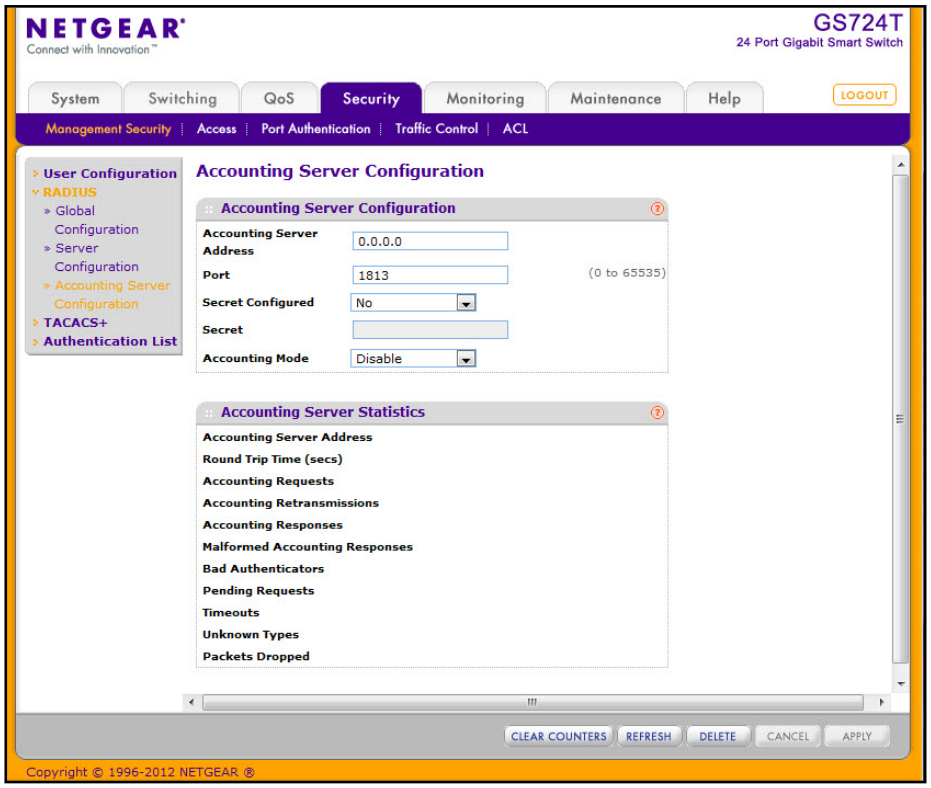
Use the buttons at the bottom of the page to perform the following actions:

- Click **Clear Counters** to clear the authentication server and RADIUS statistics to their default values.
- Click **Refresh** to refresh the page with the most current data from the switch.

## *Accounting Server Configuration*

Use the RADIUS Accounting Server Configuration page to view and configure various settings for one or more RADIUS accounting servers on the network.

To access the RADIUS Accounting Server **Configuration** page, click **Security** > **Management Security** > **RADIUS** > **Accounting Server Configuration**.




To configure the RADIUS accounting server:

1. In the **Accounting Server Address** field, specify the IP address of the RADIUS accounting server to add.
2. In the **Port** field, specify the UDP port number the server uses to verify the RADIUS accounting server authentication. The valid range is 0–65535.
3. From the **Secret Configured** menu, select Yes to add a RADIUS secret in the next field. You must select Yes before you can configure the RADIUS secret. After you add the RADIUS accounting server, this field indicates whether the shared secret for this server has been configured.
4. In the **Secret** field, type the shared secret to use with the specified accounting server.
5. From the **Accounting Mode** menu, enable or disable the RADIUS accounting mode.
6. Click **Apply** to update the switch with the RADIUS Accounting server settings.
7. To delete a configured RADIUS Accounting server, click **Delete**.
8. Click **Cancel** to cancel the configuration on the screen and reset the data on the screen to the latest value of the switch.

The following table describes RADIUS accounting server statistics available on the page.

| Field | Description |
|---|---|
| Accounting Server Address | Displays the IP address of the supported RADIUS accounting server. |
| Round Trip Time (secs) | Displays the time interval, in hundredths of a second, between the most recent Accounting-Response and the Accounting-Request that matched it from this RADIUS accounting server. |
| Accounting Requests | The number of RADIUS Accounting-Request packets sent to this server. This number does not include retransmissions. |
| Accounting Retransmissions | The number of RADIUS Accounting-Request packets retransmitted to this server. |
| Accounting Responses | Displays the number of RADIUS packets received on the accounting port from this server. |
| Malformed Accounting Responses | Displays the number of malformed RADIUS Accounting-Response packets received from this server. Malformed packets include packets with an invalid length. Bad authenticators and unknown types are not included as malformed accounting responses. |
| Bad Authenticators | Displays the number of RADIUS Accounting-Response packets that contained invalid authenticators received from this accounting server. |
| Pending Requests | The number of RADIUS Accounting-Request packets destined for this server that have not yet timed out or received a response. |
| Timeouts | The number of accounting timeouts to this server. |
| Unknown Types | The number of RADIUS packets of unknown type which were received from this server on the accounting port. |
| Packets Dropped | The number of RADIUS packets received from this server on the accounting port and dropped for some other reason. |

Use the buttons at the bottom of the page to perform the following actions:

- Click **Clear Counters** to reset all statistics to their default value.
- Click **Refresh** to update the page with the most current information.

# Configuring TACACS+

TACACS+ provides a centralized user management system, while still retaining consistency with RADIUS and other authentication processes. TACACS+ provides the following services:

- **Authentication:** Provides authentication during login and via user names and user-defined passwords.
- **Authorization:** Performed at login. When the authentication session is completed, an authorization session starts using the authenticated user name. The TACACS+ server checks the user privileges.

The TACACS+ protocol ensures network security through encrypted protocol exchanges between the device and TACACS+ server.

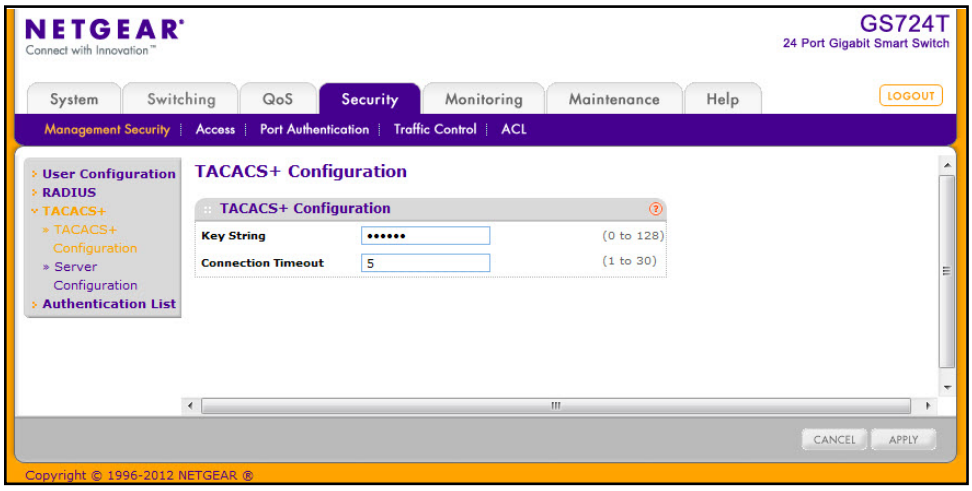
The TACACS+ folder contains links to the following features:


- *Configuring TACACS+* on page 181
- *TACACS+ Server Configuration* on page 182


## TACACS+ Configuration

The TACACS+ Configuration page contains the TACACS+ settings for communication between the switch and the TACACS+ server you configure via the inband management port.

To display the TACACS+ Configuration page, click **Security** > **Management Security**, and then click the **TACACS+** > **TACACS+ Configuration** link.



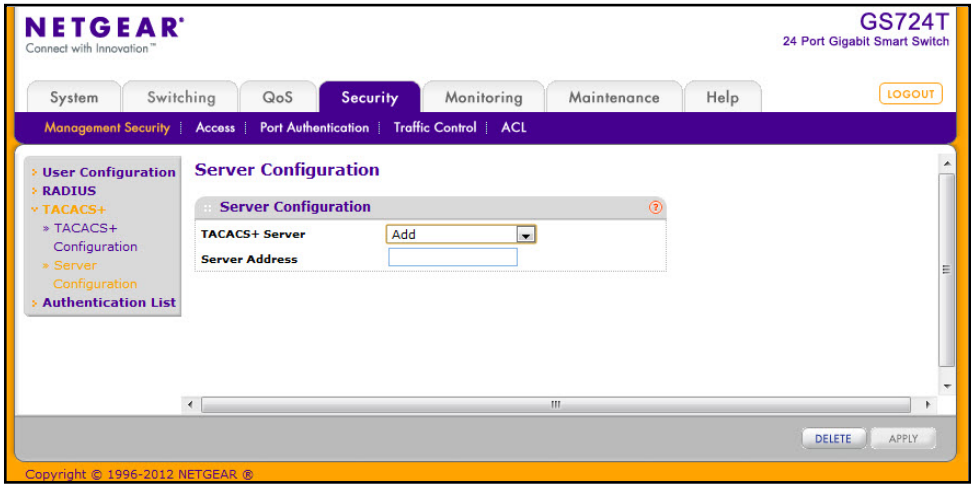
To configure global TACACS+ settings:

1. In the **Key String** field, specify the authentication and encryption key for TACACS+ communications between the GS716T and GS724T and the TACACS+ server. The valid range is 0–128 characters. The key must match the key configured on the TACACS+ server.
2. In the **Connection Timeout** field, specify the maximum number of seconds allowed to establish a TCP connection between the GS716T and GS724T and the TACACS+ server. The valid range is 1–30 seconds.
3. Click **Cancel** to cancel the configuration on the screen and reset the data on the screen to the latest value of the switch.
4. If you make any changes to the page, click **Apply** to apply the new settings to the system.

## *TACACS+ Server Configuration*

Use the TACACS+ Server Configuration page to configure up to five TACACS+ servers with which the switch can communicate.

To display the TACACS+ Server Configuration page, click **Security** > **Management Security**, and then click the **TACACS+** > **Server Configuration** link.

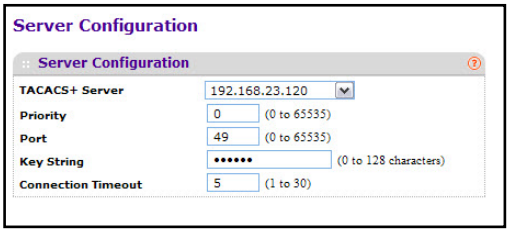



To configure TACACS+ server settings:

1. To add a new TACACS+ server, select **Add** from the **TACACS+ Server** field, enter the IP address of the server to add, and click **Apply**.

**Note:** The **Add** option is available if fewer than five TACACS+ servers are configured on the system, and the **Server Address** field is only available when Add is selected in the TACACS+ Server IP Address field.

After you add one or more TACACS+ servers, additional fields appear on the **TACACS+** Server Configuration page.



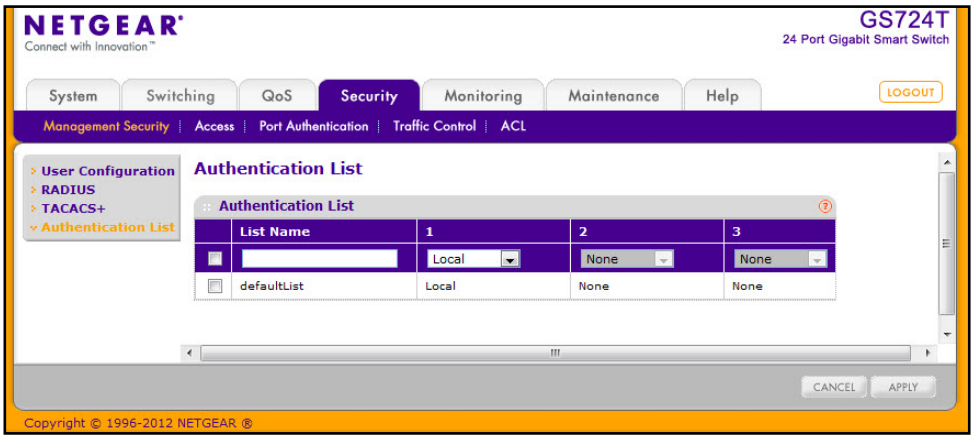

2. In the **Priority** field, specify the order in which the TACACS+ servers are used. A value of 0 is the highest priority.
3. In the **Port** field, specify the authentication port number through which the TACACS+ session occurs. The default is port 49, and the range is 0–65535.
4. In the **Key String** field, specify the authentication and encryption key for TACACS+ communications between the GS716T and GS724T and the TACACS+ server. This key must match the encryption used on the TACACS+ server. The valid range is 0–128 characters.
5. In the **Connection Timeout** field, specify the amount of time that passes before the connection between the device and the TACACS+ server times out. The field range is from 1 to 30 seconds.
6. If you make changes to the page, or add a new entry, click **Apply** to apply the changes to the system.
7. To delete a configured TACACS+ server, select the IP address of the server from the **TACACS+ Server** drop down menu, and then click **Delete**.

# Authentication List Configuration

Use the Authentication List page to configure the default login list. A login list specifies one or more authentication methods to validate switch or port access for the **admin** user.

> **Note:** **Admin** is the only user on the system and is assigned to a preconfigured list named defaultList, which you cannot delete.

To access the Authentication List page, click **Security** > **Management Security**, and then click the **Authentication List** link.




To change the authentication method for the defaultList:

1. Select the check box next to the defaultList name
2. Use the drop down menu in the **1** column to select the authentication method that should appear first in the selected authentication login list. If you select a method that does not time out as the first method, such as ‘local’, no other method will be tried, even if you have specified more than one method. This parameter will not appear when you first create a new login list. User authentication occurs in the order the methods are selected. Possible methods are as follows:
   - **Local**: The user's locally stored ID and password will be used for authentication. Since the local method does not time out, if you select this option as the first method, no other method will be tried, even if you have specified more than one method.
   - **RADIUS**: The user's ID and password will be authenticated using the RADIUS server. If you select RADIUS or TACACS+ as the first method and an error occurs during the authentication, the switch uses Method 2 to authenticate the user.
   - **TACACS+**: The user's ID and password will be authenticated using the TACACS+ server. If you select RADIUS or TACACS+ as the first method and an error occurs during the authentication, the switch attempts user authentication Method 2.
   - **None**: The authentication method is unspecified. This option is only available for Method 2 and Method 3.

3. Use the menu in the **2** column to select the authentication method, if any, that should appear second in the selected authentication login list. This is the method that will be used if the first method times out. If you select a method that does not time out as the second method, the third method will not be tried. This parameter will not appear when you first create a new login list.
4. Use the menu in the **3** column to select the authentication method, if any, that should appear third in the selected authentication login list. This parameter will not appear when you first create a new login list.
5. Click **Cancel** to cancel the configuration on the screen and reset the data on the screen to the latest value of the switch.
6. If you make changes to the page, click **Apply** to apply the changes to the system.

# Configuring Management Access

From the Access page, you can configure HTTP and Secure HTTP access to the GS716T and GS724T management interface. You can also configure Access Control Profiles and Access Rules.

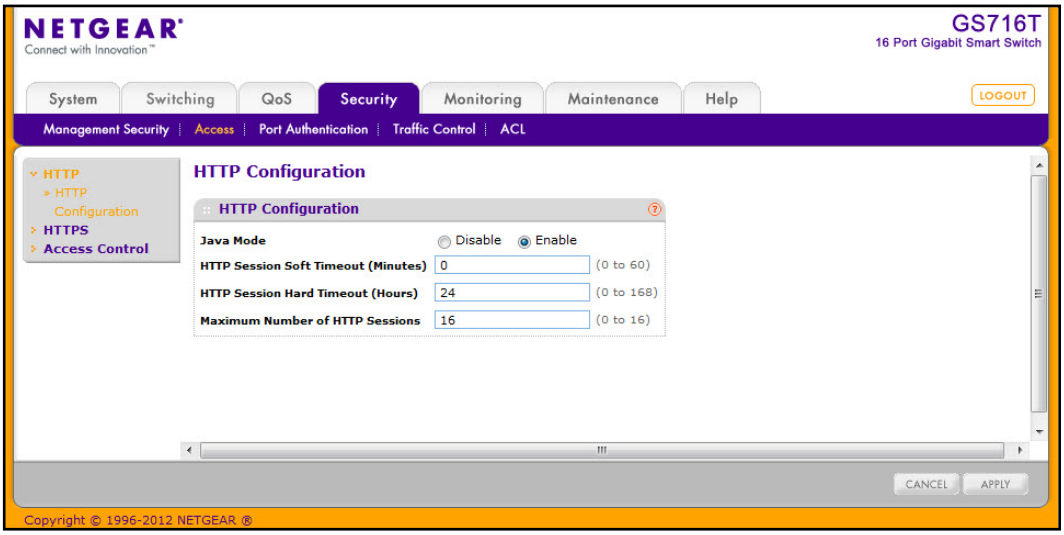
The **Security** > **Access** tab contains the following folders:

- *HTTP Configuration* on page 186
- *Secure HTTP Configuration* on page 187
- *Certificate Download* on page 188
- *Access Profile Configuration* on page 190
- *Access Rule Configuration* on page 192

# HTTP Configuration

Use the HTTP Configuration page to configure the HTTP server settings on the system.

To access the HTTP Configuration page, click the **Security** tab, then click **Access**, and then click the **HTTP** > **HTTP Configuration** link.




To configure the HTTP server settings:

1. Enable or disable the Web Java Mode. This applies to both secure and un-secure HTTP connections. The currently configured value is shown when the Web page is displayed. The default value is Enable.
2. In the **HTTP Session Soft Timeout** field, specify the number of minutes an HTTP session can be idle before a timeout occurs.

   After the session is inactive for the configured amount of time, the administrator is automatically logged out and must re-enter the password to access the management interface. A value of zero corresponds to an infinite timeout. The default value is 5 minutes. The currently configured value is shown when the Web page is displayed.
3. In the **HTTP Session Hard Timeou**t field, specify the hard timeout for HTTP sessions.

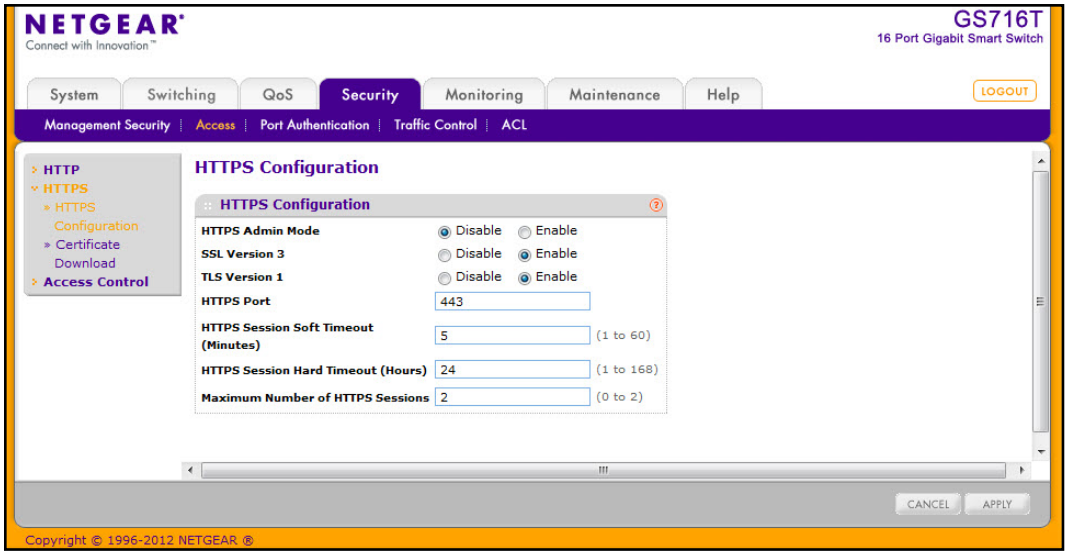
   This timeout is unaffected by the activity level of the session. The value must be in the range of (0–168) hours. A value of zero corresponds to an infinite timeout. The default value is 24 hours. The currently configured value is shown when the Web page is displayed.
4. In the Maximum Number of HTTP Sessions field, specify the maximum number of HTTP sessions that can exist at the same time. The value must be in the range of (0–16). The default value is 16. The currently configured value is shown when the Web page is displayed.
5. Click **Cancel** to cancel the configuration on the screen and reset the data on the screen to the latest value of the switch.
6. If you make changes to the page, click **Apply** to apply the changes to the system.

# Secure HTTP Configuration

Secure HTTP enables the transmission of HTTP over an encrypted Secure Sockets Layer (SSL) or Transport Layer Security (TLS) connection. When you manage the switch by using a Web interface, secure HTTP can help ensure that communication between the management system and the switch is protected from eavesdroppers and man-in-the-middle attacks.

Use the Secure HTTP Configuration page to configure the settings for HTTPS communication between the management station and the switch.

To display the Secure HTTP Configuration page, click **Security** > **Access**, and then click the **HTTPS** > **HTTPS Configuration** link.




To configure HTTPS settings:

1. Use the radio buttons in the **HTTPS Admin Mode** field to enable or disable the Administrative Mode of Secure HTTP.

   The currently configured value is shown when the Web page is displayed. The default value is Disable. You can only download SSL certificates when the HTTPS Admin mode is disabled.

2. Use the radio buttons in the **SSL Version 3** field to enable or disable Secure Sockets Layer Version 3.0. The currently configured value is shown when the Web page is displayed. The default value is Enable.
3. Use the radio buttons in the **TLS Version 1** field to enable or disable Transport Layer Security Version 1.0. The currently configured value is shown when the Web page is displayed. The default value is Enable.
4. In the **HTTPS Port** field, specify the TCP port to use for HTTPS data. The value must be in the range of 1–65535. Port 443 is the default value. The currently configured value is shown when the Web page is displayed.
5. In the **HTTPS Session Soft Timeout** field, specify the number of minutes an HTTPS session can be idle before a timeout occurs.

After the session is inactive for the configured amount of time, the administrator is automatically logged out and must re-enter the password to access the management interface. A value of zero corresponds to an infinite timeout. The default value is 5 minutes. The currently configured value is shown when the Web page is displayed.

6. In the **HTTPS Session Hard Timeout** field, specify the number of hours an HTTPS session can remain active, regardless of session activity. The value must be in the range of (1–168) hours. The default value is 24 hours. The currently configured value is shown when the Web page is displayed.
7. In the **Maximum Number of HTTPS Sessions** field, specify the maximum number of HTTPS sessions that can be open at the same time. The value must be in the range of (0–2). The default value is 2. The currently configured value is shown when the Web page is displayed.
8. Click **Cancel** to cancel the configuration on the screen and reset the data on the screen to the latest value of the switch.
9. If you make changes to the page, click **Apply** to apply the changes to the system.

# Certificate Download

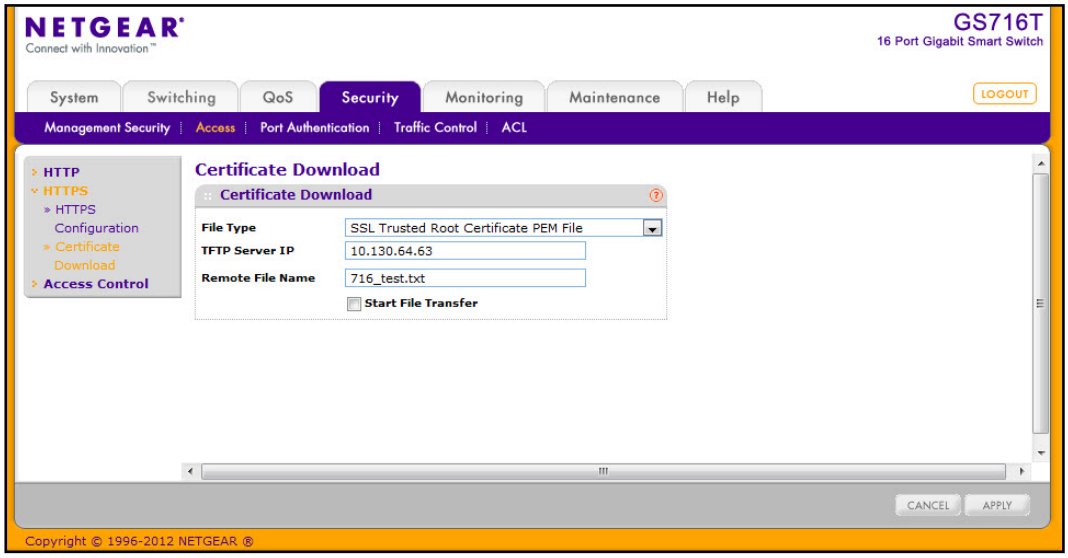
For the Web server on the switch to accept HTTPS connections from a management station, the Web server needs a public key certificate. You can generate a certificate externally (for example, off-line) and download it to the switch.

To display the Certificate Download page, click **Security** > **Access**, and then click the **HTTPS** > **Certificate Download** link.

## Downloading SSL Certificates

Before you download a file to the switch, the following conditions must be true:

- The file to download from the TFTP server is on the server in the appropriate directory.
- The file is in the correct format.
- The switch has a path to the TFTP server.




To configure the certificate download settings for HTTPS sessions:

1. From the **File Type** menu, select the type of SSL certificate to download, which can be one of the following:
   - **SSL Trusted Root Certificate PEM File**. SSL Trusted Root Certificate File (PEM Encoded).
   - **SSL Server Certificate PEM File**. SSL Server Certificate File (PEM Encoded).
   - **SSL DH Weak Encryption Parameter PEM File**. SSL Diffie-Hellman Weak Encryption Parameter File (PEM Encoded).
   - **SSL DH Strong Encryption Parameter PEM File**. SSL Diffie-Hellman Strong Encryption Parameter File (PEM Encoded).
2. In the **TFTP Server IP** field, specify the address of the TFTP server. The address can be an IP address in standard x.x.x.x format or a host name. The host name must start with a letter of the alphabet. Make sure that the software image or other file to be downloaded is available on the TFTP server.
3. In the **Remote File Name** field, specify the name of the file to download, including the path. You may enter up to 32 characters.
4. Select the **Start File Transfer** check box.
5. Click **Apply** to start the transfer. A status message displays during the transfer and upon successful completion of the transfer.
6. Click **Cancel** to cancel the configuration on the screen and reset the data on the screen to the latest value of the switch.

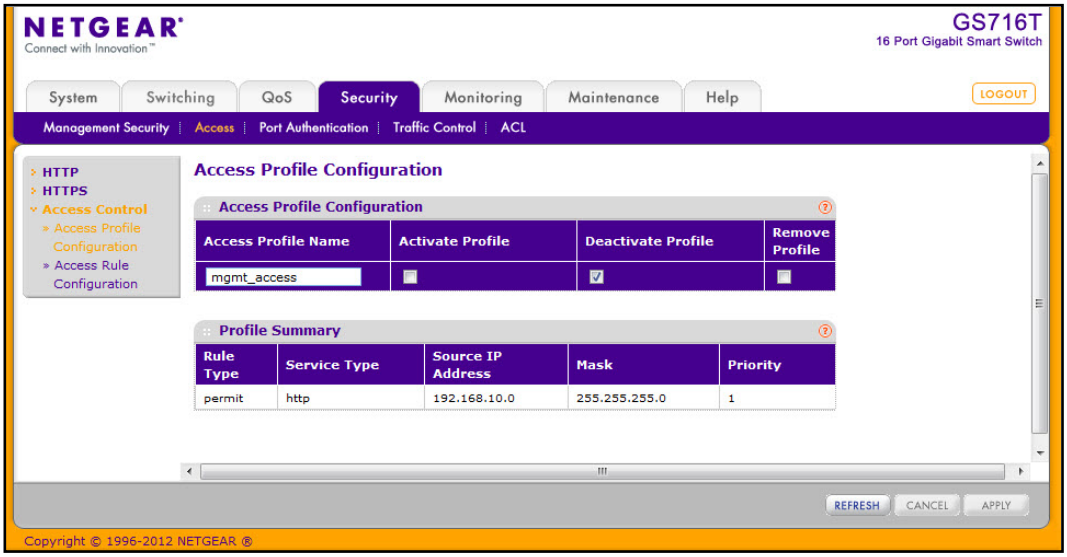
# Access Profile Configuration

Use the Access Profile Configuration page to configure settings that control management access to the switch. Access profile configuration requires three steps:

1. Use the Access Profile Configuration page to create an access profile. To add rules to the profile, the access profile must be deactivated, which is the default setting.
2. Use the Access Rule Configuration page to add one or more access rules to the profile.
3. Return to the Access Profile Configuration page to activate the profile.

To access the Access Profile Configuration page, click **Security** > **Access**, and then click the **Access Control** > **Access Profile Configuration link.**

In the following figure, a profile called *mgmt_access* has been created, and one rule has been added to the profile.



To create an Access Profile:

1. In the **Access Profile Name** field, specify the name of the access profile to be added. The maximum length is 15 characters.
2. To activate an access profile, select the **Activate Profile** check box. You cannot add rules to an active profile.
3. To deactivate an access profile, select the **Deactivate Profile** check box.
4. To remove an access profile, select the **Remove Profile** check box. The access profile should be deactivated before removing the access profile.
5. Click **Cancel** to cancel the configuration on the screen and reset the data on the screen to the latest value of the switch.
6. If you make changes to the page, click **Apply** to apply the changes to the system.

The Profile Summary table shows the rules that are configured for the profile, as the following table describes.

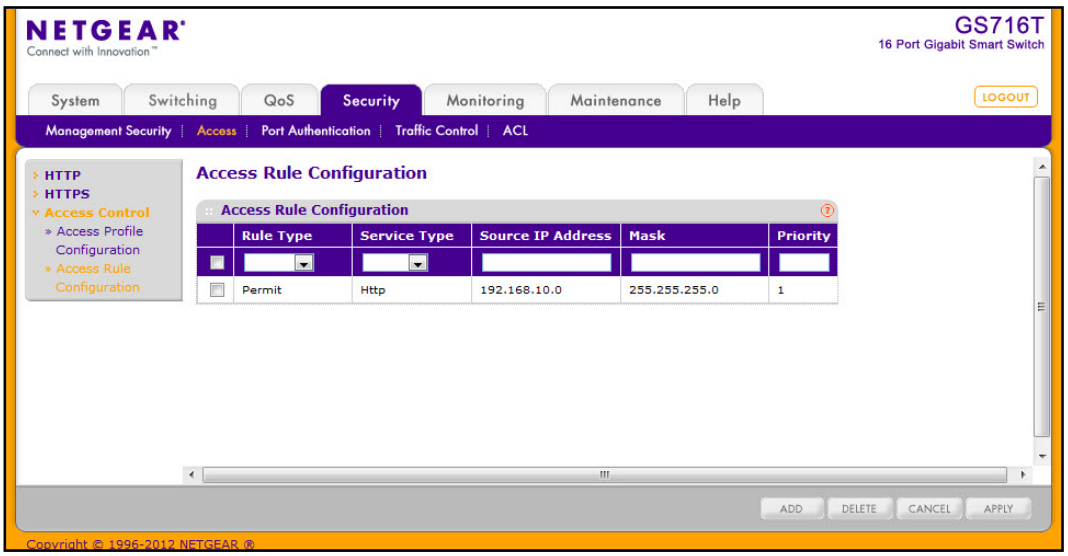
| Field | Description |
|---|---|
| Rule Type | Identifies the action the rule takes, which is either Permit or Deny. |
| Service Type | Displays the type of service to allow or prohibit from accessing the switch management interface:<br>• SNMP<br>• HTTP<br>• HTTPS |
| Source IP Address | Displays the IP Address of the client that may or may not originate management traffic. |
| Mask | Displays the subnet mask associated with the IP address. |
| Priority | Displays the priority of the rule. The rules are validated against the incoming management request in the ascending order of their priorities. If a rule matches, action is performed and subsequent rules below are ignored. |

Click **Refresh** to update the page with the most current information.

# Access Rule Configuration

Use the Access Rule Configuration page to configure the rules about what systems can access the GS716T and GS724T Web interface and what protocols are allowed.

To access the Access Rule Configuration page, click **Security** > **Access**, and then click the **Access Control** > **Access Rule Configuration link.**




Before you create access rules, make sure:

- An access profile exists.
- The access profile is deactivated.

To configure access profile rules:

1. To add an access profile rule, configure the following settings and click **Add**.
   - **Rule Type**: Specify whether the rule permits or denies access to the GS716T and GS724T management interface.
     - Select **Permit** to allow access to the management interface for traffic that meets the criteria you configure for the rule. Any traffic that does not meet the rules is denied.
     - Select **Deny** to prohibit access to the management interface for traffic that meets the criteria you configure for the rule. Any traffic that does not meet the rules is allowed access to the switch. Unlike MAC ACLs and IP ACLs, there is no implied *deny all* rule at the end of the rule list.
   - **Service Type**. Select the type of service to allow or prohibit from accessing the switch management interface:
     - SNMP
     - HTTP
     - HTTPS

- **Source IP Address**. Specify the IP Address of the client originating the management traffic.
- **Mask**. Specify the subnet mask associated with the IP address. The subnet mask is a standard subnet mask, and *not* an inverse (wildcard) mask that you use with IP ACLs.
- **Priority**. Configure priority to the rule. The rules are validated against the incoming management request in the ascending order of their priorities. If a rule matches, action is performed and subsequent rules below are ignored. For example, if a Source IP 10.10.10.10 is configured with priority 1 to permit, and Source IP 10.10.10.10 is configured with priority 2 to Deny, then access is permitted if the profile is active, and the second rule is ignored.

2. To modify an access rule, select the check box next to the Rule Type, update the desired settings, and click **Apply**
3. To delete an access rule, select the check box next to the Rule Type, and click **Delete**.
4. Click **Cancel** to cancel the configuration on the screen and reset the data on the screen to the latest value of the switch.

# Port Authentication

In port-based authentication mode, when 802.1X is enabled globally and on the port, successful authentication of any one supplicant attached to the port results in all users being able to use the port without restrictions. At any given time, only one supplicant is allowed to attempt authentication on a port in this mode. Ports in this mode are under bidirectional control. This is the default authentication mode.

The 802.1X network has three components:

- **Authenticators:** Specifies the port that is authenticated before permitting system access.
- **Supplicants:** Specifies the host connected to the authenticated port requesting access to the system services.
- **Authentication Server:** Specifies the external server, for example, the RADIUS server that performs the authentication on behalf of the authenticator, and indicates whether the user is authorized to access system services.

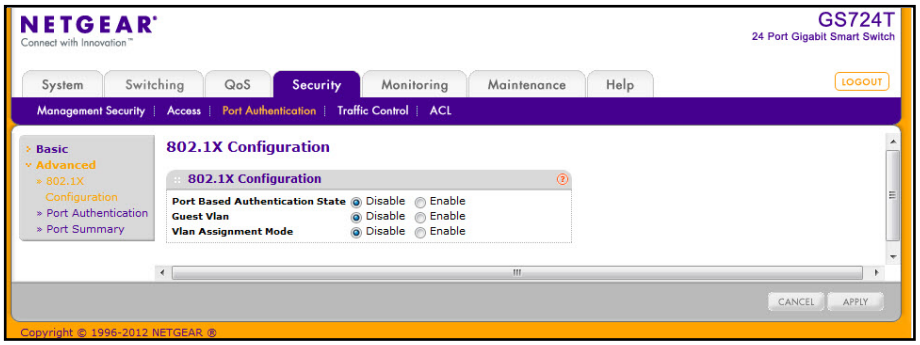
From the Port Authentication link, you can access the following pages:

- Basic:
  - *802.1X Configuration* on page 194
- Advanced:
  - *Port Authentication* on page 195
  - *Port Summary* on page 198

# 802.1X Configuration

Use the 802.1X Configuration page to enable or disable port access control on the system.

To display the 802.1X Configuration page, click **Security** > **Port Authentication** > **Basic** > **802.1X Configuration**.




To configure global 802.1X settings:

1. Select the appropriate radio button in the **Port Based Authentication State** field to enable or disable 802.1X administrative mode on the switch.
   - **Enable**. Port-based authentication is permitted on the switch.

   **Note:** If 802.1X is enabled, authentication is performed by a RADIUS server. This means the primary authentication method must be RADIUS. To set the method, go to **Security** > **Management Security** > **Authentication List** and select RADIUS as method 1 for defaultList. For more information, see *Authentication List Configuration* on page 184.

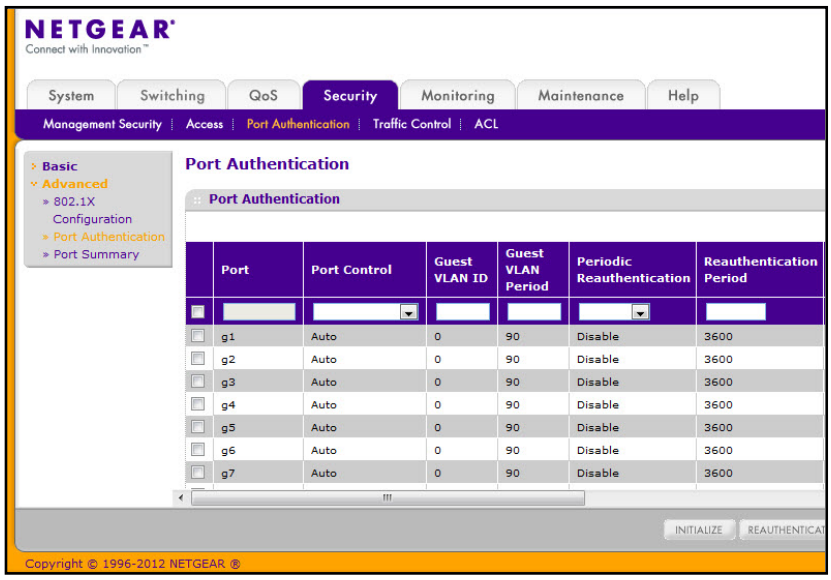
   - **Disable**. The switch does not check for 802.1X authentication before allowing traffic on any ports, even if the ports are configured to allow only authenticated users.
2. Enable or disable the **Guest VLAN** supplicant mode.
   - **Enabled**. When no 802.1X supplicant is authenticated on a port, the port still provides limited network access, as determined by a guest VLAN configured on the authentication server.
   - **Disabled**. A guest VLAN cannot be used for unauthorized ports.
3. Enable or disable the **VLAN Assignment** mode:
   - **Enable**. Allow a RADIUS server to assign the VLAN ID to authenticated supplicants.
   - **Disable**. The RADIUS server can not assign authenticated clients to VLANs.
4. Click **Cancel** to cancel the configuration on the screen and reset the data on the screen to the latest value of the switch.
5. If you change the settings, click **Apply** to apply the new settings to the system.

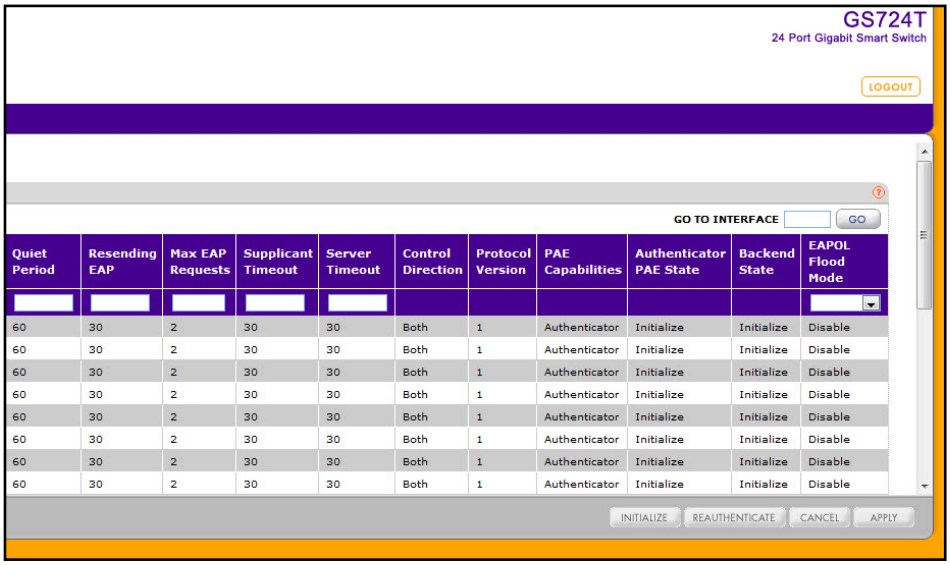
# Port Authentication

Use the Port Authentication page to enable and configure port access control on one or more ports.

To access the Port Authentication page, click **Security** > **Port Authentication**, and then click the **Advanced** > **Port Authentication** link.

**Note:** Use the horizontal scroll bar at the bottom of the browser to view all the fields on the Port Authentication page. The figures on the following page are both images of the Port Authentication page.



To configure 802.1X settings for the port:

1. Select the check box next to the port to configure. You can also select multiple check boxes to apply the same settings to the select ports, or select the check box in the heading row to apply the same settings to all ports.
2. For the selected port(s), specify the following settings:
   - **Port Control**. Defines the port authorization state. The control mode is only set if the link status of the port is link up. The possible field values are:
     - Auto: Automatically detects the mode of the interface.
     - Authorized: Places the interface into an authorized state without being authenticated. The interface sends and receives normal traffic without client port-based authentication.
     - Unauthorized: Denies the selected interface system access by moving the interface into unauthorized state. The switch cannot provide authentication services to the client through the interface.
   - **Guest VLAN ID**. This field allows the user to configure the Guest VLAN ID on the interface. The valid range is 0–4093.The default value is 0. Enter 0 to reset the Guest VLAN ID on the interface.
   - **Guest VLAN Period**. This input field allows the user to enter the Guest VLAN period for the selected port. The Guest VLAN period is the value, in seconds, of the timer used by the Guest VLAN Authentication. The Guest VLAN timeout must be a value in the range of 1–300. The default value is 90.
   - **Periodic Reauthentication**. Use this field to enable or disable reauthentication of the supplicant for the specified port. Select Enable and Disable. If the value is Enable, reauthentication will occur. Otherwise, reauthentication will not be allowed. The default value is Disable. Changing the selection will not change the configuration until the Apply button is pressed.
   - **Reauthentication Period**. Indicates the time span in which the selected port is reauthenticated. The field value is in seconds. The range is 1–65535, and the field default is 3600 seconds.
   - **Quiet Period**. Defines the amount of time that the switch remains in the quiet state following a failed authentication exchange. The possible field range is 0–65535. The field value is in seconds. The field default is 60 seconds.
   - **Resending EAP**. This input field allows you to configure the transmit period for the selected port. The transmit period is the value, in seconds, of the timer used by the authenticator state machine on the specified port to determine when to send an EAPOL EAP Request/Identify frame to the supplicant. The transmit period must be a number in the range of 1–65535. The default value is 30. Changing the value will not change the configuration until you click the Apply button.
   - **Max EAP Requests**. This input field allows you to enter the maximum requests for the selected port. The maximum requests value is the maximum number of times the authenticator state machine on this port will retransmit an EAPOL EAP Request/Identity before timing out the supplicant. The maximum requests value must be in the range of 1–10. The default value is 2. Changing the value will not change the configuration until you click the Apply button.

- **Supplicant Timeout**. Defines the amount of time that lapses before EAP requests are resent to the user. The field value is in seconds. The field default is 30 seconds.
- **Server Timeout**. Defines the amount of time that lapses before the switch resends a request to the authentication server. The field value is in seconds. The range is 1–65535, and the field default is 30 seconds.
- **Control Direction**. This displays the control direction for the specified port, which is always Both. The control direction dictates the degree to which protocol exchanges take place between Supplicant and Authenticator.The unauthorized controlled port exerts control over communication in both directions (disabling both incoming and outgoing frames). This field is not configurable.
- **Protocol Version**. This field displays the protocol version associated with the selected port. The only possible value is 1, corresponding to the first version of the 802.1X specification. This field is not configurable.
- **PAE Capabilities**. This field displays the port access entity (PAE) functionality of the selected port. Possible values are Authenticator or Supplicant. This field is not configurable.
- **Authenticator PAE State**. This field displays the current state of the authenticator PAE state machine. Possible values are as follows:
  - Initialize
  - Disconnected
  - Connecting
  - Authenticating
  - Authenticated
  - Aborting
  - Held
  - ForceAuthorized
  - ForceUnauthorized
- **Backend State**. This field displays the current state of the backend authentication state machine. Possible values are as follows:
  - Request
  - Response
  - Success
  - Fail
  - Timeout
  - Initialize
  - Idle
- **EAPOL Flood Mode**. This field is used to enable or disable the EAPOL Flood mode per Interface.The default value is Disable.

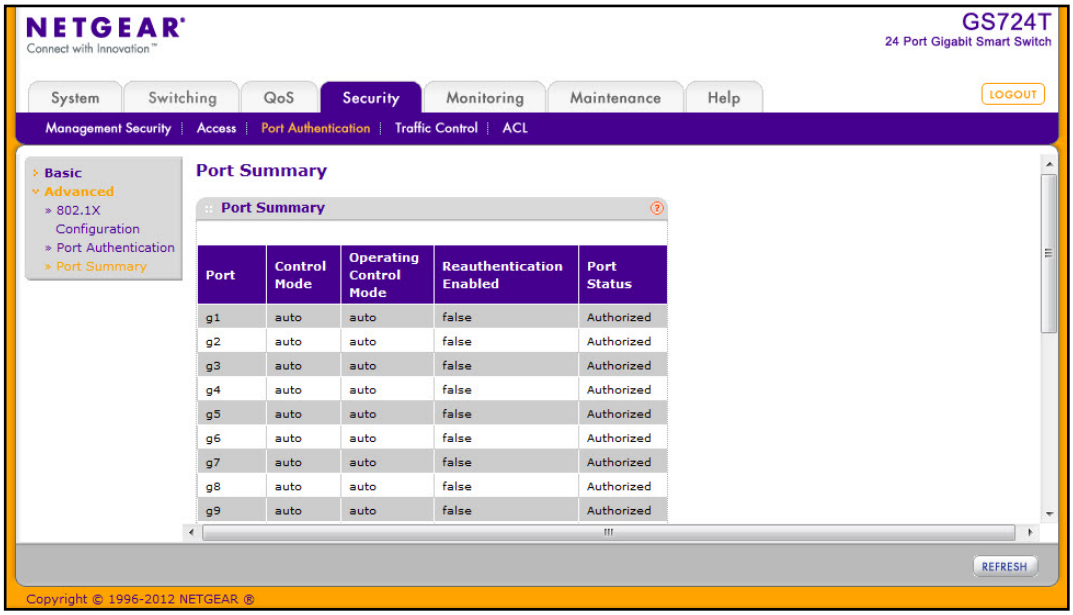
3. Click **Apply** to send the updated screen to the switch and cause the changes to occur on the switch and the changes will be saved.

4. Click **Initialize** to begin the initialization sequence on the selected port(s). This button is only selectable if the control mode is *auto*. If the button is not selectable, it will be grayed out. When this button is clicked, the action is immediate. It is not required to click **Apply** for the action to occur.
5. Click **Reauthenticate** to begin the reauthentication sequence on the selected port. This button is only selectable if the control mode is *auto*. If the button is not selectable, it will be grayed out. When this button is pressed, the action is immediate. It is not required to click **Apply** for the action to occur.
6. Click **Cancel** to cancel the configuration on the screen and reset the data on the screen to the latest value of the switch.

# Port Summary

Use the Port Summary page to view information about the port access control settings on a specific port.

To access the Port Summary page, click **Security** > **Port Authentication** > **Advanced** > **Port Summary**.



The following table describes the fields on the Port Summary page.

| Field | Description |
|---|---|
| Port | The port whose settings are displayed in the current table row. |
| Control Mode | Defines the port authorization state. The control mode is only set if the link status of the port is link up. The possible field values are:<br>• **Auto:** Automatically detects the mode of the interface.<br>• **Force Authorized:** Places the interface into an authorized state without being authenticated. The interface sends and receives normal traffic without client port-based authentication.<br>• **Force Unauthorized:** Denies the selected interface system access by moving the interface into unauthorized state. The switch cannot provide authentication services to the client through the interface. |
| Operating Control Mode | This field indicates the control mode under which the port is actually operating. Possible values are:<br>• ForceUnauthorized<br>• ForceAuthorized<br>• Auto<br>• N/A: If the port is in detached state it cannot participate in port access control. |
| Reauthentication Enabled | Displays if reauthentication is enabled on the selected port. This is a configurable field. The possible values are *true* and *false*. If the value is *true*, reauthentication will occur. Otherwise, reauthentication will not be allowed. |
| Port Status | This field displays the authorization status of the specified port. The possible values are *Authorized*, *Unauthorized*, and *N/A*. If the port is in detached state, the value will be *N/A* since the port cannot participate in port access control. |

Click **Refresh** to update the information on the screen.

# Traffic Control

From the **Traffic Control** link, you can configure MAC Filters, Storm Control, Port Security, and Protected Port settings. To display the page, click the **Security** > **Traffic Control** tab.

The Traffic Control folder contains links to the following features:

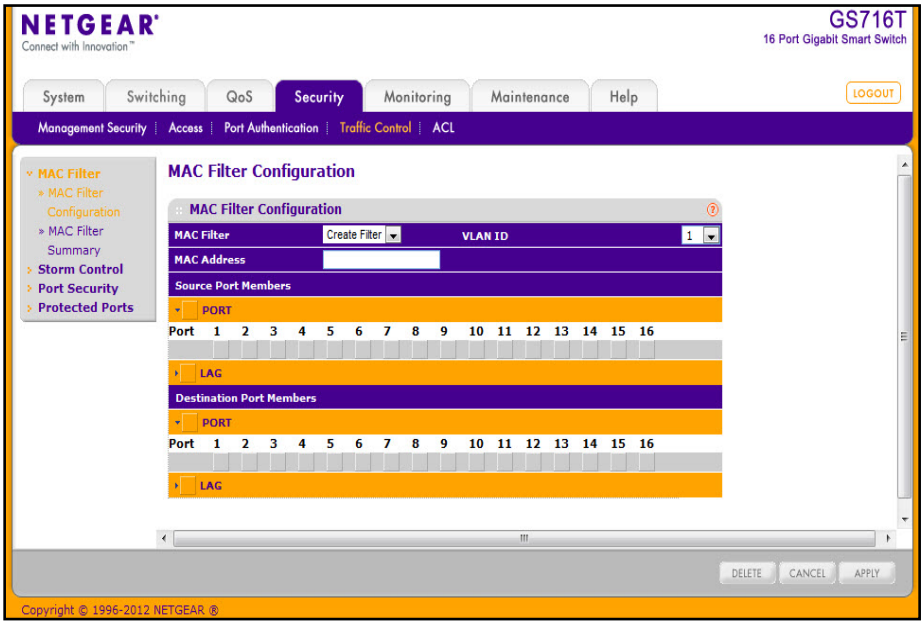
- MAC Filter:
  - *MAC Filter Configuration* on page 200
  - *MAC Filter Summary* on page 202
- *Storm Control* on page 203
- Port Security:
  - *Port Security Configuration* on page 204
  - *Port Security Interface Configuration* on page 205
  - *Security MAC Address* on page 207
- *Protected Ports Membership* on page 208

## MAC Filter Configuration

Use the MAC Filter Configuration page to create MAC filters that limit the traffic allowed into and out of specified ports on the system.

To display the MAC Filter Configuration page, click **Security** > **Traffic Control,** and then click the **MAC Filter** > **MAC Filter Configuration** link.

In the following figure, the source and destination port member areas have been expanded to show the ports. Click the orange bar to show the ports or LAGs.



To configure MAC filter settings:

1. To configure a new MAC filter:
   a. Select Create Filter from the **MAC Filter** menu. If no filters have been configured, this is the only option available.
   b. From the VLAN ID menu, select the VLAN to use with the MAC address to fully identify packets you want filtered. You can change this field only when the Create Filter option is selected from the MAC Filter menu.
   c. In the MAC Address field, specify the MAC address of the filter in the format 00:01:1A:B2:53:4D. You can change this field when you have selected the Create Filter option.

      You cannot define filters for the following MAC addresses:

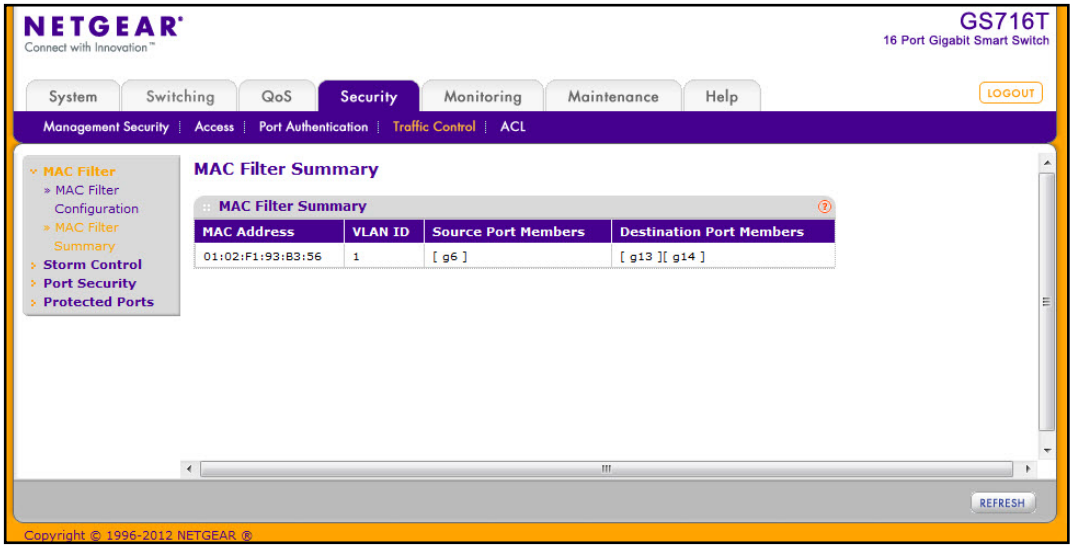
      - 00:00:00:00:00:00
      - 01:80:C2:00:00:00 to 01:80:C2:00:00:0F
      - 01:80:C2:00:00:20 to 01:80:C2:00:00:21
      - FF:FF:FF:FF:FF:FF

   d. Click the orange bar under the Source Port Members heading to display the available ports. Select the port(s) to include in the inbound filter. If a packet with the MAC address and VLAN ID you specify is received on a port that is not in the list, it will be dropped.
   e. Click the orange bar under the Destination Port Members heading to display the available ports. Select the port(s) to include in the outbound filter. Packets with the MAC address and VLAN ID you selected will be transmitted only out of ports that are in the list. Destination ports can be included only in the Multicast filter.
2. To delete a configured MAC Filter, select it from the menu, and then click **Delete**.
3. Click **Cancel** to cancel the configuration on the screen and reset the data on the screen to the latest value of the switch.
4. If you make changes to the page, click **Apply** to apply the changes to the system.

# MAC Filter Summary

Use the MAC Filter Summary page to view the MAC filters that are configured on the system.

To display the MAC Filter Summary page, click **Security** > **Traffic Control**, and then click the **MAC Filter** > **MAC Filter Summary** link.




The following table describes the information displayed on the page:

| Field | Description |
|---|---|
| MAC Address | Identifies the MAC address that is filtered. |
| VLAN ID | The VLAN ID used with the MAC address to fully identify packets you want filtered. You can only change this field when you have selected the **Create Filter** option. |
| Source Port Members | Displays the ports included in the inbound filter. |
| Destination Port Members | Displays the ports included in the outbound filter. |

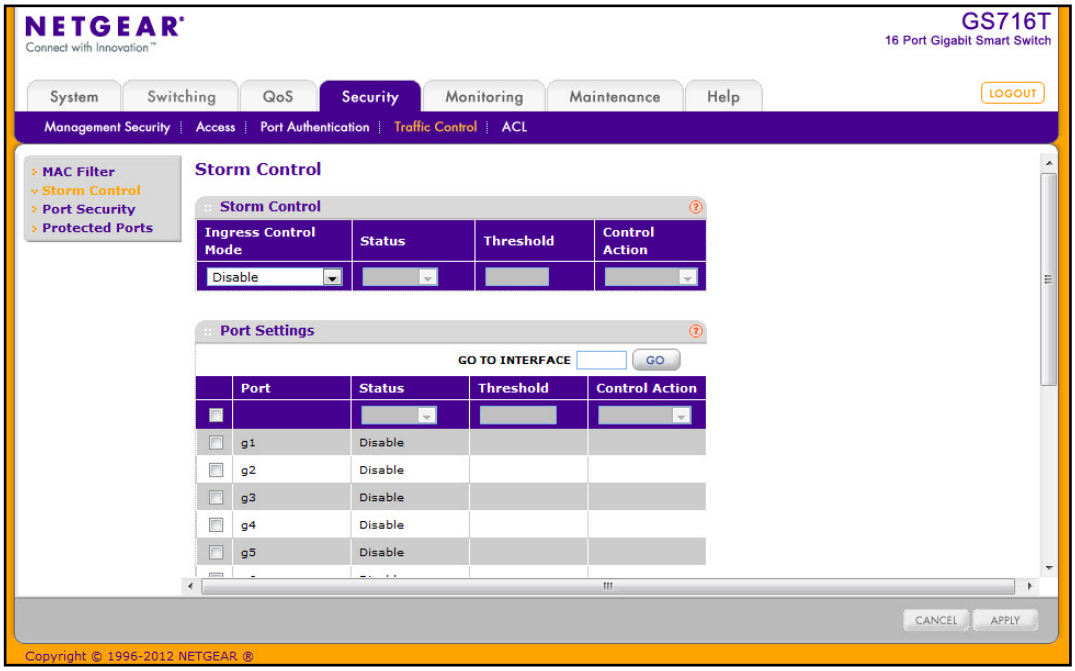
Click **Refresh** to update the page with the most current information.

# Storm Control

A broadcast storm is the result of an excessive number of broadcast messages simultaneously transmitted across a network by a single port. Forwarded message responses can overload network resources and/or cause the network to time out.

The switch measures the incoming broadcast/multicast/unknown unicast packet rate per port and discards packets when the rate exceeds the defined value. Storm control is enabled per interface, by defining the packet type and the rate at which the packets are transmitted.

To display the Storm Control page, click **Security** > **Traffic Control**, and then click the **Storm Control** link.




To configure storm control settings:

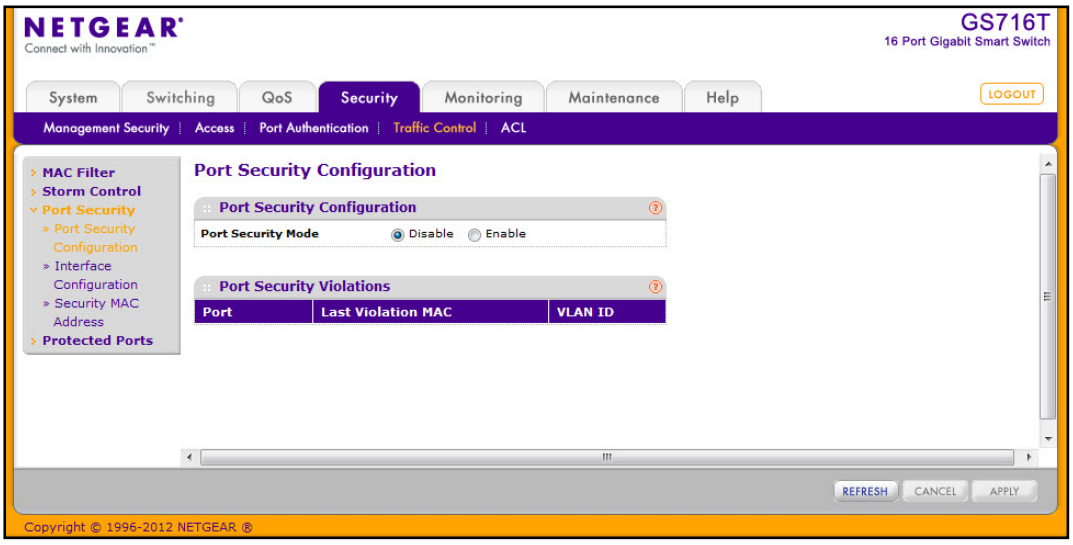
1. Select the check box next to the port to configure. Select multiple check boxes to apply the same setting to all selected ports. Select the check box in the heading row to apply the same settings to all ports.
2. From the **Ingress Control Mode** menu, select the mode of broadcast affected by storm control.
   - **Disable**. Do not use storm control.
   - **Unknown Unicast**. If the rate of unknown L2 unicast (destination lookup failure) traffic ingressing on an interface increases beyond the configured threshold, the traffic will be dropped.
   - **Multicast**. If the rate of L2 multicast traffic ingressing on an interface increases beyond the configured threshold, the traffic will be dropped.
   - **Broadcast**. If the rate of L2 broadcast traffic ingressing on an interface increases beyond the configured threshold, the traffic will be dropped.

3. When the selected Ingress Control Mode is an option other than Disable, select Enable or Disable from the **Status** menu to specify the administrative status of the mode.
4. In the **Threshold** field, specify the maximum rate at which unknown packets are forwarded. The range is a percent of the total threshold between 0–100%. The default is 5%.
5. Click **Cancel** to cancel the configuration on the screen and reset the data on the screen to the latest value of the switch.
6. If you make changes to the page, click **Apply** to apply the changes to the system.

# Port Security Configuration

Use the Port Security feature to lock one or more ports on the system. When a port is locked, only packets with an allowable source MAC addresses can be forwarded. All other packets are discarded.

To display the Port Security Configuration page, click **Security** > **Traffic Control**, and then click the **Port Security** > **Port Security Configuration** link.




To configure the global port security mode:

1. In the **Port Security Mode** field, select the appropriate radio button to enable or disable port security on the switch.
2. Click **Cancel** to cancel the configuration on the screen and reset the data on the screen to the latest value of the switch.
3. If you change the mode, click **Apply** to apply the change to the system.

The Port Security Violation table shows information about violations that occurred on ports that are enabled for port security. The following table describes the fields in the Port Security Violation table.

| Field | Description |
|---|---|
| Port | Identifies the port where a violation occurred. |
| Last Violation MAC | Displays the source MAC address of the last packet that was discarded at a locked port. |
| VLAN ID | Displays the VLAN ID corresponding to the Last Violation MAC address. |

Click **Refresh** to refresh the page with the most current data from the switch.

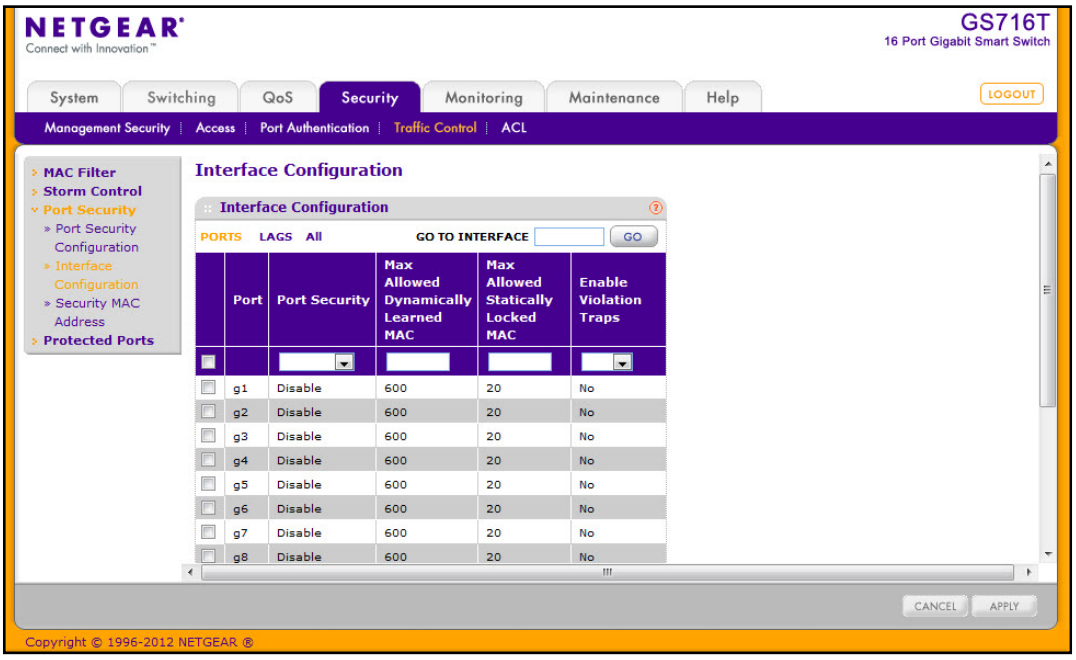
## Port Security Interface Configuration

A MAC address can be defined as allowable by one of two methods: dynamically or statically. Both methods are used concurrently when a port is locked.

Dynamic locking implements a first arrival mechanism for Port Security. You specify how many addresses can be learned on the locked port. If the limit has not been reached, then a packet with an unknown source MAC address is learned and forwarded normally. When the limit is reached, no more addresses are learned on the port. Any packets with source MAC addresses that were not already learned are discarded. You can effectively disable dynamic locking by setting the number of allowable dynamic entries to zero.

Static locking allows you to specify a list of MAC addresses that are allowed on a port. The behavior of packets is the same as for dynamic locking: only packets with an allowable source MAC address can be forwarded.

To display the Port Security Interface Configuration page, click **Security** > **Traffic Control**, and then click the **Port Security** > **Interface Configuration** link.



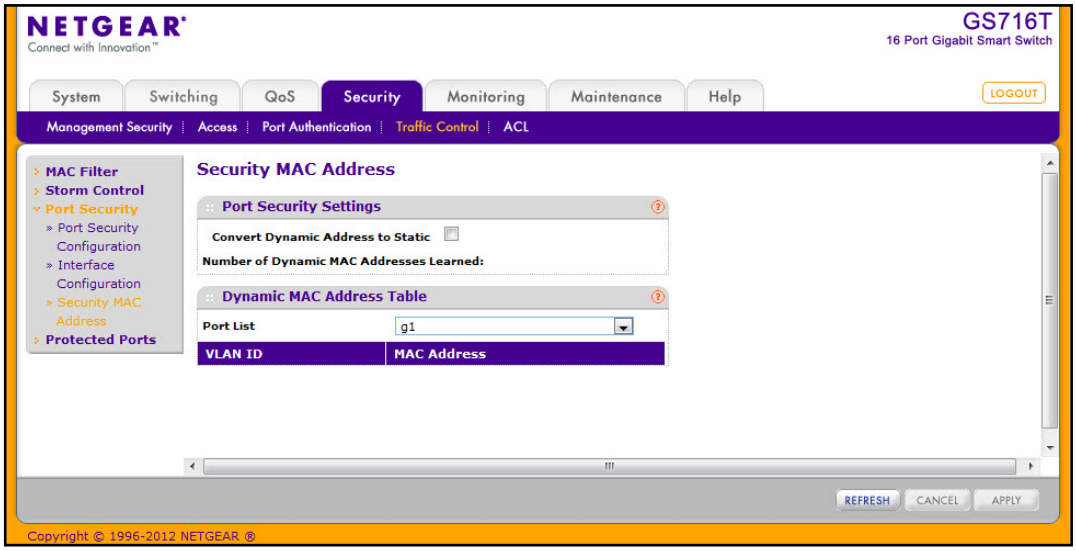

To configure port security settings:

1. To configure port security settings for a physical port, click PORTS.
2. To configure port security settings for a Link Aggregation Group (LAG), click LAGS.
3. To configure port security settings for both physical ports and LAGs, click ALL.
4. Select the check box next to the port or LAG to configure. Select multiple check boxes to apply the same setting to all selected interfaces. Select the check box in the heading row to apply the same settings to all interfaces.
5. Specify the following settings:
   - **Port Security**. Enable or Disable the port security feature for the selected port.
   - **Max Allowed Dynamically Learned MAC**. Sets the maximum number of dynamically learned MAC addresses on the selected interface. Valid range is 0–600.
   - **Max Allowed Statically Locked MAC**. Sets the maximum number of statically locked MAC addresses on the selected interface. Valid range is 0–20.
   - **Enable Violation Traps**. Enables or disables the sending of new violation traps designating when a packet with a disallowed MAC address is received on a locked port.
6. Click **Cancel** to cancel the configuration on the screen and reset the data on the screen to the latest value of the switch.
7. If you make changes to the page, click **Apply** to apply the changes to the system.

# Security MAC Address

Use the Security MAC Address page to convert a dynamically learned MAC address to a statically locked address.

To display the Security MAC Address page, click **Security** > **Traffic Control**, and then click the **Port Security** > **Security MAC Address** link.




To convert learned MAC addresses:

1. Select the **Convert Dynamic Address to Static** check box.
2. Click **Apply**. The Dynamic MAC Address entries are converted to Static MAC address entries in a numerically ascending order until the Static limit is reached.

The Dynamic MAC Address Table shows the MAC addresses and their associated VLANs learned on the selected port. Use the **Port List** menu to select the interface for which you want to display data.

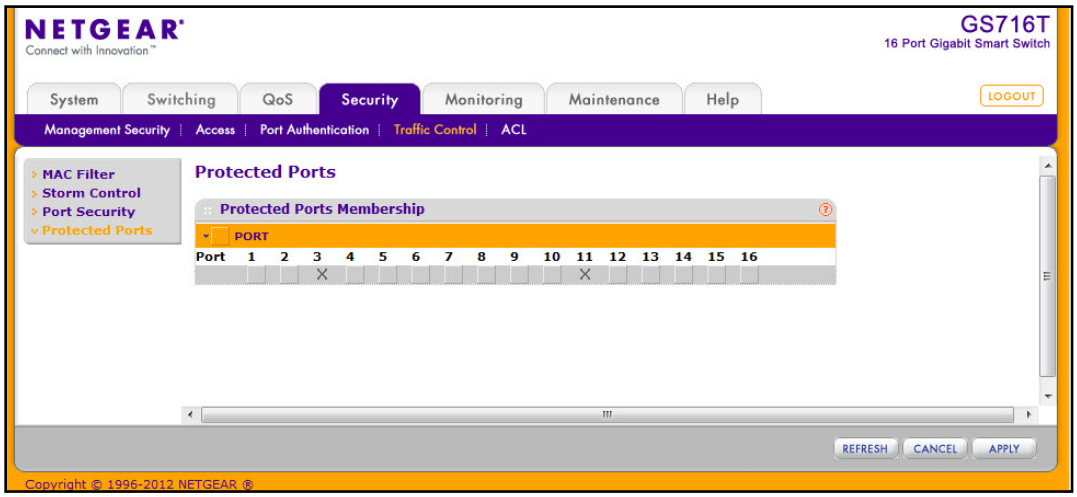
| Field | Description |
|---|---|
| VLAN ID | Displays the VLAN ID corresponding to the Last Violation MAC address. |
| MAC Address | Displays the MAC addresses learned on a specific port. |

Click **Refresh** to refresh the page with the most current data from the switch.

# Protected Ports Membership

If a port is configured as protected, it does not forward traffic to any other protected port on the switch, but it will forward traffic to unprotected ports. Use the Protected Ports Membership page to configure the ports as protected or unprotected.

To display the Protected Ports Membership page, click the **Security** > **Traffic Control** > **Protected Ports** link.




To configure protected ports:

1. Click the orange bar to display the available ports.
2. Click the box below each port to configure as a protected port. Protected ports are marked with an X. No traffic forwarding is possible between two protected ports.
3. Click **Refresh** to refresh the page with the most current data from the switch.
4. Click **Cancel** to cancel the configuration on the screen and reset the data on the screen to the latest value of the switch.
5. If you make changes to the page, click **Apply** to apply the changes to the system. Configuration changes take effect immediately.

# Configuring Access Control Lists

Access Control Lists (ACLs) ensure that only authorized users have access to specific resources while blocking off any unwarranted attempts to reach network resources. ACLs are used to provide traffic flow control, restrict contents of routing updates, decide which types of traffic are forwarded or blocked, and above all provide security for the network. GS716T and GS724T Smart Switches software supports IPv4, IPv6 and MAC ACLs.

The basic steps for configuring an ACL are as follows:

1. Create an IPv4-based, IPv6-based, or MAC-based ACL ID.
2. Use the ACL Wizard or an ACL Rule page to create and define a rule to associate with an existing ACL. ACL rules define the packet-matching criteria, such as protocols, source, and destination IP and MAC addresses.
3. Bind the ACL to a port or to a LAG.

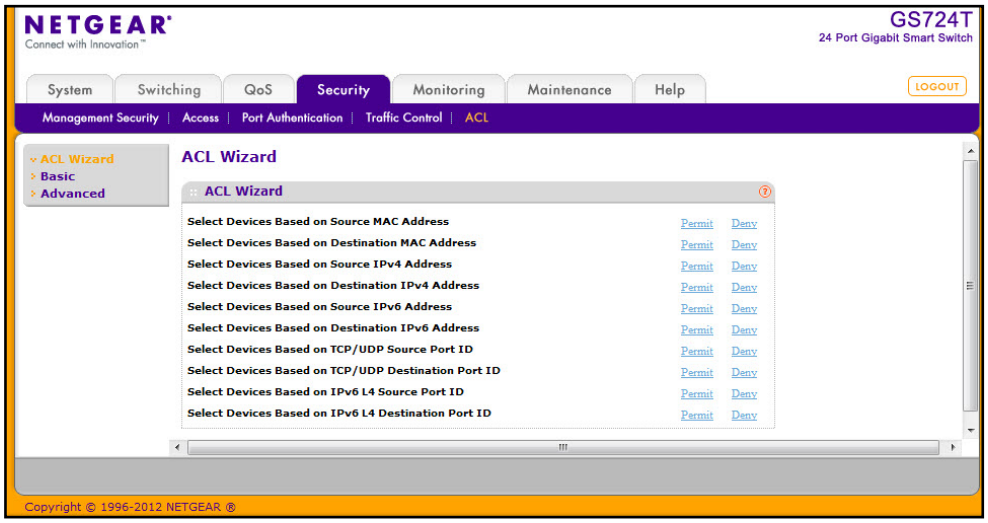
The **Security** > **ACL** folder contains links to the following features:

- ACL Wizard
- Basic
  - *MAC ACL* on page 211
  - *MAC Rules* on page 212
  - *MAC Binding Configuration* on page 214
  - *MAC Binding Table* on page 215
- Advanced
  - *IP ACL* on page 216
  - *IP Rules* on page 217
  - *IP Extended Rules* on page 219
  - *IPv6 ACL* on page 222
  - *IPv6 Rules* on page 223
  - *IP Binding Configuration* on page 226
  - *IP Binding Table* on page 227

# ACL Wizard

The ACL Wizard allows you to configure ACL permissions for devices based on the source and destination of MAC address, IP address, and port IDs.

To display the MAC ACL page, click **Security** > **ACL Wizard**.




When a packet meets the match criteria of a rule, the specified rule action (Permit or Deny) is taken and the additional rules are not checked for a match; configure as follows:

- **Select Devices Based on Source MAC Address**. Permit and Deny options are used to configure devices based on source MAC address.
- **Select Devices Based on Destination MAC Address**. Permit and Deny options are used to configure devices based on destination MAC address.
- **Select Devices Based on Source IPv4 Address**. Permit and Deny options are used to configure devices based on the source IPv4 address.
- **Select Devices Based on Destination IPv4 Address**. Permit and Deny options are used to configure devices based on the destination IPv4 address.
- **Select Devices Based on Source IPv6 Address**. Permit and Deny options are used to configure devices based on the source IPv6 address.
- **Select Devices Based on Destination IPv6 Address**. Permit and Deny options are used to configure devices based on the destination IPv6 address.
- **Select Devices Based on TCP/UDP Source Port ID**. Permit and Deny options are used to configure devices based on the TCP/UDP source port ID.
- **Select Devices Based on TCP/UDP Destination Port ID**. Permit and Deny options are used to configure devices based on the TCP/UDP destination port ID.
- **Select Devices Based on IPv6 L4 Source Port ID**. Permit and Deny options are used to configure devices based on the IPv6 layer 4 source port ID.
- **Select Devices Based on IPv6 L4 Destination Port ID**. Permit and Deny options are used to configure devices based on the IPv6 layer 4 destination port ID.

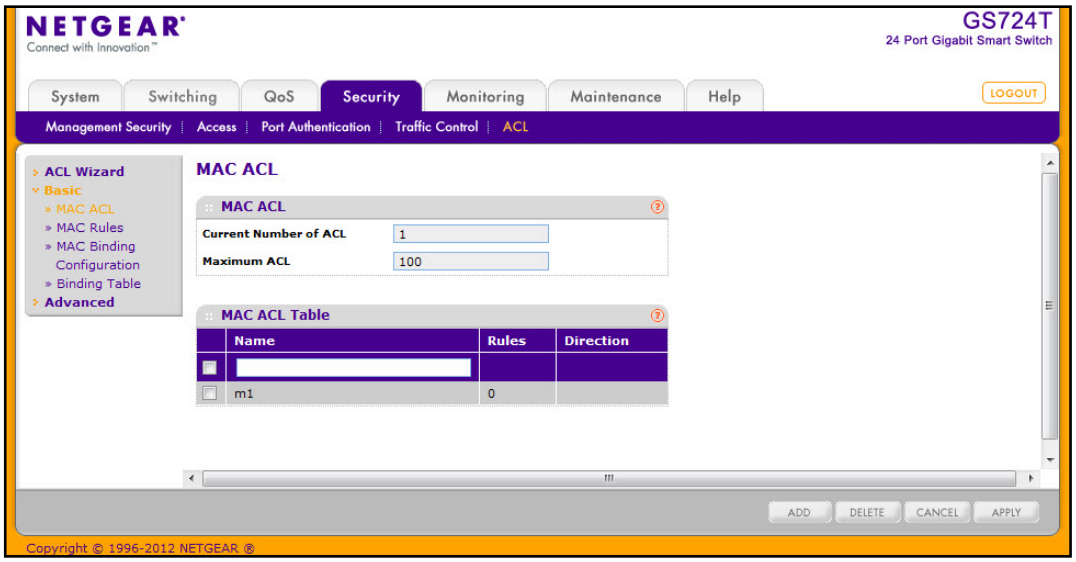
# MAC ACL

A MAC ACL consists of a set of rules which are matched sequentially against a packet. When a packet meets the match criteria of a rule, the specified rule action (Permit/Deny) is taken and the additional rules are not checked for a match.

There are multiple steps involved in defining a MAC ACL and applying it to the switch:

1. Use the *MAC ACL* page to create the ACL ID.
2. Use the *MAC Rules* page to create rules for the ACL.
3. Use the *MAC Binding Configuration* page to assign the ACL by its ID number to a port.
4. Optionally, use the *MAC Binding Table* page to view the configurations.

To display the MAC ACL page, click **Security** > **ACL**. The MAC ACL page is under the **Basic** link.




The MAC ACL table displays the number of ACLs currently configured in the switch and the maximum number of ACLs that can be configured. The current size is equal to the number of configured IPv4 ACLs plus the number of configured MAC ACLs.

To configure a MAC ACL:

1. To add a MAC ACL, specify a name for the MAC ACL in the **Name** field, and click **Add**. The name string may include alphabetic, numeric, dash, underscore, or space characters only. The name must start with an alphabetic character.

   Each configured ACL displays the following information:

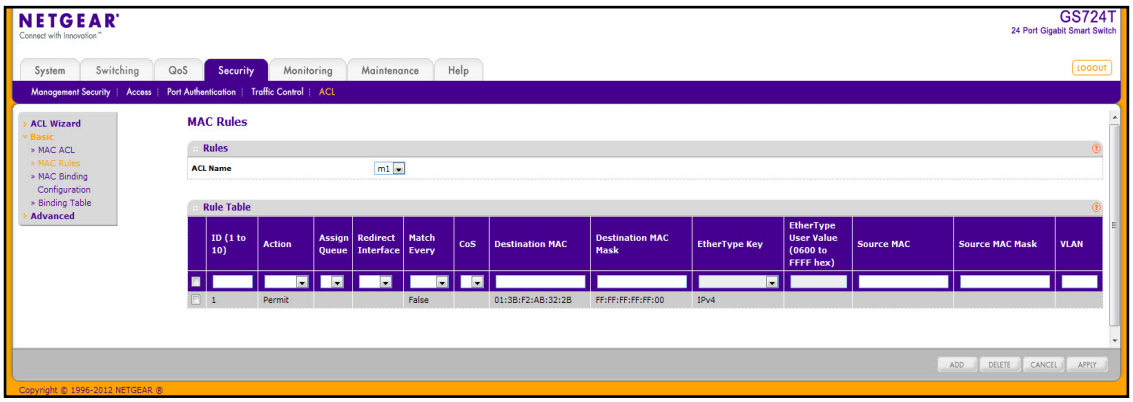
   - **Rules**. Displays the number of rules currently configured for the MAC ACL.
   - **Direction**. Displays the direction of packet traffic affected by the MAC ACL, which can be Inbound or blank.
2. To delete a MAC ACL, select the check box next to the Name field, then click **Delete**.

3. To change the name of a MAC ACL, select the check box next to the Name field, update the name, then click **Apply.**
4. Click **Cancel** to cancel the configuration on the screen and reset the data on the screen to the latest value of the switch.

# MAC Rules

Use the MAC Rules page to define rules for MAC-based ACLs. The access list definition includes rules that specify whether traffic matching the criteria is forwarded normally or discarded. A default 'deny all' rule is the last rule of every list.

To display the MAC Rules page, click **Security** > **ACL**, then click the **Basic** > **MAC Rules** link.




To configure MAC ACL rules:

1. From the ACL Name field, specify the existing MAC ACL to which the rule will apply. To set up a new MAC ACL use the *MAC ACL* page.
2. To add a new rule, enter an ID for the rule, configure the following settings, and click **Add**.
   - **Action**. Specify what action should be taken if a packet matches the rule's criteria:
     - Permit: Forwards packets that meet the ACL criteria.
     - Deny: Drops packets that meet the ACL criteria.
   - **Assign Queue**. Specifies the hardware egress queue identifier used to handle all packets matching this ACL rule. Enter an identifying number from 0–7 in this field.
   - **Redirect Interface**. Specifies the specific egress interface where the matching traffic stream is forced, bypassing any forwarding decision normally performed by the device.
   - **Match Every**. Requires a packet to match the criteria of this ACL. Select True or False from the drop-down menu. Match Every is exclusive to the other filtering rules, so if Match Every is True, the other rules on the screen are not available.
   - **CoS**. Requires a packet's class of service (CoS) to match the CoS value listed here. Enter a CoS value between 0–7 to apply this criteria.

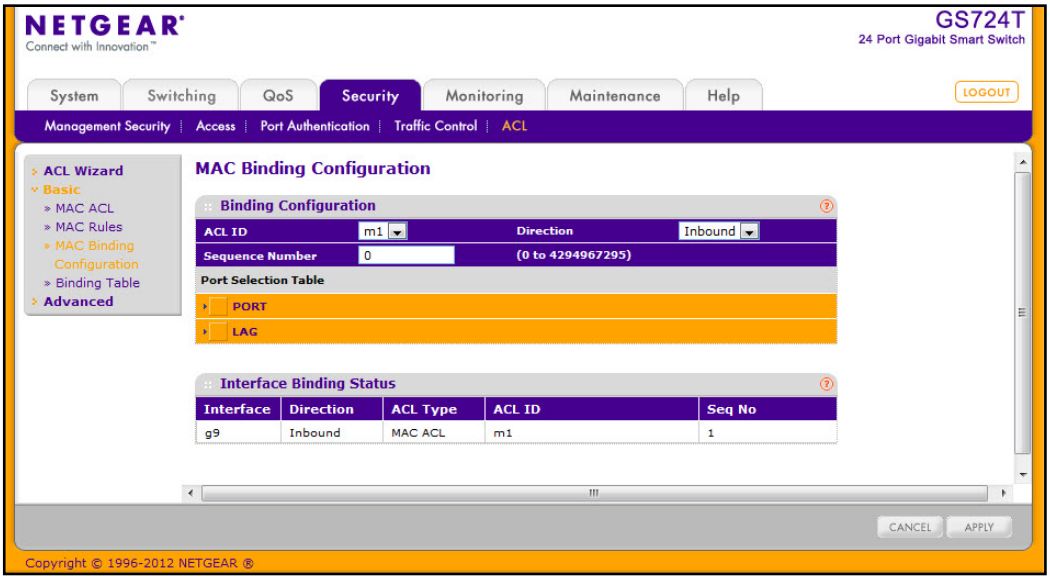
- **Destination MAC**. Requires an Ethernet frame's destination port MAC address to match the address listed here. Enter a MAC address in this field. The valid format is xx:xx:xx:xx:xx:xx.
- **Destination MAC Mask**. If desired, enter the MAC Mask associated with the Destination MAC to match. The MAC address mask specifies which bits in the destination MAC to compare against an Ethernet frame. Use Fs and zeros in the MAC mask, which is in a wildcard format. An F means that the bit is not checked, and a zero in a bit position means that the data must equal the value given for that bit. For example, if the MAC address is aa:bb:cc:dd:ee:ff, and the mask is 00:00:ff:ff:ff:ff, all MAC addresses with aa:bb:xx:xx:xx:xx result in a match (where x is any hexadecimal number). A MAC mask of 00:00:00:00:00:00 matches a single MAC address.
- **EtherType Key**. Requires a packet's EtherType to match the EtherType you select. Select the EtherType value from the drop down menu. If you select User Value, you can enter a custom EtherType value.
- **EtherType User Value**. This field is configurable if you select User Value from the EtherType drop down menu. The value you enter specifies a customized Ethertype to compare against an Ethernet frame. The valid range of values is 0x0600–0xFFFF.
- **Source MAC**. Requires a packet's source port MAC address to match the address listed here. Enter a MAC address in the this field. The valid format is xx:xx:xx:xx:xx:xx.
- **Source MAC Mask**. If desired, enter the MAC mask for the source MAC address to match. Use Fs and zeros in the MAC mask, which is in a wildcard format. An F means that the bit is not checked, and a zero in a bit position means that the data must equal the value given for that bit. The valid format is xx:xx:xx:xx:xx:xx. A MAC mask of 00:00:00:00:00:00 matches a single MAC address.
- **VLAN**. Requires a packet's VLAN ID to match the ID listed here. Enter the VLAN ID to apply this criteria. The valid range is 1–4093.

3. Click **Cancel** to cancel the configuration on the screen and reset the data on the screen to the latest value of the switch.
4. To delete a rule, select the check box associated with the rule and click **Delete**.
5. To change a rule, select the check box associated with the rule, change the desired fields and click **Apply**.

# MAC Binding Configuration

When an ACL is bound to an interface, all the rules that have been defined are applied to the selected interface. Use the MAC Binding Configuration page to assign MAC ACL lists to ACL Priorities and Interfaces.

To display the MAC Binding Configuration page, click **Security** > **ACL**, then click the **Basic** > **MAC Binding Configuration** link.




To configure MAC ACL interface bindings:

1. Select an existing MAC ACL from the ACL ID menu.

   The packet filtering direction for ACL is Inbound, which means the MAC ACL rules are applied to traffic entering the port.

2. Specify an optional sequence number to indicate the order of this access list relative to other access lists already assigned to this interface and direction.

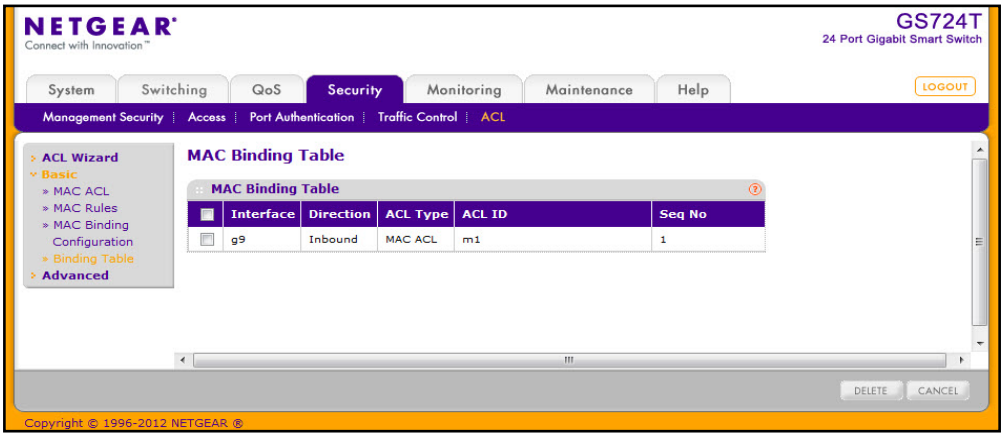
   A low number indicates high precedence order. If a sequence number is already in use for this interface and direction, the specified access list replaces the currently attached access list using that sequence number. If the sequence number is not specified by the user, a sequence number that is one greater than the highest sequence number currently in use for this interface and direction will be used. The valid range is 1–4294967295.

3. Click the appropriate orange bar to expose the available ports or LAGs.
   - To add the selected ACL to a port or LAG, click the box directly below the port or LAG number so that an *X* appears in the box.
   - To remove the selected ACL from a port or LAG, click the box directly below the port or LAG number to clear the selection. An *X* in the box indicates that the ACL is applied to the interface.
4. Click **Cancel** to cancel the configuration on the screen and reset the data on the screen to the latest value of the switch.
5. Click **Apply** to save any changes to the running configuration.

# MAC Binding Table

Use the MAC Binding Table page to view or delete the MAC ACL bindings.

To display the MAC Binding Table, click **Security** > **ACL**, then click the **Basic** > **Binding Table** link.




The following table describes the information displayed in the **MAC Binding Table**.

| Field | Description |
|---|---|
| Interface | Displays the interface to which the MAC ACL is bound. |
| Direction | Specifies the packet filtering direction for ACL. The only valid direction is Inbound, which means the MAC ACL rules are applied to traffic entering the port. |
| ACL Type | Displays the type of ACL assigned to selected interface and direction. |
| ACL ID | Displays the ACL Name identifying the ACL assigned to selected interface and direction. |
| Sequence No | Displays the Sequence Number signifying the order of specified ACL relative to other ACLs assigned to selected interface and direction. |

To delete a MAC ACL-to-interface binding, select the check box next to the interface and click **Delete**.

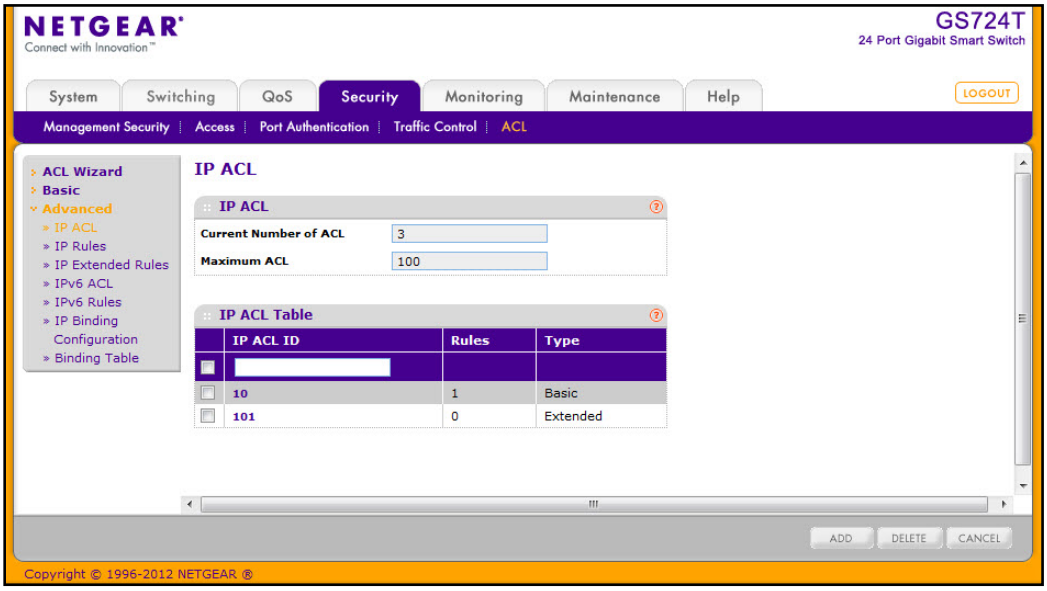
# IP ACL

IP ACLs allow network managers to define classification actions and rules for specific ingress ports. Packets can be filtered on ingress (inbound) ports only. If the filter rules match, then some actions can be taken, including dropping the packet or disabling the port. For example, a network administrator defines an ACL rule that says port number 20 can receive TCP packets. However, if a UDP packet is received the packet is dropped.

ACLs are composed of access control entries (ACE), or rules, that consist of the filters that determine traffic classifications.

Use the IP ACL Configuration page to add or remove IP-based ACLs.

To display the IP ACL page, click **Security** > **ACL**, then click the **Advanced** > **IP ACL** link.




The IP ACL area shows the current size of the ACL table versus the maximum size of the ACL table. The current size is equal to the number of configured IPv4 plus the number of configured MAC ACLs. The maximum size is 100.

To configure an IP ACL:

1. In the **IP ACL ID** field, specify the ACL ID. The ID is an integer in the following range:
   - 1–99: Creates an IP Standard ACL, which allows you to permit or deny traffic from a source IP address.
   - 100–199: Creates an IP Extended ACL, which allows you to permit or deny specific types of layer 3 or layer 4 traffic from a source IP address to a destination IP address. This type of ACL provides more granularity and filtering capabilities than the standard IP ACL.

   Each configured ACL displays the following information:

   - **Rules**. Displays the number of rules currently configured for the IP ACL.

- **Type**. Identifies the ACL as either a standard or extended IP ACL.

2. To delete an IP ACL, select the check box next to the IP ACL ID field, then click **Delete**.
3. To change the name of an IP ACL, select the check box next to the IP ACL ID field, update the name, then click **Apply.**
4. Click **Cancel** to cancel the configuration on the screen and reset the data on the screen to the latest value of the switch.

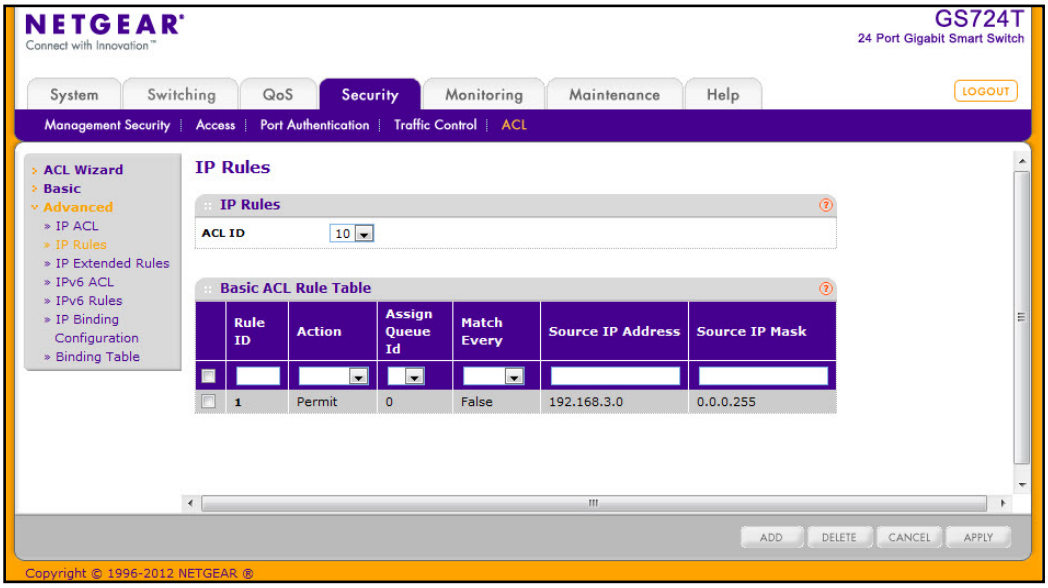
**Note:** To configure a rule for an existing IP ACL, click its ID in the IP ACL Table. The IP ACL ID is a hyperlink to the rule configuration page for the ACL type.

## IP Rules

Use the IP Rules page to define rules for IP-based standard ACLs. The access list definition includes rules that specify whether traffic matching the criteria is forwarded normally or discarded.

**Note:** There is an implicit “deny all” rule at the end of an ACL list. This means that if an ACL is applied to a packet and if none of the explicit rules match, then the final implicit “deny all” rule applies and the packet is dropped.

To display the IP Rules page, click **Security** > **ACL**, then click the **Advanced** > **IP Rules** link.



To configure rules for an IP ACL:

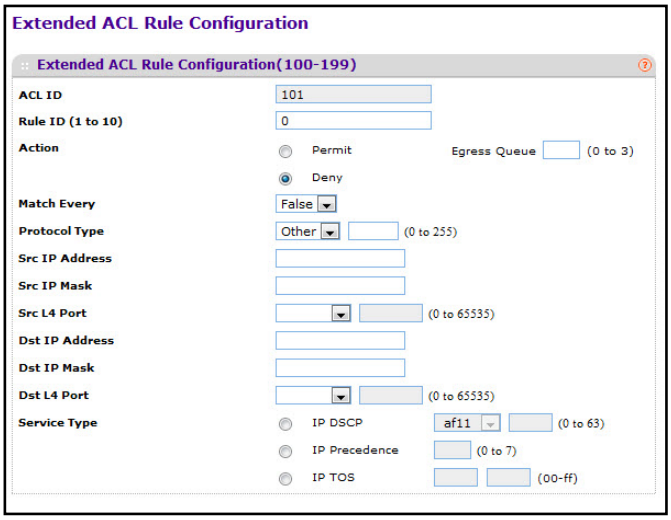
1. To add an IP ACL rule, select the ACL ID to add the rule to, complete the fields described in the following list, and click **Add**.
   - **Rule ID**. Specify a number from 1–10 to identify the IP ACL rule. You can create up to 10 rules for each ACL.
   - **Action**. Selects the ACL forwarding action, which is one of the following:
     - Permit. Forwards packets which meet the ACL criteria.
     - Deny. Drops packets which meet the ACL criteria.
   - **Assign Queue ID**. Specifies the hardware egress queue identifier used to handle all packets matching this ACL rule. Enter an identifying number from 0–7 in the appropriate field.
   - **Match Every**. Requires a packet to match the criteria of this ACL. Select True or False from the drop down menu. Match Every is exclusive to the other filtering rules, so if Match Every is True, the other rules on the screen are not available.
   - **Source IP Address**. Requires a packet's source IP address to match the address listed here. Type an IP Address in the appropriate field using dotted-decimal notation. The address you enter is compared to a packet's source IP Address.
   - **Source IP Mask**. Specifies the source IP address wildcard mask. Wild card masks determines which bits are used and which bits are ignored. A wild card mask of 255.255.255.255 indicates that no bit is important. A wildcard of 0.0.0.0 indicates that all of the bits are important. Wildcard masking for ACLs operates differently from a subnet mask. A wildcard mask is in essence the inverse of a subnet mask. For example, to apply the rule to all hosts in the 192.168.1.0/24 subnet, you type 0.0.0.255 in the Source IP Mask field. This field is required when you configure a source IP address.
2. To delete an IP ACL rule, select the check box associated with the rule, and then click **Delete**.
3. To update an IP ACL rule, select the check box associated with the rule, update the desired fields, and then click **Apply**. You cannot modify the Rule ID of an existing IP rule.
4. Click **Cancel** to cancel the configuration on the screen and reset the data on the screen to the latest value of the switch.
5. If you change any of the settings on the page, click **Apply** to send the updated configuration to the switch. Configuration changes take effect immediately.

# IP Extended Rules

Use the IP Extended Rules page to define rules for IP-based extended ACLs. The access list definition includes rules that specify whether traffic matching the criteria is forwarded normally or discarded.

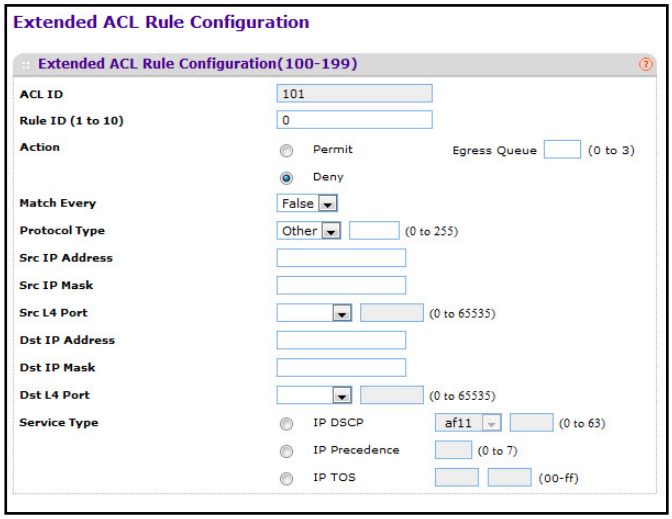
**Note:** There is an implicit “deny all” rule at the end of an ACL list. This means that if an ACL is applied to a packet and if none of the explicit rules match, then the final implicit “deny all” rule applies and the packet is dropped.

To display the IP extended Rules page, click **Security** > **ACL**, then click the **Advanced** > **IP Extended Rules** link. In the following figure, an extended IP ACL exists, and one rule has been configured.



To configure rules for an IP ACL:

1. To add an IP ACL rule, select the ACL ID to add the rule to, select the check box in the Extended ACL Rule table, and click **Add**. The page displays the extended ACL Rule Configuration fields.




2. Configure the new rule.
   - **Rule ID**. Specify a number from 1–10 to identify the IP ACL rule. You can create up to 10 rules for each ACL.
   - **Action**. Selects the ACL forwarding action, which is one of the following:
     - Permit. Forwards packets which meet the ACL criteria.
     - Deny. Drops packets which meet the ACL criteria.
   - **Egress Queue**. Specifies the hardware egress queue identifier used to handle all packets matching this ACL rule. Enter an identifying number from 0–7 in the appropriate field.
   - **Match Every**. Requires a packet to match the criteria of this ACL. Select True or False from the drop down menu. Match Every is exclusive to the other filtering rules, so if Match Every is True, the other rules on the screen are not available.
   - **Protocol Type**. Requires a packet's protocol to match the protocol listed here. Select a type from the drop down menu or enter the protocol number in the available field.
   - **Src IP Address**. Requires a packet's source IP address to match the address listed here. Type an IP Address in the appropriate field using dotted-decimal notation. The address you enter is compared to a packet's source IP Address.
   - **Src IP Mask**. Specifies the source IP address wildcard mask. Wild card masks determines which bits are used and which bits are ignored. A wild card mask of 255.255.255.255 indicates that no bit is important. A wildcard of 0.0.0.0 indicates that all of the bits are important. Wildcard masking for ACLs operates differently from a subnet mask. A wildcard mask is in essence the inverse of a subnet mask. For example, to apply the rule to all hosts in the 192.168.1.0/24 subnet, you type 0.0.0.255 in the Source IP Mask field. This field is required when you configure a source IP address.

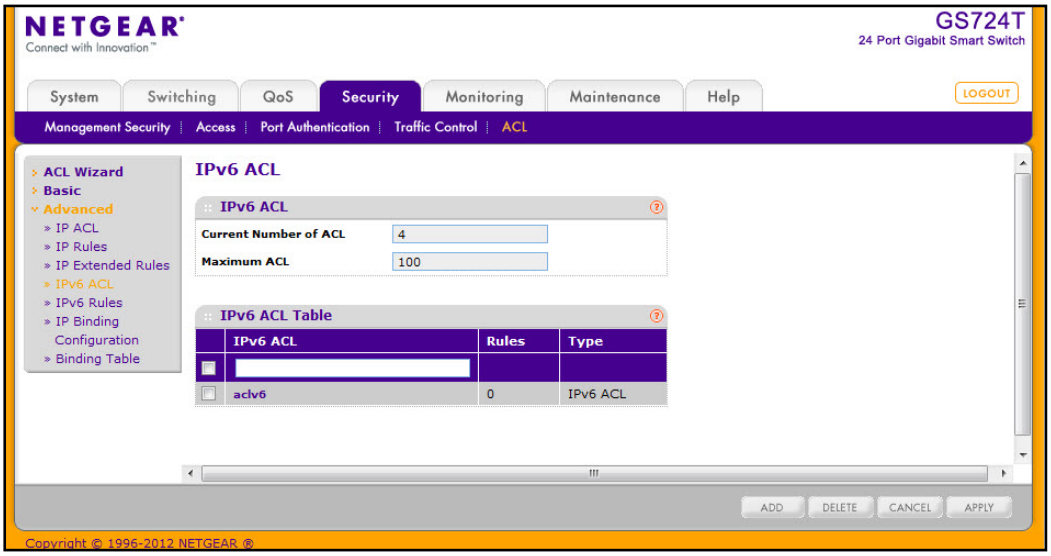
- **Src L4 Port**. Requires a packet's TCP/UDP source port to match the port listed here. Click Complete one of the following fields:
  - Source L4 Keyword: Select the desired L4 keyword from a list of source ports on which the rule can be based.
  - Source L4 Port Number: If the source L4 keyword is Other, enter a user-defined Port ID by which packets are matched to the rule.
- **Dst IP Address**. Requires a packet's destination port IP address to match the address listed here. Enter an IP Address in the appropriate field using dotted-decimal notation. The address you enter is compared to a packet's destination IP Address.
- **Dst IP Mask**. Specifies the destination IP address wildcard mask. Wild card masks determines which bits are used and which bits are ignored. A wild card mask of 255.255.255.255 indicates that no bit is important. A wildcard of 0.0.0.0 indicates that all of the bits are important. Wildcard masking for ACLs operates differently from a subnet mask. A wildcard mask is in essence the inverse of a subnet mask. For example, to apply the rule to all hosts in the 192.168.1.0/24 subnet, you type 0.0.0.255 in the Source IP Mask field. This field is required when you configure a source IP address.
- **Dst L4 Port**. Requires a packet's TCP/UDP destination port to match the port listed here. Complete one of the following fields:
  - Destination L4 Keyword: Select the desired L4 keyword from a list of destination ports on which the rule can be based.
  - Destination L4 Port Number: If the destination L4 keyword is Other, enter a user-defined Port ID by which packets are matched to the rule.
- **Service Type**. Choose one of the Service Type match conditions for the extended IP ACL rule. The possible values are IP DSCP, IP precedence, and IP TOS, which are alternative ways of specifying a match criterion for the same Service Type field in the IP header, however each uses a different user notation. After you select the service type, specify the value associated with the type.
  - IP DSCP: Specify the IP DiffServ Code Point (DSCP) value. The DSCP is defined as the high-order six bits of the Service Type octet in the IP header. Select an IP DSCP value from the menu. To specify a numeric value in the available field, select Other from the menu and type an integer from 0 to 63 in the field.
  - IP Precedence: The IP Precedence field in a packet is defined as the high-order three bits of the Service Type octet in the IP header. This is an optional configuration. Enter an integer from 0 to 7.
  - IP TOS Bits: Matches on the Type of Service bits in the IP header when checked. In the first TOS field, specify the two-digit hexadecimal TOS number. The second field is for the TOS Mask, which specifies the bit positions that are used for comparison against the IP TOS field in a packet. The TOS Mask value is a two-digit hexadecimal number from 00 to ff, representing an inverted (i.e., wildcard) mask. The zero-valued bits in the TOS Mask denote the bit positions in the TOS Bits value that are used for comparison against the IP TOS field of a packet. For example, to check for an IP TOS value having bits 7 and 5 set and bit 1 clear, where bit 7 is most significant, use a TOS Bits value of a0 and a TOS Mask of 00.

3. To delete an IP ACL rule, select the check box associated with the rule, and then click **Delete**.
4. Click **Cancel** to cancel the configuration on the screen and reset the data on the screen to the latest value of the switch.
5. To modify an existing IP Extended ACL rule, click the Rule ID. The number is a hyperlink to the Extended ACL Rule Configuration page. If the rule is Deny, you can specify the **CPU Notification Mode**.
   - Enable. No power is supplied to the port.
   - Disable. When a packet matches the ACL rule, the CPU is not notified, and the port continues to provide power.
6. If you modify the rule, click **Apply** to submit the changes to the switch.

# IPv6 ACL

An IPv6 ACL consists of a set of rules which are matched sequentially against a packet. When a packet meets the match criteria of a rule, the specified rule action (Permit/Deny) is taken and the additional rules are not checked for a match. On this menu, the interfaces to which an IP ACL applies must be specified, as well as whether it applies to inbound or outbound traffic. Rules for the IP ACL are specified/created using the IP ACL Rule Configuration menu.

To display the IPv6 ACL page, click **Security** > **ACL > Advanced** > **IPv6 ACL**.




The current number of the IP ACLs configured on the switch is displayed in the **Current Number of ACL** area. The maximum number of IP ACL that can be configured on the switch is displayed in the **Maximum ACL** field, depending on the hardware. The name of IPv6 ACL can be configured in IPv6 ACL field. The number of the rules associated with the IP ACL is displayed in the **Rules** field. The ACL type is IPv6 ACL and displayed in the **Type** field.

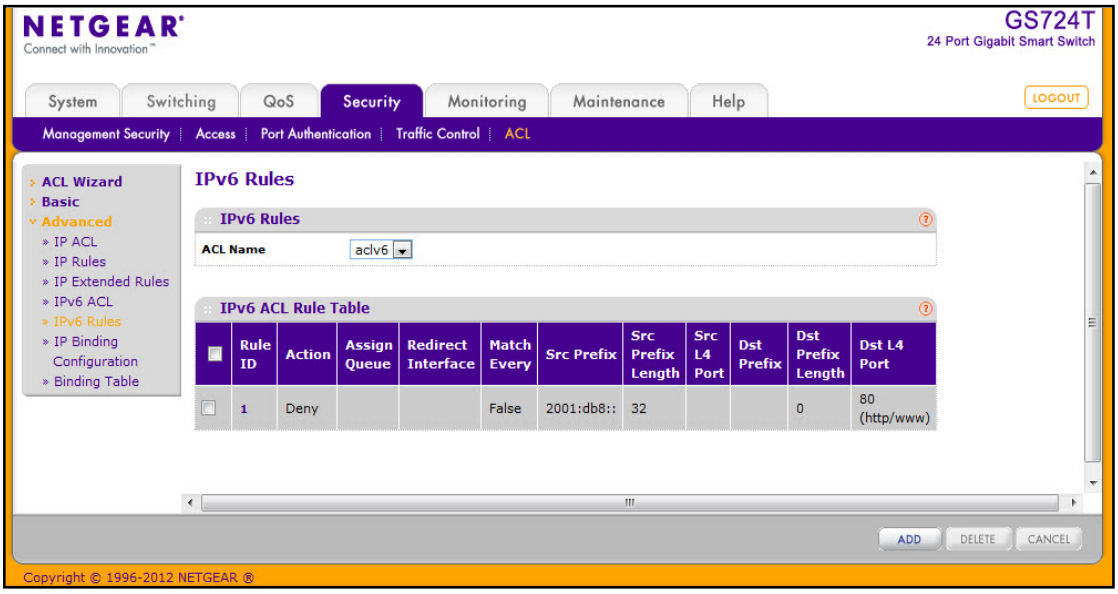
To create an IPv6 ACL:

1. To add an ACL, type a name in the IPv6 ACL field, and then click **Add**.
2. To delete an ACL, select the check box associated with the ACL, and then click **Delete**.
3. Click **Cancel** to cancel the configuration on the screen and reset the data on the screen to the latest value of the switch.
4. If you modify the IPv6 ACL name, click **Apply** to submit the changes to the switch.

# IPv6 Rules

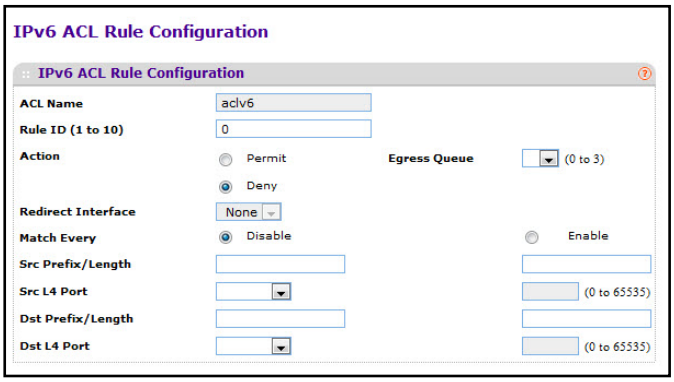
Use the IPv6 Rules page to configure the rules for the IPv6 Access Control Lists. The IPv6 Access Control Lists are created using the IPv6 Access Control List Configuration page. By default, no specific value is in effect for any of the IPv6 ACL rules.

To display the IPv6 Rules page, click **Security** > **ACL > Advanced** > **IPv6 Rules**. In the following figure, an IPv6 rule exists, and one rule has been configured.



To configure the IPv6 rules, select the following:

1. To add an IPv6 rule, use the pull-down list in the **ACL Name** field to select the IP ACL for which to create or update a rule. Complete the fields described in the following list, and click **Add**.




2. Configure the new rule.
   - **Rule ID**: Enter a whole number in the range of 1 to 10 that will be used to identify the rule. An IPv6 ACL may have up to 10 rules.
   - **Action**: Specify what action should be taken if a packet matches the rule's criteria. The choices are Permit or Deny.
   - **Egress Queue**: Specifies the hardware egress queue identifier used to handle all packets matching this IPv6 ACL rule. The valid range of Queue IDs is from 0 to 6. This field is visible for a Permit Action.
   - **Redirect Interface**: Specifies the egress interface where the matching traffic stream is forced, bypassing any forwarding decision normally performed by the device. This field is visible for a Permit action and cannot be set if a Mirror Interface is already configured for the ACL rule. Redirected interfaces should be part of the traffic VLAN.
   - **Match Every**: Select true or false from the pull down menu. True signifies that all packets will match the selected IPv6 ACL and Rule and will be either permitted or denied. In this case, since all packets match the rule, the option of configuring other match criteria will not be offered. To configure specific match criteria for the rule, remove the rule and recreate it, or reconfigure Match Every to False for the other match criteria to be visible.
   - **Source Prefix/Prefix Length**: Specify IPv6 Prefix combined with IPv6 Prefix length of the network or host from which the packet is being sent. Prefix length can be in the range (0 to 128).

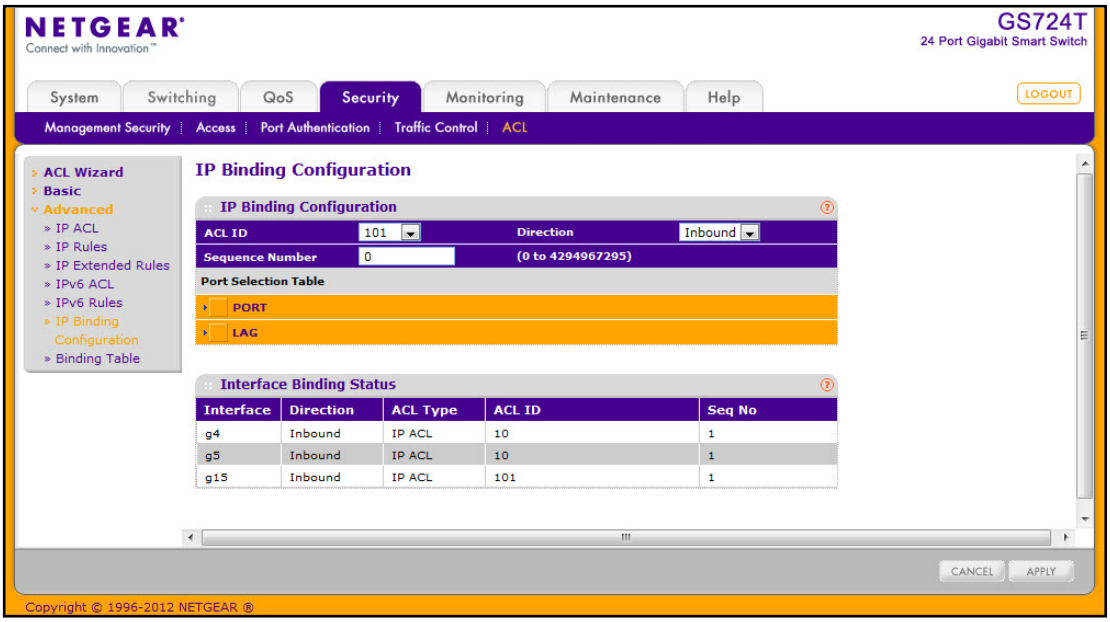
- **Source L4 Port**: Specify a packet's source layer 4 port as a match condition for the selected IPv6 ACL rule. Source port information is optional. Source port information can be specified in two ways:
  - Select keyword “other” from the drop-down menu and specify the number of the port in the range from 0 to 65535.
  - Select one of the keyword from the list: DOMAIN, ECHO, FTP, FTPDATA, HTTP, SMTP, SNMP, TELNET, TFTP, and WWW. Each of these values translates into its equivalent port number, which is used as both the start and end of the port range.
- **Destination Prefix/Prefix Length**: Enter up to 128-bit prefix combined with prefix length to be compared to a packet's destination IP Address as a match criteria for the selected IPv6 ACL rule. Prefix length can be in the range (0 to 128).
- **Destination L4 Port**: Specify a packet's destination layer 4 port as a match condition for the selected IPv6 ACL rule. Destination port information is optional. Destination port information can be specified in two ways:
  - Select keyword “other” from the drop-down menu and specify the number of the port in the range from 0 to 65535.
  - Select one of the keyword from the list: DOMAIN, ECHO, FTP, FTPDATA, HTTP, SMTP, SNMP, TELNET, TFTP, and WWW. Each of these values translates into its equivalent port number, which is used as both the start and end of the port range.

3. Click **Cancel** to cancel the configuration on the screen and reset the data on the screen to the latest value of the switch.
4. To add the new rule to the ACL, click **Apply**.
5. To delete a rule from an ACL, select the check box associated with the rule and click **Delete**.

# IP Binding Configuration

When an ACL is bound to an interface, all the rules that have been defined are applied to the selected interface. Use the IP Binding Configuration page to assign IPv4 and IPv6 ACLs to ports and LAGs. From this page, you can also assign a sequence number to the ACLs that are bound to interfaces, which determines the priority of the ACLs when an interface is associated with more than one.

To display the IP Binding Configuration page, click **Security** > **ACL**, then click the **Advanced** > **IP Binding Configuration** link.



To configure IP ACL interface bindings:

1. Select an existing IP ACL from the ACL ID menu.

   The packet filtering direction for ACL is Inbound, which means the IP ACL rules are applied to traffic entering the port.

2. Specify an optional sequence number to indicate the order of this access list relative to other access lists already assigned to this interface and direction.

   A low number indicates high precedence order. If a sequence number is already in use for this interface and direction, the specified access list replaces the currently attached access list using that sequence number. If the sequence number is not specified by the user, a sequence number that is one greater than the highest sequence number currently in use for this interface and direction will be used. The valid range is 1–4294967295.

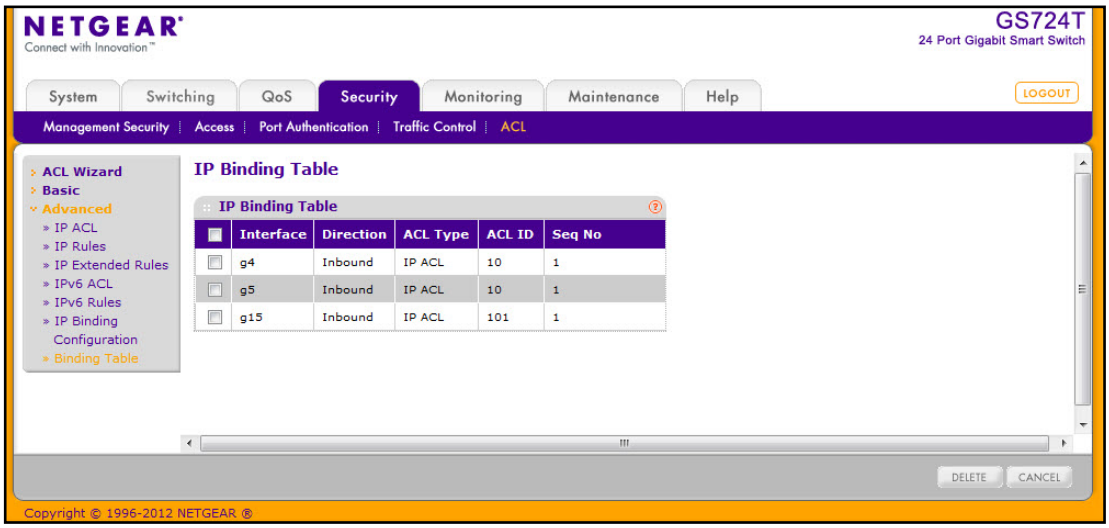
3. Click the appropriate orange bar to expose the available ports or LAGs.
   - To add the selected ACL to a port or LAG, click the box directly below the port or LAG number so that an X appears in the box.
   - To remove the selected ACL from a port or LAG, click the box directly below the port or LAG number to clear the selection. An X in the box indicates that the ACL is applied to the interface.

4. Click **Cancel** to cancel the configuration on the screen and reset the data on the screen to the latest value of the switch.
5. Click **Apply** to save any changes to the running configuration.

# IP Binding Table

Use the IP Binding Table page to view or delete the IP ACL bindings.

To display the IP Binding Table, click **Security** > **ACL**, then click the **Advanced** > **Binding Table** link.



The following table describes the information displayed in the **MAC Binding Table**.

| Field | Description |
|---|---|
| Interface | Displays the interface to which the IP ACL is bound. |
| Direction | Specifies the packet filtering direction for ACL. The only valid direction is Inbound, which means the IP ACL rules are applied to traffic entering the port. |
| ACL Type | Displays the type of ACL assigned to selected interface and direction. |
| ACL ID | Displays the ACL Number identifying the ACL assigned to selected interface and direction. |
| Seq No. | Displays the Sequence Number signifying the order of specified ACL relative to other ACLs assigned to selected interface and direction. |

To delete an IP ACL-to-interface binding, select the check box next to the interface and click **Delete**.

# Monitoring the System

# 6

Use the features available from the Monitoring tab to view a variety of information about the switch and its ports and to configure how the switch monitors events. The **Monitoring** tab contains links to the following features:

- *Ports* on page 229
- *System Logs* on page 241
- *Port Mirroring* on page 250

## Ports

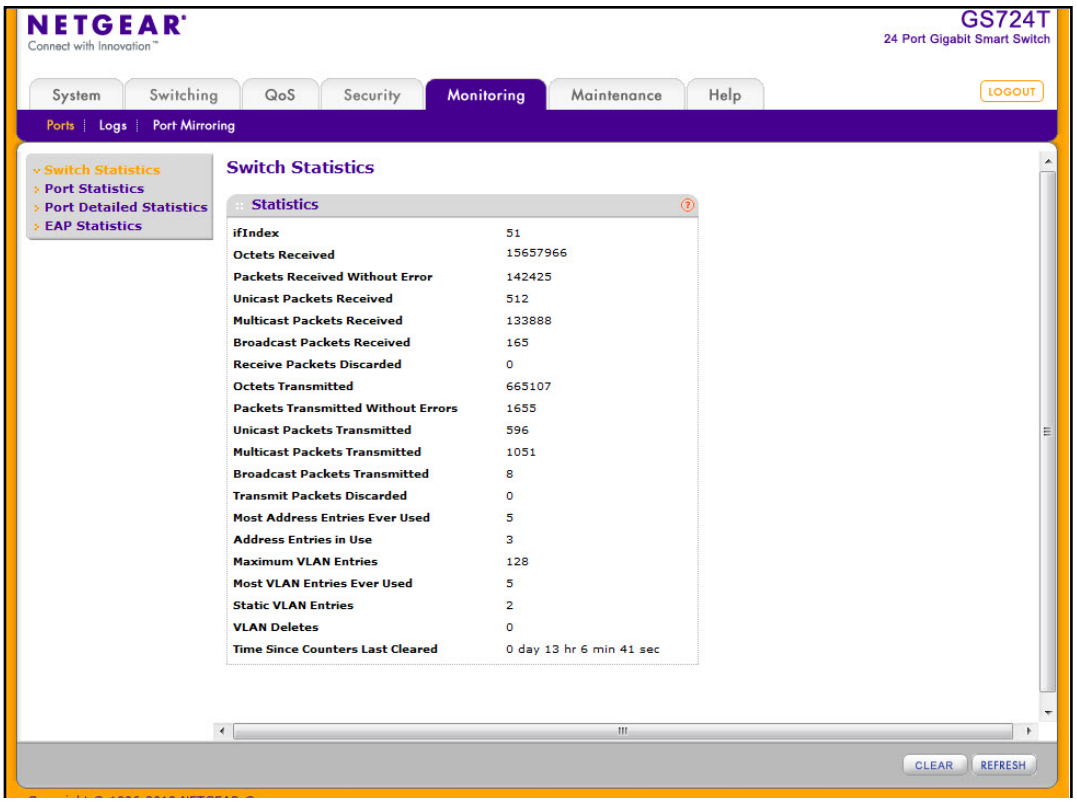
The pages available from the Ports link contain a variety of information about the number and type of traffic transmitted from and received on the switch. From the Ports link, you can access the following pages:

- *Switch Statistics* on page 229
- *Port Statistics* on page 232
- *Port Detailed Statistics* on page 233
- *EAP Statistics* on page 240

### Switch Statistics

The Switch Statistics page displays detailed statistical information about the traffic the switch handles.

To access the Switch Statistics page, click **Monitoring** > **Ports** > **Switch Statistics**.




The following table describes the Switch Statistics displayed on the screen.

| Field | Description |
|---|---|
| ifIndex | This object indicates the ifIndex of the interface table entry associated with the processor of this switch. |
| Octets Received | The total number of octets of data received by the processor (excluding framing bits, but including FCS octets). |
| Packets Received Without Errors | The total number of packets (including broadcast packets and multicast packets) received by the processor. |
| Unicast Packets Received | The number of subnetwork-unicast packets delivered to a higher layer protocol. |
| Multicast Packets Received | The total number of packets received that were directed to a multicast address. This number does not include packets directed to the broadcast address. |
| Broadcast Packets Received | The total number of packets received that were directed to the broadcast address. This does not include multicast packets. |
| Receive Packets Discarded | The number of inbound packets which were chosen to be discarded, even though no errors had been detected, in order to prevent their being delivered to a higher layer protocol. A possible reason for discarding a packet could be to free up buffer space. |

| Field | Description |
|---|---|
| Octets Transmitted | The total number of octets transmitted out of the interface, including framing characters. |
| Packets Transmitted Without Errors | The total number of packets transmitted out of the interface. |
| Unicast Packets Transmitted | The total number of packets that higher level protocols requested be transmitted to a subnetwork-unicast address, including those that were discarded or not sent. |
| Multicast Packets Transmitted | The total number of packets that higher level protocols requested be transmitted to a Multicast address, including those that were discarded or not sent. |
| Broadcast Packets Transmitted | The total number of packets that higher-level protocols requested be transmitted to the Broadcast address, including those that were discarded or not sent. |
| Transmit Packets Discarded | The number of outbound packets which were chosen to be discarded, even though no errors had been detected, in order to prevent their being delivered to a higher layer protocol. A possible reason for discarding a packet could be to free up buffer space. |
| Most Address Entries Ever Used | The highest number of Forwarding Database Address Table entries that have been learned by this switch since the most recent reboot. |
| Address Entries in Use | The number of Learned and static entries in the Forwarding Database Address Table for this switch. |
| Maximum VLAN Entries | The maximum number of Virtual LANs (VLANs) allowed on this switch. |
| Most VLAN Entries Ever Used | The largest number of VLANs that have been active on this switch since the last reboot. |
| Static VLAN Entries | The number of presently active VLAN entries on this switch that have been created statically. |
| Dynamic VLAN Entries | The number of presently active VLAN entries on this switch. |
| VLAN Deletes | The number of VLANs on this switch that have been created and then deleted since the last reboot. |
| Time Since Counters Last Cleared | The elapsed time, in days, hours, minutes, and seconds, since the statistics for this switch were last cleared. |

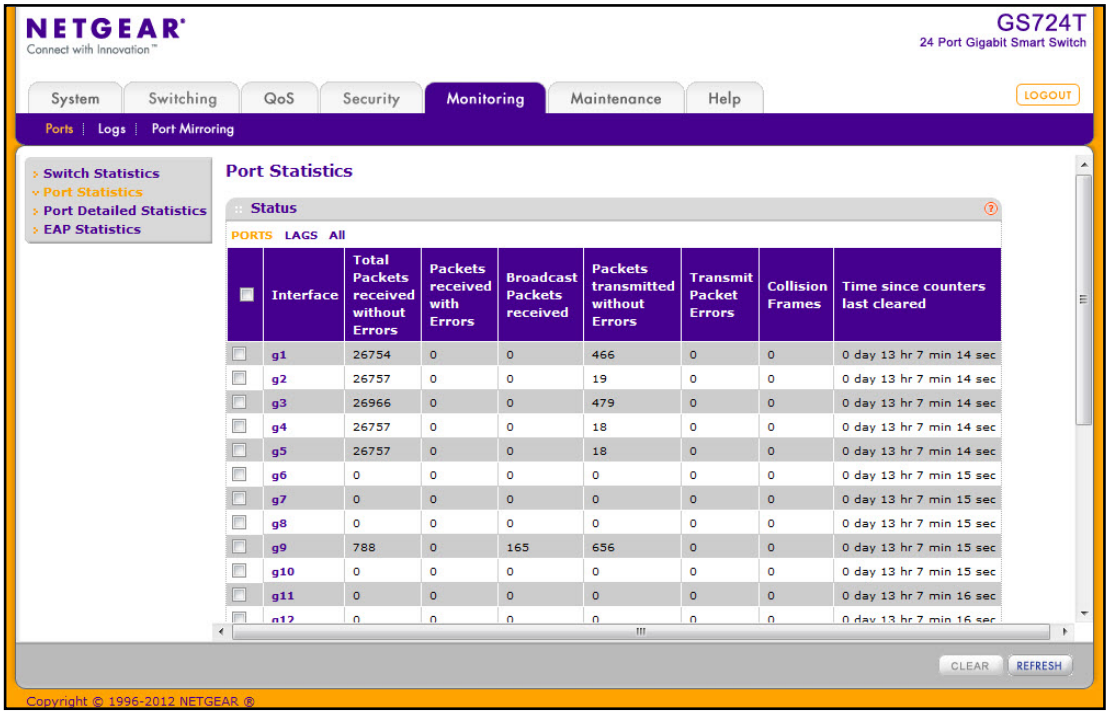
Use the buttons at the bottom of the page to perform the following actions:

- Click **Clear** to clear all the statistics counters, resetting all switch summary and detailed statistics to default values. The discarded packets count cannot be cleared.
- Click **Refresh** to refresh the page with the most current data from the switch.

# Port Statistics

The Port Statistics page displays a summary of per-port traffic statistics on the switch.

To access the Port Summary page, click **Monitoring** > **Ports** tab, and then click the **Port Statistics** link.




To view port statistics:

1. To view statistics for the physical ports, click **PORTS**. Click the interface ID to view detailed statistics for the port.
2. To view statistics for the Link Aggregation Groups (LAGs), click **LAGS**. Click the LAG ID to view detailed statistics for the port

The following table describes the per-port statistics displayed on the screen.

| Field | Description |
|---|---|
| Interface | Lists the ports on the system. |
| Total Packets Received Without Errors | The total number of packets received that were without errors. |
| Packets Received With Error | The number of inbound packets that contained errors preventing them from being deliverable to a higher layer protocol. |
| Broadcast Packets Received | The total number of good packets received that were directed to the broadcast address. This does not include multicast packets. |

| Field | Description |
|---|---|
| Packets Transmitted Without Errors | The number of frames that have been transmitted by this port to its segment. |
| Transmit Packet Errors | The number of outbound packets that could not be transmitted because of errors. |
| Collision Frames | The best estimate of the total number of collisions on this Ethernet segment. |
| Time Since Counters Last Cleared | The elapsed time, in days, hours, minutes, and seconds since the statistics for this port were last cleared. |

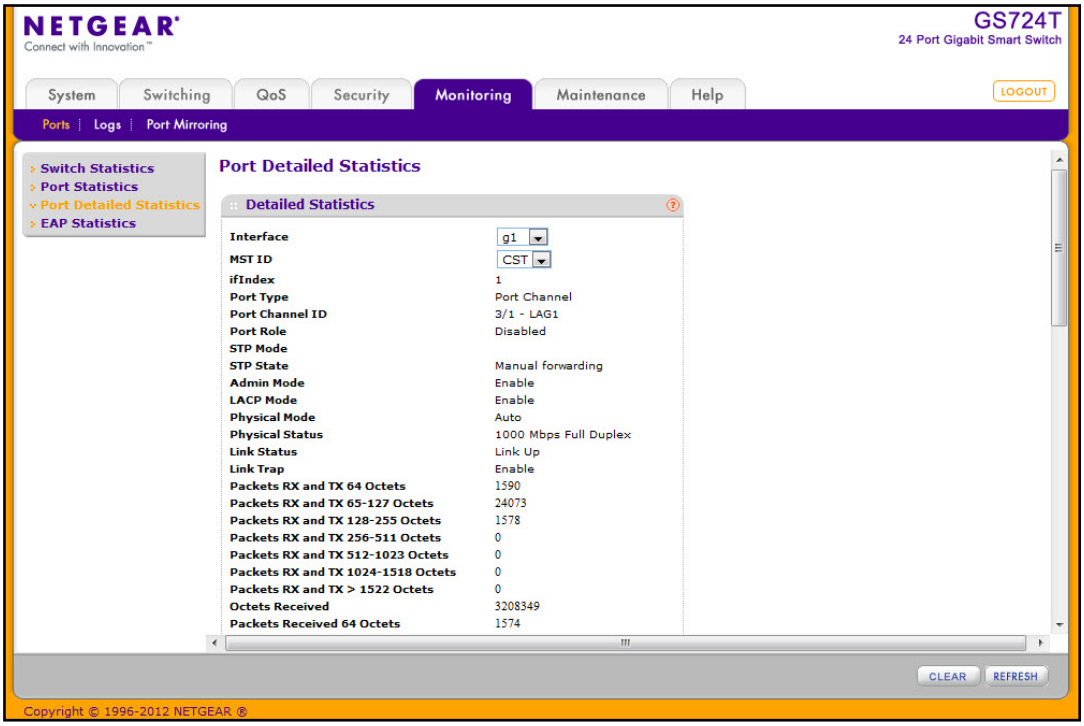
Use the buttons at the bottom of the page to perform the following actions:

- To clear all the counters for all ports on the switch, select the check box in the row heading and click **Clear**. The button resets all statistics for all ports to default values.
- To clear the counters for a specific port, select the check box associated with the port and click **Clear**.
- Click **Refresh** to refresh the data on the screen and display the most current statistics.

## Port Detailed Statistics

The Port Detailed Statistics page displays a variety of per-port traffic statistics.

To access the Port Detailed page, click the **Monitoring** > **Ports** tab, and then click **Port Detailed Statistics**. (The Port Detailed Statistics figure shows some, but not all, of the fields on the page.)



The following table describes the detailed port information displayed on the screen. To view information about a different port, select the port number from the Interface menu.

| Field | Description |
|---|---|
| Interface | Use the drop down menu to select the interface for which data is to be displayed or configured. |
| MST ID | Displays the created or existing MSTs. |
| ifIndex | This field indicates the ifIndex of the interface table entry associated with this port on an adapter. |
| Port Type | For most ports this field is blank. Otherwise the possible values are:<br>• **Mirrored:** Indicates that the port has been configured as a monitoring port and is the source port in a port mirroring session. For additional information about port monitoring and probe ports, see *Multiple Port Mirroring* on page 250.<br>• **Probe:** Indicates that the port has been configured as a monitoring port and is the destination port in a port mirroring session. For additional information about port monitoring and probe ports, see *Multiple Port Mirroring* on page 250.<br>• **Port Channel**: Indicates that the port has been configured as a member of a port-channel, which is also known as a link Aggregation Group (LAG). |
| Port Channel ID | If the port is a member of a port channel, the port channel's interface ID and name are shown. Otherwise, Disable is shown. |
| Port Role | Each MST Bridge Port that is enabled is assigned a Port Role for each spanning tree. The port role will be one of the following values: Root Port, Designated Port, Alternate Port, Backup Port, Master Port, or Disabled Port. |
| STP Mode | Displays the Spanning Tree Protocol (STP) Administrative Mode for the port or LAG. The possible values for this field are:<br>• **Enable:** Enables the Spanning Tree Protocol for this port.<br>• **Disable:** Disables the Spanning Tree Protocol for this port. |
| STP State | Displays the port's current state Spanning Tree state. This state controls what action a port takes on receipt of a frame. If the bridge detects a malfunctioning port it will place that port into the broken state. The other five states are defined in IEEE 802.1D:<br>• Disabled<br>• Blocking<br>• Listening<br>• Learning<br>• Forwarding<br>• Broken |
| Admin Mode | Displays the port control administration state:<br>• **Enable:** The port can participate in the network (default).<br>• **Disable:** The port is administratively down and does not participate in the network. |

| Field | Description |
|---|---|
| LACP Mode | Selects the Link Aggregation Control Protocol administration state:<br>• **Enable:** Specifies that the port is allowed to participate in a port channel (LAG), which is the default mode.<br>• **Disable:** Specifies that the port cannot participate in a port channel (LAG). |
| Physical Mode | Indicates the port speed and duplex mode. In auto-negotiation mode, the duplex mode and speed are set from the auto-negotiation process. |
| Physical Status | Indicates the port speed and duplex mode status. |
| Link Status | Indicates whether the link is up or down. |
| Link Trap | This object determines whether or not to send a trap when link status changes. The factory default is Enable.<br>• **Enable:** Specifies that the system sends a trap when the link status changes.<br>• **Disable:** Specifies that the system does not send a trap when the link status changes. |
| Packets RX and TX 64 Octets | The total number of packets (including bad packets) received or transmitted that were 64 octets in length (excluding framing bits but including FCS octets). |
| Packets RX and TX 65-127 Octets | The total number of packets (including bad packets) received or transmitted that were between 65 and 127 octets in length inclusive (excluding framing bits but including FCS octets). |
| Packets RX and TX 128-255 Octets | The total number of packets (including bad packets) received or transmitted that were between 128 and 255 octets in length inclusive (excluding framing bits but including FCS octets). |
| Packets RX and TX 256-511 Octets | The total number of packets (including bad packets) received or transmitted that were between 256 and 511 octets in length inclusive (excluding framing bits but including FCS octets). |
| Packets RX and TX 512-1023 Octets | The total number of packets (including bad packets) received or transmitted that were between 512 and 1023 octets in length inclusive (excluding framing bits but including FCS octets). |
| Packets RX and TX 1024-1518 Octets | The total number of packets (including bad packets) received or transmitted that were between 1024 and 1518 octets in length inclusive (excluding framing bits but including FCS octets). |
| Packets RX and TX > 1522 Octets | The total number of packets (including bad packets) received or transmitted that are in excess of 1522 octets in length inclusive (excluding framing bits but including FCS octets). |
| Octets Received | The total number of octets of data (including those in bad packets) received on the network (excluding framing bits but including FCS octets). This object can be used as a reasonable estimate of ethernet utilization. If greater precision is desired, the etherStatsPkts and etherStatsOctets objects should be sampled before and after a common interval. |
| Packets Received 64 Octets | The total number of packets (including bad packets) received that were 64 octets in length (excluding framing bits but including FCS octets). |

| Field | Description |
|---|---|
| Packets Received 65-127 Octets | The total number of packets (including bad packets) received that were between 65 and 127 octets in length inclusive (excluding framing bits but including FCS octets). |
| Packets Received 128-255 Octets | The total number of packets (including bad packets) received that were between 128 and 255 octets in length inclusive (excluding framing bits but including FCS octets). |
| Packets Received 256-511 Octets | The total number of packets (including bad packets) received that were between 256 and 511 octets in length inclusive (excluding framing bits but including FCS octets). |
| Packets Received 512-1023 Octets | The total number of packets (including bad packets) received that were between 512 and 1023 octets in length inclusive (excluding framing bits but including FCS octets). |
| Packets Received 1024-1518 Octets | The total number of packets (including bad packets) received that were between 1024 and 1518 octets in length inclusive (excluding framing bits but including FCS octets). |
| Packets Received > 1522 Octets | The total number of packets received that were in excess of 1522 octets (excluding framing bits, but including FCS octets) and were otherwise well formed. |
| Total Packets Received Without Errors | The total number of packets received that were without errors. |
| Unicast Packets Received | The number of subnetwork-unicast packets delivered to a higher-layer protocol. |
| Multicast Packets Received | The total number of good packets received that were directed to a multicast address. This number does not include packets directed to the broadcast address. |
| Broadcast Packets Received | The total number of good packets received that were directed to the broadcast address. This does not include multicast packets. |
| Total Packets Received with MAC Errors | The total number of inbound packets that contained errors preventing them from being deliverable to a higher-layer protocol. |
| Jabbers Received | The total number of packets received that were longer than 1518 octets (excluding framing bits, but including FCS octets), and had either a bad Frame Check Sequence (FCS) with an integral number of octets (FCS Error) or a bad FCS with a non-integral number of octets (Alignment Error). This definition of jabber is different than the definition in IEEE 802.3 section 8.2.1.5 (10BASE5) and section 10.3.1.4 (10BASE2). These documents define jabber as the condition where any packet exceeds 20 ms. The allowed range to detect jabber is between 20 ms and 150 ms. |
| Fragments Received | The total number of packets received that were less than 64 octets in length with ERROR CRC (excluding framing bits but including FCS octets). |
| Undersize Received | The total number of packets received that were less than 64 octets in length with GOOD CRC (excluding framing bits but including FCS octets). |

| Field | Description |
|---|---|
| Alignment Errors | The total number of packets received that had a length (excluding framing bits, but including FCS octets) of between 64 and 1518 octets, inclusive, but had a bad Frame Check Sequence (FCS) with a non-integral number of octets. |
| Rx FCS Errors | The total number of packets received that had a length (excluding framing bits, but including FCS octets) of between 64 and 1518 octets, inclusive, but had a bad Frame Check Sequence (FCS) with an integral number of octets |
| Overruns | The total number of frames discarded as this port was overloaded with incoming packets, and could not keep up with the inflow. |
| Total Received Packets Not Forwarded | A count of valid frames received which were discarded (i.e., filtered) by the forwarding process. |
| Local Traffic Frames | The total number of frames dropped in the forwarding process because the destination address was located off of this port. |
| 802.3x Pause Frames Received | A count of MAC Control frames received on this interface with an opcode indicating the PAUSE operation. This counter does not increment when the interface is operating in half-duplex mode. |
| Unacceptable Frame Type | The number of frames discarded from this port due to being an unacceptable frame type. |
| Multicast Tree Viable Discards | The number of frames discarded when a lookup in the multicast tree for a VLAN occurs while that tree is being modified. |
| Reserved Address Discards | The number of frames discarded that are destined to an IEEE 802.1 reserved address and are not supported by the system. |
| Broadcast Storm Recovery | The number of frames discarded that are destined for FF:FF:FF:FF:FF:FF when Broadcast Storm Recovery is enabled. |
| CFI Discards | The number of frames discarded that have CFI bit set and the addresses in RIF are in non-canonical format. |
| Upstream Threshold | The number of frames discarded due to lack of cell descriptors available for that packet's priority level. |
| Total Packets Transmitted (Octets) | The total number of octets of data (including those in bad packets) transmitted on the network (excluding framing bits but including FCS octets). This object can be used as a reasonable estimate of ethernet utilization. If greater precision is desired, the etherStatsPkts and etherStatsOctets objects should be sampled before and after a common interval. |
| Packets Transmitted 64 Octets | The total number of packets (including bad packets) transmitted that were 64 octets in length (excluding framing bits but including FCS octets). |
| Packets Transmitted 65-127 Octets | The total number of packets (including bad packets) transmitted that were between 65 and 127 octets in length inclusive (excluding framing bits but including FCS octets). |
| Packets Transmitted 128-255 Octets | The total number of packets (including bad packets) transmitted that were between 128 and 255 octets in length inclusive (excluding framing bits but including FCS octets). |

| Field | Description |
|---|---|
| Packets Transmitted 256-511 Octets | The total number of packets (including bad packets) transmitted that were between 256 and 511 octets in length inclusive (excluding framing bits but including FCS octets). |
| Packets Transmitted 512-1023 Octets | The total number of packets (including bad packets) transmitted that were between 512 and 1023 octets in length inclusive (excluding framing bits but including FCS octets). |
| Packets Transmitted 1024-1518 Octets | The total number of packets (including bad packets) transmitted that were between 1024 and 1518 octets in length inclusive (excluding framing bits but including FCS octets). |
| Packets Transmitted 1519-1522 Octets | The total number of packets (including bad packets) transmitted that were between 1519 and 1522 octets in length inclusive (excluding framing bits but including FCS octets). |
| Total Packets Transmitted Successfully | The number of frames that have been transmitted by this port to its segment. |
| Unicast Packets Transmitted | The total number of packets that higher-level protocols requested be transmitted to a subnetwork-unicast address, including those that were discarded or not sent. |
| Multicast Packets Transmitted | The total number of packets that higher-level protocols requested be transmitted to a Multicast address, including those that were discarded or not sent. |
| Broadcast Packets Transmitted | The total number of packets that higher-level protocols requested be transmitted to the Broadcast address, including those that were discarded or not sent. |
| Total Transmit Errors | The sum of Single, Multiple, and Excessive Collisions. |
| Tx FCS Errors | The total number of packets transmitted that had a length (excluding framing bits, but including FCS octets) of between 64 and 1518 octets, inclusive, but had a bad Frame Check Sequence (FCS) with an integral number of octets |
| Tx Oversized | The total number of frames that exceeded the max permitted frame size. This counter has a max increment rate of 815 counts per second at 10 Mb/s. |
| Underrun Errors | The total number of frames discarded because the transmit FIFO buffer became empty during frame transmission. |
| Total Transmit Packets Discarded | The sum of single collision frames discarded, multiple collision frames discarded, and excessive frames discarded. |
| Single Collision Frames | A count of the number of successfully transmitted frames on a particular interface for which transmission is inhibited by exactly one collision. |
| Multiple Collision Frames | A count of the number of successfully transmitted frames on a particular interface for which transmission is inhibited by more than one collision. |
| Excessive Collision Frames | A count of frames for which transmission on a particular interface fails due to excessive collisions. |
| Port Membership Discards | The number of frames discarded on egress for this port due to egress filtering being enabled. |

| Field | Description |
|---|---|
| STP BPDUs Received | Number of STP BPDUs received at the selected port. |
| STP BPDUs Transmitted | Number of STP BPDUs transmitted from the selected port. |
| RSTP BPDUs Received | Number of RSTP BPDUs received at the selected port. |
| RSTP BPDUs Transmitted | Number of RSTP BPDUs transmitted from the selected port. |
| MSTP BPDUs Received | Number of MSTP BPDUs received at the selected port. |
| MSTP BPDUs Transmitted | Number of MSTP BPDUs transmitted from the selected port. |
| 802.3x Pause Frames Transmitted | A count of MAC Control frames transmitted on this interface with an opcode indicating the PAUSE operation. This counter does not increment when the interface is operating in half-duplex mode. |
| EAPOL Frames Received | The number of valid EAPOL frames of any type that have been received by this authenticator. |
| EAPOL Frames Transmitted | The number of EAPOL frames of any type that have been transmitted by this authenticator. |
| Time Since Counters Last Cleared | The elapsed time, in days, hours, minutes, and seconds since the statistics for this port were last cleared. |

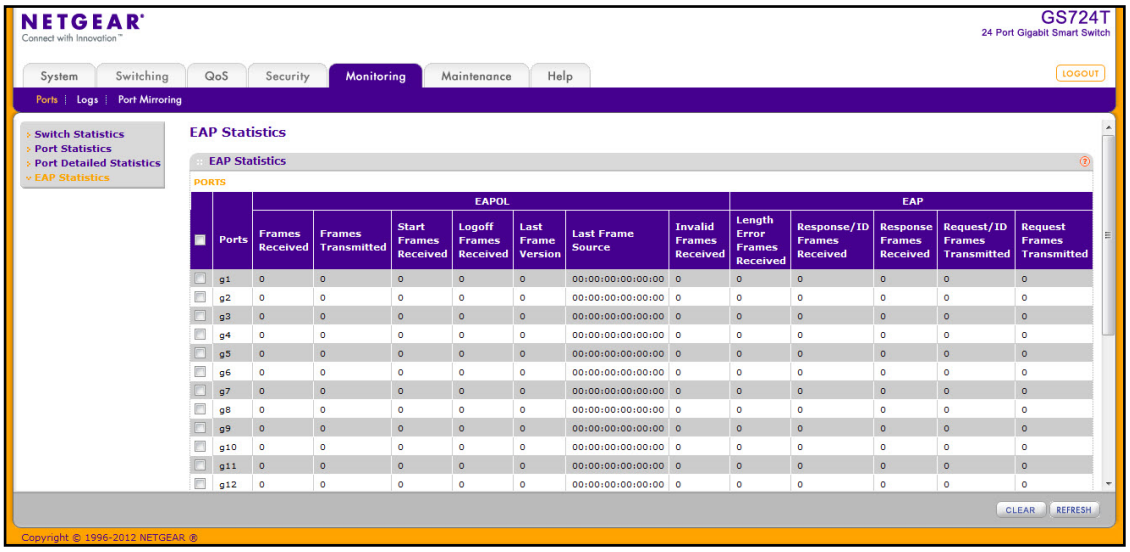
Use the buttons at the bottom of the page to perform the following actions:

- Click **Clear** to clear all the counters. This resets all statistics for this port to the default values.
- Click **Refresh** to refresh the data on the screen and display the most current statistics.

# EAP Statistics

Use the EAP Statistics page to display information about EAP packets received on a specific port.

To display the EAP Statistics page, click the **Monitoring** > **Ports** tab, and then click the **EAP Statistics** link.




The following table describes the EAP statistics displayed on the screen.

| Field | Description |
|---|---|
| Ports | Specifies the interface which is polled for statistics. |
| Frames Received | Displays the number of valid EAPOL frames received on the port. |
| Frames Transmitted | Displays the number of EAPOL frames transmitted through the port. |
| Start Frames Received | Displays the number of EAPOL Start frames received on the port. |
| Logoff Frames Received | Displays the number of EAPOL Log off frames that have been received on the port. |
| Last Frame Version | Displays the protocol version number attached to the most recently received EAPOL frame. |
| Last Frame Source | Displays the source MAC Address attached to the most recently received EAPOL frame. |
| Invalid Frames Received | Displays the number of unrecognized EAPOL frames received on this port. |
| Length Error Frames Received | Displays the number of EAPOL frames with an invalid Packet Body Length received on this port. |

| Field | Description |
|---|---|
| Response/ID Frames Received | Displays the number of EAP Respond ID frames that have been received on the port. |
| Response Frames Received | Displays the number of valid EAP Response frames received on the port. |
| Request/ID Frames Transmitted | Displays the number of EAP Requested ID frames transmitted through the port. |
| Request Frames Transmitted | Displays the number of EAP Request frames transmitted through the port. |

Use the buttons at the bottom of the page to perform the following actions:

- To clear all the EAP counters for all ports on the switch, select the check box in the row heading and click **Clear**. The button resets all statistics for all ports to default values.
- To clear the counters for a specific port, select the check box associated with the port and click **Clear**.
- Click **Refresh** to refresh the data on the screen and display the most current statistics.

# System Logs

The switch may generate messages in response to events, faults, or errors occurring on the platform as well as changes in configuration or other occurrences. These messages are stored locally and can be forwarded to one or more centralized points of collection for monitoring purposes or long term archival storage. Local and remote configuration of the logging capability includes filtering of messages logged or forwarded based on severity and generating component.

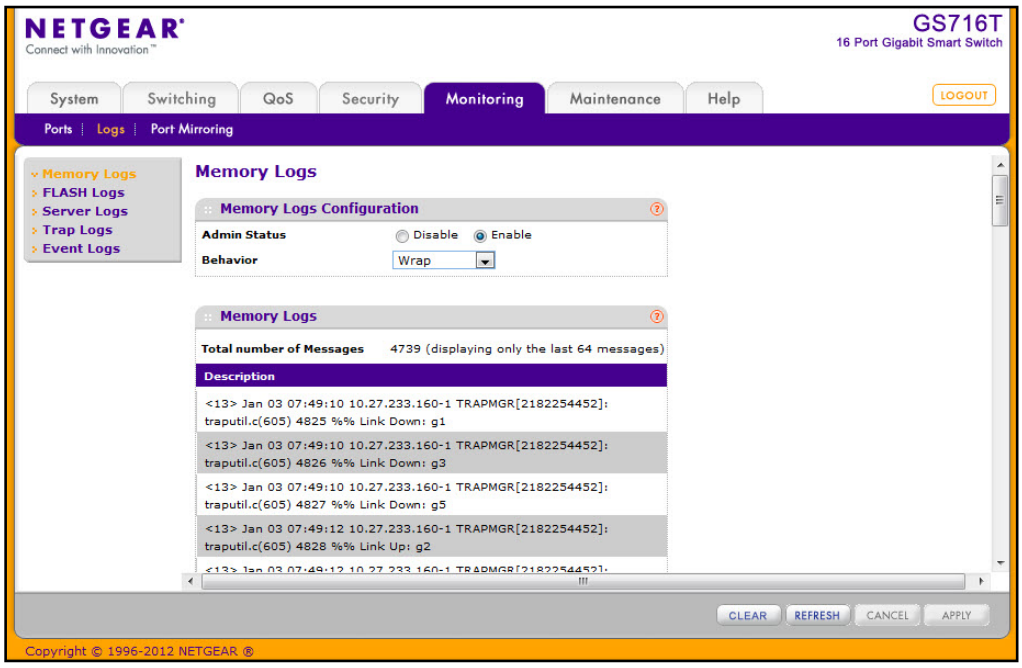
The **Monitoring** > **Logs** tab contains links to the following folders:

- *Memory Logs* on page 242
- *FLASH Log Configuration* on page 244
- *Server Log Configuration* on page 246
- *Trap Logs* on page 248
- *Event Logs* on page 249

# Memory Logs

The *in-memory* log stores messages in memory based upon the settings for message component and severity. Use the Memory Logs page to set the administrative status and behavior of logs in the system buffer. These log messages are cleared when the switch reboots.

To access the Memory Log page, click the **Monitoring** > **Logs** tab, and then click the **Memory Log** link.




To configure the Memory Log settings:

1. Use the radio buttons in the **Admin Status** field to determine whether to log messages.
   - **Enable**: Enables system logging.
   - **Disable**: Prevents the system from logging messages.
2. From the **Behavior** menu, specify the behavior of the log when it is full.
   - **Wrap**: When the buffer is full, the oldest log messages are deleted as the system logs new messages.
   - **Stop on Full**: When the buffer is full, the system stops logging new messages and preserves all existing log messages.
3. If you change the buffered log settings, click **Apply** to apply the changes to the system and the changes will be saved.

The Memory Log table also appears on the Memory Log page.

| Field | Description |
|---|---|
| Total Number of Messages | Displays the number of messages the system has logged in memory. Only the 64 most recent entries are displayed on the page. |
| Description | The log message text, which includes the time the log was recorded. |

The rest of the page displays the Memory Log messages. The format of the log message is the same for messages that are displayed for the message log, persistent log, or console log. Messages logged to a collector or relay via syslog have the same format as well.

The following example shows the standard format for a log message:

```
<14> Mar 24 05:34:05 10.131.12.183-1 UNKN[2176789276]:
main_login.c(179) 3855 %% HTTP Session 19 initiated for user admin
connected from 10.27.64.122
```

The number contained in the angle brackets represents the message priority, which is derived from the following values:

Priority = (facility value × 8) + severity level.

The facility value is usually one, which means it is a user-level message. Therefore, to determine the severity level of the message, subtract eight from the number in the angle brackets. The example log message has a severity level of 6 (informational). For more information about the severity of a log message, see the **Severity Filter** description on *page 247*.

The message was generated on March 24 at 5:34:05 a.m by the switch with an IP address of 10.131.12.183. The component that generated the message is unknown, but it came from line 179 of the main_login.c file. This is the 3,855th message logged since the switch was last booted. The message indicates that the administrator logged onto the HTTP management interface from a host with an IP address of 10.27.64.122.

Use the buttons at the bottom of the page to perform the following actions:

- Click **Clear** to clear the messages out of the buffered log in the memory.
- Click **Refresh** to update the page with the latest messages in the log.
- Click **Cancel** to cancel the configuration on the screen and reset the data on the screen to the latest value of the switch.

# FLASH Log Configuration

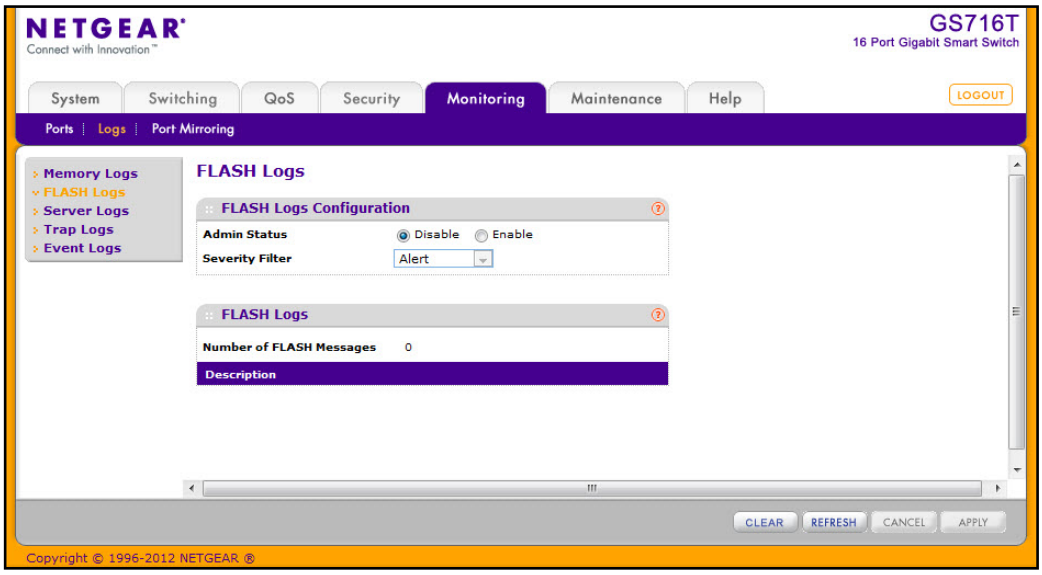
The FLASH log is a log that is stored in persistent storage, which means that the log messages are retained across a switch reboot.

- The first log type is the ***system startup log***. The system startup log stores the first N messages received after system reboot. This log always has the log full operation attribute set to stop on full and can store up to 32 messages.
- The second log type is the ***system operation log***. The system operation log stores the last N messages received during system operation. This log always has the log full operation attribute set to overwrite. This log can store up to 1000 messages.

Either the system startup log or the system operation log stores a message received by the log subsystem that meets the storage criteria, but not both. On system startup, if the startup log is configured, it stores messages up to its limit. The operation log, if configured, then begins to store the messages.

Use the FLASH Log Configuration page to enable or disable persistent logging and to set the severity filter.

To access the FLASH Log Configuration page, click the **Monitoring** > **Logs** tab, and then click the **FLASH Log** link.




To configure the FLASH Log settings:

1. Use the radio buttons in the **Admin Status** field to determine whether to log messages to persistent storage.
   - **Enable**: Enables persistent logging.
   - **Disable**: Prevents the system from logging messages in persistent storage.
2. From the **Severity Filter** field, specify the type of log messages to record. A log records messages equal to or above a configured severity threshold. For example, if you select

Error, the logged messages include Error, Critical, Alert, and Emergency. The default severity level is Alert (1).

The severity can be one of the following levels:

- **Emergency** (0): The highest level warning level. If the device is down or not functioning properly, an emergency log is saved to the device.
- **Alert** (1): The second highest warning level. An alert log is saved if there is a serious device malfunction, such as all device features being down. Action must be taken immediately.
- **Critical** (2): The third highest warning level. A critical log is saved if a critical device malfunction occurs, for example, two device ports are not functioning, while the rest of the device ports remain functional.
- **Error** (3): A device error has occurred, such as if a port is offline.
- **Warning** (4): The lowest level of a device warning.
- **Notice** (5): Normal but significant conditions. Provides the network administrators with device information.
- **Information** (6): Provides device information.
- **Debug** (7): Provides detailed information about the log. Debugging should only be entered by qualified support personnel.

3. If you make any changes to the page, click **Apply** to apply the change to the system.

The rest of the page displays the number of persistent messages the system has logged and the persistent log messages.

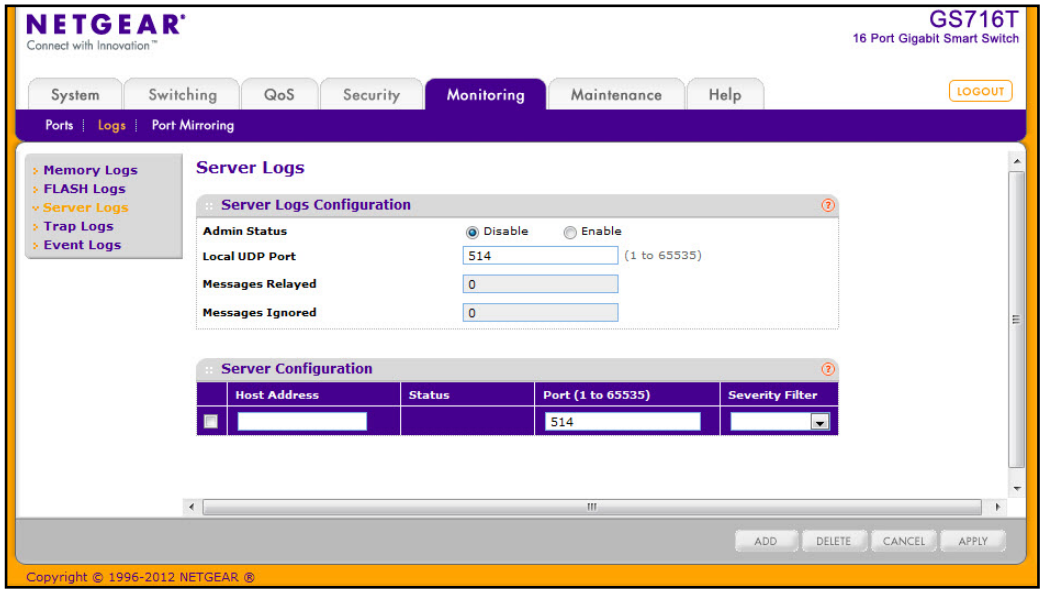
Use the buttons at the bottom of the page to perform the following actions:

- Click **Clear** to clear the messages out of the buffered log.
- Click **Refresh** to refresh the page with the most current data from the switch.
- Click **Cancel** to cancel the configuration on the screen and reset the data on the screen to the latest value of the switch.

# Server Log Configuration

Use the Server Log Configuration page to allow the switch to send log messages to the remote logging hosts configured on the system.

To access the Server Log Configuration page, click the **Monitoring** > **Logs** tab, and then click the **Server Log** link.




To configure local log server settings:

1. Use the radio buttons in the **Admin Status** field to determine whether to send log messages to the remote syslog hosts configured on the switch.
   - **Enable**: Messages will be sent to all configured hosts (syslog collectors or relays) using the values configured for each host.
   - **Disable**: Stops logging to all syslog hosts. Disable means no messages will be sent to any collector/relay.
2. In the Local UDP Port field, specify the port on the switch from which syslog messages are sent.
3. Click **Apply** to save the settings.

The Server Log Configuration area also displays the following information:

- The **Messages Relayed** field shows the number of messages forwarded by the syslog function to a syslog host. Messages forwarded to multiple hosts are counted once for each host.
- The **Messages Ignored** field shows the number of messages that were ignored.

To configure a remote log server

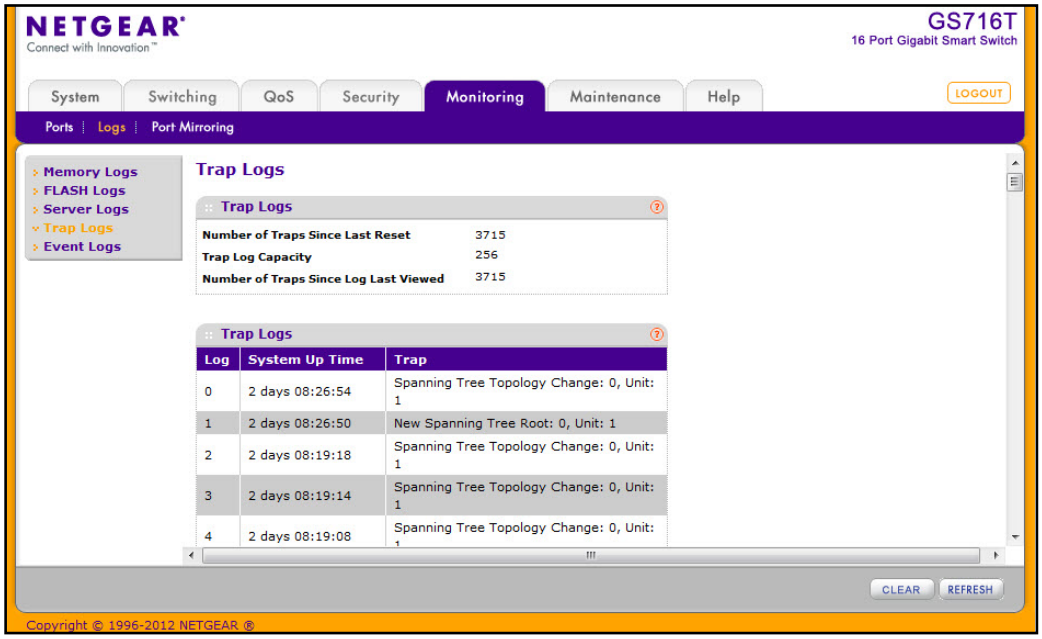
1. To add a remote syslog host (log server), specify the settings in the following list and click **Add**.
   - **Host Address**. Specify the IP address or host name of the host configured for syslog.
   - **Port**. Specify the port on the host to which syslog messages are sent. The default port is 514.
   - **Severity Filter**. Use the menu to select the severity of the logs to send to the logging host. Logs with the selected severity level and all logs of greater severity are sent to the host. For example, if you select Error, the logged messages include Error, Critical, Alert, and Emergency. The default severity level is Alert (1). The severity can be one of the following levels:
     - **Emergency** (0): The highest level warning level. If the device is down or not functioning properly, an emergency log is saved to the device.
     - **Alert** (1): The second highest warning level. An alert log is saved if there is a serious device malfunction, such as all device features being down.
     - **Critical** (2): The third highest warning level. A critical log is saved if a critical device malfunction occurs, for example, two device ports are not functioning, while the rest of the device ports remain functional.
     - **Error** (3): A device error has occurred, such as if a port is offline.
     - **Warning** (4): The lowest level of a device warning.
     - **Notice** (5): Provides the network administrators with device information.
     - **Informational** (6): Provides device information.
     - **Debug** (7): Provides detailed information about the log. Debugging should only be entered by qualified support personnel.
2. To delete an existing host, select the check box next to the host and click **Delete**.
3. To modify the settings for an existing host, select the check box next to the host, change the desired information, and click **Apply**.
4. Click **Cancel** to cancel the configuration on the screen and reset the data on the screen to the latest value of the switch.

The **Status** field in the Server Configuration table shows whether the remote logging host is currently active.

# Trap Logs

Use the Trap Logs page to view information about the SNMP traps generated on the switch.

To access the Trap Logs page, click the **Monitoring** > **Logs** tab, and then click the **Trap Logs** link.




The following table describes the Trap Log information displayed on the screen.

| Field | Description |
|---|---|
| Number of Traps Since Last Reset | The number of traps that have occurred since the switch last reboot. |
| Trap Log Capacity | The maximum number of traps stored in the log. If the number of traps exceeds the capacity, the entries will overwrite the oldest entries. |
| Number of Traps Since Log Last Viewed | The number of traps that have occurred since the traps were last displayed. Displaying the traps by any method (such as terminal interface display, Web display, or upload file from switch) will cause this counter to be cleared to 0. |

The page also displays information about the traps that were sent.

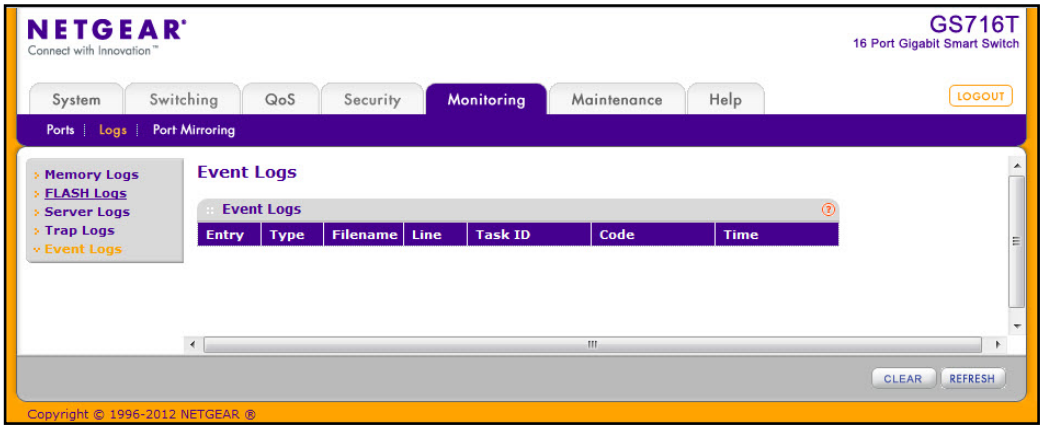
| Field | Description |
|---|---|
| Log | The sequence number of this trap. |
| System Up Time | The time at which this trap occurred, expressed in days, hours, minutes, and seconds since the last reboot of the switch. |
| Trap | Information identifying the trap. |

Click **Clear Counters** to clear all the counters. This resets all statistics for the trap logs to the default values.

## Event Logs

Use the Event Log page to display the event log, which is used to hold error messages for catastrophic events. After the event is logged and the updated log is saved in flash memory, the switch will be reset. The log can hold at least 2,000 entries and is erased when an attempt is made to add an entry after it is full. The event log is preserved across system resets.

To access the Event Log page, click the **Monitoring** > **Logs** tab, and then click the **Event Logs** link.




The following table describes the Event Log information displayed on the screen.

| Field | Description |
|---|---|
| Entry | The number of the entry within the event log. The most recent entry is first. |
| Type | Specifies the type of entry. |
| Filename | The GS716T and GS724T source code filename identifying the code that detected the event. |
| Line | The line number within the source file of the code that detected the event. |

| Field | Description |
|---|---|
| Task ID | The OS-assigned ID of the task reporting the event. |
| Code | The event code passed to the event log handler by the code reporting the event. |
| Time | The time the event occurred, measured from the previous reset. |

Use the buttons at the bottom of the page to perform the following actions:

- Click **Clear** to clear the messages out of the Event Log.
- Click **Refresh** to refresh the data on the screen and display the most current information.

# Port Mirroring

The page under the Mirroring link allows you to view and configure port mirroring on the system.

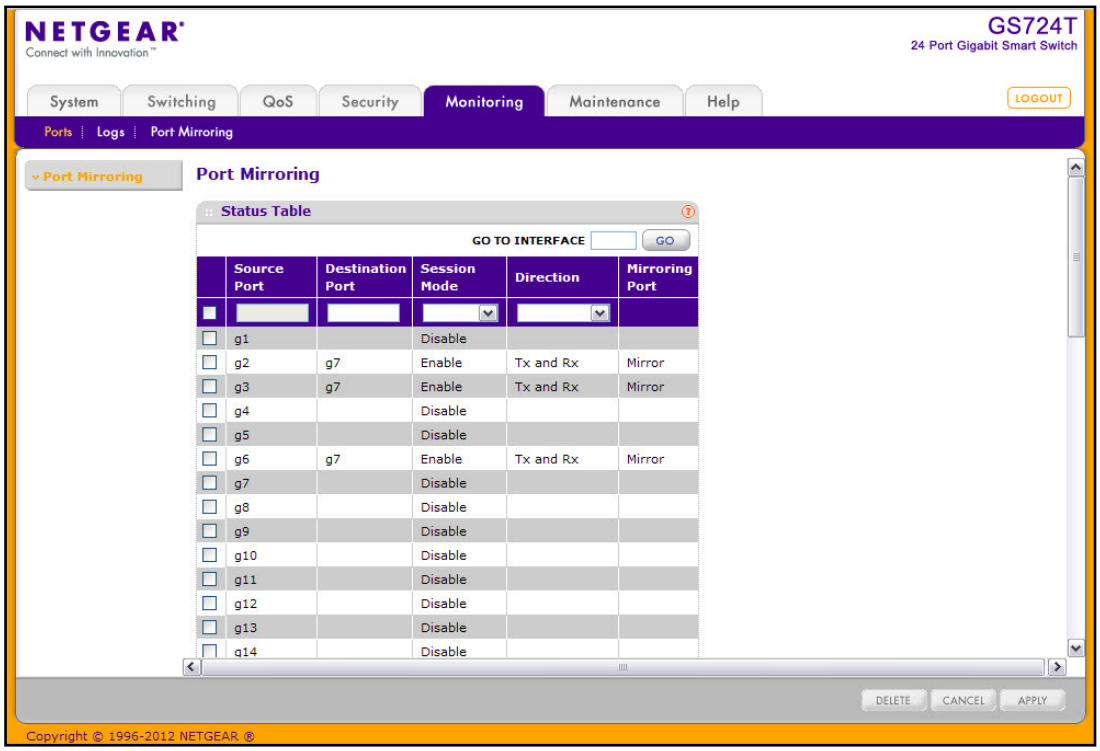
## Multiple Port Mirroring

Port mirroring selects the network traffic for analysis by a network analyzer. This is done for specific ports of the switch. As such, many switch ports are configured as source ports and one switch port is configured as a destination port. You have the ability to configure how traffic is mirrored on a source port. Packets that are received on the source port, that are transmitted on a port, or are both received and transmitted, can be mirrored to the destination port.

The packet that is copied to the destination port is in the same format as the original packet on the wire. This means that if the mirror is copying a received packet, the copied packet is VLAN tagged or untagged as it was received on the source port. If the mirror is copying a transmitted packet, the copied packet is VLAN tagged or untagged as it is being transmitted on the source port.

Use the Multiple Port Mirroring page to define port mirroring sessions.

To access the Multiple Port Mirroring page, click **Monitoring** > **Port Mirroring**. In the following figure, a port mirroring session is configured with ports g2, g3, and g6 as the source ports that are mirroring transmitted and received traffic to port g7.




To configure Port Mirroring:

1. Select the check box next to a port to configure it as a source port.
2. In the **Destination Port** field, specify the port to which port traffic is be copied. Use the g1, g2,...format to specify the port. You can configure only one destination port on the system.
3. From the **Session Mode** menu, select the mode for port mirroring on the selected port:
   - **Enable**. Multiple Port Mirroring is active on the selected port.
   - **Disable**. Port mirroring is not active on the selected port, but the mirroring information is retained.
4. From the **Direction** menu, specify the direction of the Traffic to be mirrored from the configured mirrored port(s). The default value is Tx and Rx.
   - **Tx and Rx**. Enable both transmitting and receiving on the selected ports.
   - **Tx only**. Enable only transmitting on the selected ports.
   - **Rx only**. Enable only receiving on the selected ports.
5. Click **Apply** to apply the settings to the system. If the port is configured as a source port, the **Mirroring Port** field value is Mirrored.
6. To delete a mirrored port, select the check box next to the mirrored port, and then click **Delete**.
7. Click **Cancel** to cancel the configuration on the screen and reset the data on the screen to the latest value of the switch.

# Maintenance

# 7

Use the features available from the Maintenance tab to help you manage the switch. The Maintenance tab contains links to the following features:



## Reset

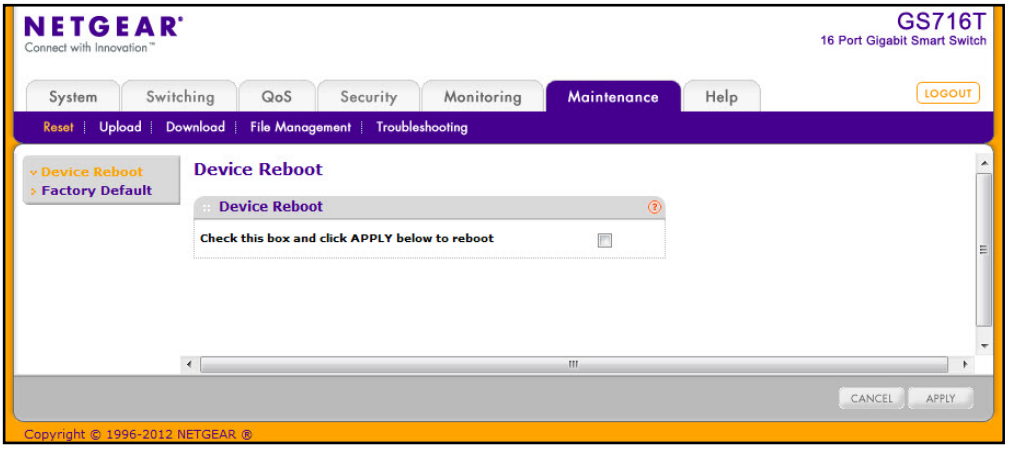
The **Reset** menu contains links to the following options:



### Device Reboot

Use the Device Reboot page to reboot the GS716T and GS724T.

To access the Device Reboot page, click **Maintenance** > **Reset** > **Device Reboot**.



To reboot the switch:

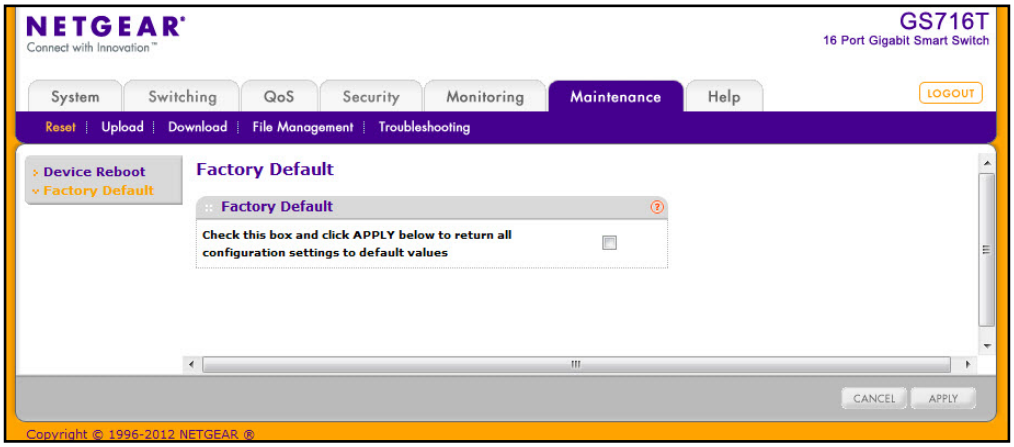
1. Select the check box on the page.
2. Click **Apply** to reset the switch immediately, or click **Cancel** to abandon the reset request. After the switch reset begins, the management interface is not available until the switch completes the boot cycle. After the switch resets, the login screen appears.

# Factory Default

Use the Factory Default page to reset the system configuration to the factory default values.

**Note:** If you reset the switch to the default configuration, the IP address is reset to 192.168.0.239, and the DHCP client is enabled. If you loose network connectivity after you reset the switch to the factory defaults, see *Connecting the Switch to the Network* on page 11.

To access the Factory Defaults page, click **Maintenance** > **Reset** > **Factory Default**.




To reset the switch to the factory default settings:

1. Select the check box on the page.
2. Click **Apply**, or click **Cancel** to abandon the changes. The switch resets immediately.

# Upload File From Switch

The switch supports system file uploads from the switch to a remote system by using either TFTP or HTTP.

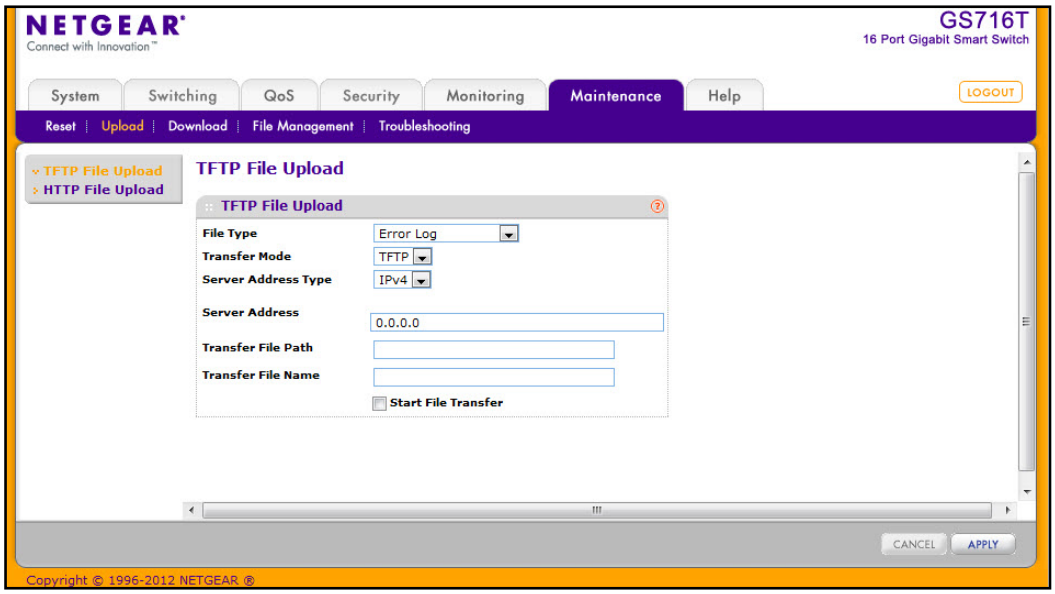
The **Upload** menu contains links to the following options:

- *TFTP File Upload* on page 255
- *HTTP File Download* on page 260

## TFTP File Upload

Use the TFTP File Upload page to upload configuration (ASCII), log (ASCII), and image (binary) files from the switch to an TFTP server on the network.

To display the File Upload page, click **Maintenance** > **Upload** > **TFTP File Upload**.




To upload a file from the switch to the TFTP server:

1. Use the **File Type** menu to specify the type of file you want to upload:
   - **Code**: Uploads a stored code image.
   - **Text Configuration**: Uploads the text configuration file, which can be used as a backup copy or to download and apply to another switch.
   - **Error Log**: Uploads the system error (persistent) log, sometimes referred to as the event log.
   - **Buffered Log**: Uploads the system buffered (in-memory) log.
   - **Trap Log**: Uploads the system trap records.
2. If the file type is Code, specify whether to upload image1 or image2. This field is only visible when Code is selected as the File Type.

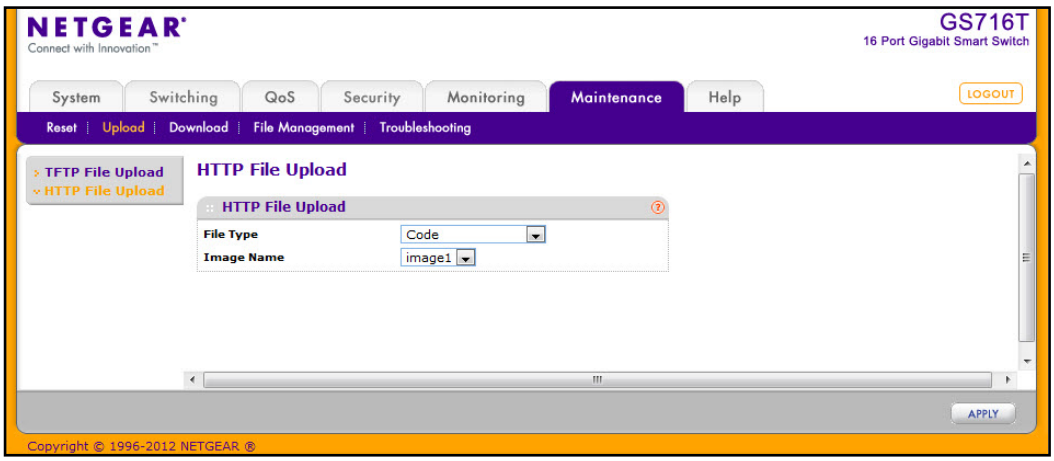
3. From the **Server Address Type** filed, specify the format to use for the address you type in the TFTP Server Address field:
   - **IPv4**. Indicates the TFTP server address is an IP address in dotted-decimal format.
   - **DNS**. Indicates the TFTP server address is a host name.
4. In the **Server Address** field, specify the IP address or host name of the TFTP server. The address you type must be in the format indicated by the TFTP Server Address Type.
5. In the **Transfer File Path** field, specify the path on the TFTP server where you want to put the file. You may enter up to 32 characters. Include the backslash at the end of the path. A path name with a space is not accepted. Leave this field blank to save the file to the root TFTP directory.
6. In the **Transfer File Name** field, specify a destination file name for the file to upload. You may enter up to 32 characters. The transfer fails if you do not specify a file name. For a code transfer, use an *.stk* file extension.
7. Select the **Start File Transfer** check box to initiate the file upload.
8. Click **Apply** to begin the file transfer.

   The last row of the table displays information about the progress of the file transfer. The page refreshes automatically until the file transfer completes or fails.

## HTTP File Upload

Use the HTTP File Upload page to upload files of various types from the switch to the management system by using an HTTP session (for example, via your Web browser).

To display this page, click **Maintenance** > **Upload** > **HTTP File Upload**.



To upload a file from the switch to another system by using HTTP:

1. From the **File Type** menu, specify what type of file you want to upload from the switch:
   - **Code**: The code is the system software image, which is saved in one of two flash sectors called images (image1 and image2). The active image stores the active copy; while the other image stores a second copy. The device boots and runs from the active image. If the active image is corrupt, the system automatically boots from the non-active image. This is a safety feature for faults occurring during the boot upgrade process.
   - **Text Configuration**: A text-based configuration file enables you to edit a configured text file (startup-config) offline as needed without having to translate the contents for the switch to understand. The most common usage of text-based configuration is to upload a working configuration from a device, edit it offline to personalize it for another similar device (for example, change the device name, serial number, IP address), and download it to that device.
2. If you are uploading an GS716T and GS724T image (Code), select the image on the switch to upload to the management system. This field is visible only when Code is selected as the File Type.
3. Click **Apply**. A window appears to allow you to open the text file on the management system or to save the image or text file to the management system.
4. Click **Cancel** to cancel the operation on the screen and reset the data on the screen to the latest value of the switch.

# Download File To Switch

The switch supports system file downloads from a remote system to the switch by using either TFTP or HTTP.

The **Download** menu contains links to the following options:

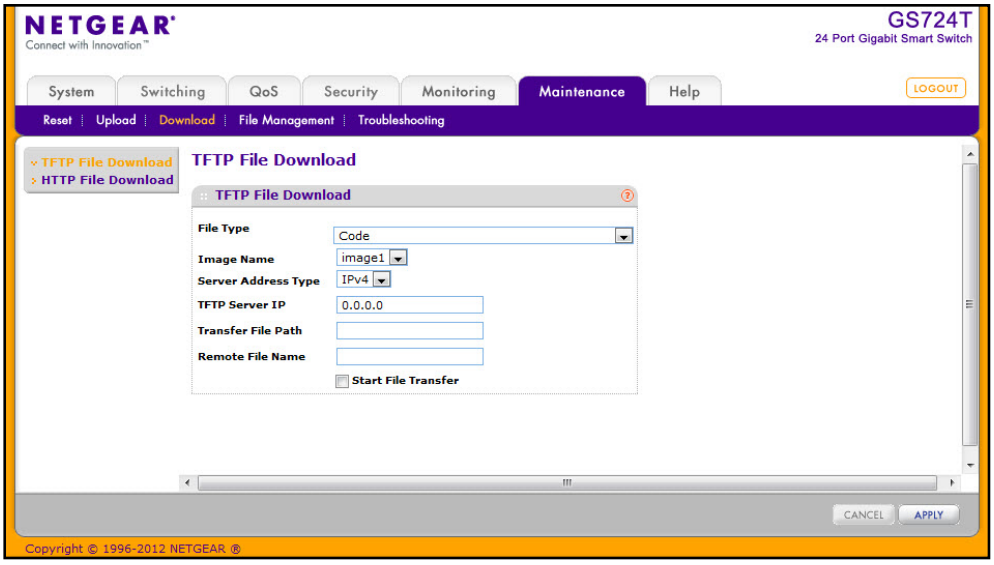
- *TFTP File Download* on page 257
- *HTTP File Download* on page 260

## TFTP File Download

Use the Download File to Switch page to download device software, the image file, the configuration files and SSL files from a TFTP server to the switch.

You can also download files via HTTP. See *HTTP File Download* on page 260 for additional information.

To access the TFTP File Download page, click **Maintenance** > **Download** > **TFTP File Download**.




Before you download a file to the switch, the following conditions must be true:

- The file to download from the TFTP server is on the server in the appropriate directory.
- The file is in the correct format.
- The switch has a path to the TFTP server.

To download a file to the switch from a TFTP server:

1. From the **File Type** menu, Specify what type of file you want to download to the switch:
   - **Code**: The code is the system software image, which is saved in one of two flash sectors called images (image1 and image2). The active image stores the active copy; while the other image stores a second copy. The device boots and runs from the active image. If the active image is corrupt, the system automatically boots from the non-active image. This is a safety feature for faults occurring during the boot upgrade process.
   - **Text Configuration**: A text-based configuration file enables you to edit a configured text file (startup-config) offline as needed without having to translate the contents for the switch to understand. The most common usage of text-based configuration is to upload a working configuration from a device, edit it offline to personalize it for another similar device (for example, change the device name, serial number, IP address), and download it to that device.
   - **License Key**: The license key file that activates certain features on the switch.
   - **SSL Trusted Root Certificate PEM File**: SSL Trusted Root Certificate File (PEM Encoded).
   - **SSL Server Certificate PEM File**: SSL Server Certificate File (PEM Encoded).
   - **SSL DH Weak Encryption Parameter PEM File**: SSL Diffie-Hellman Weak Encryption Parameter File (PEM Encoded).
   - **SSL DH Strong Encryption Parameter PEM File**: SSL Diffie-Hellman Strong Encryption Parameter File (PEM Encoded).

2. If you are downloading an GS716T and GS724T image (Code), select the image on the switch to overwrite. This field is visible only when Code is selected as the File Type.

   **Note:** It is recommended that you not overwrite the active image. The system will display a warning that you are trying to overwrite the active image.

3. From the **Server Address Type** filed, specify the format for the address you type in the TFTP Server Address field
   - **IPv4**. Indicates the TFTP server address is an IP address in dotted-decimal format.
   - **DNS**. Indicates the TFTP server address is a host name.
4. In the **Server Address** field, specify the IP address or host name of the TFTP server. The address you type must be in the format indicated by the TFTP Server Address Type.
5. In the **Transfer File Path** field, specify the path on the TFTP server where the file is located. You may enter up to 32 characters. Include the backslash at the end of the path. A path name with a space is not accepted. Leave this field blank to save the file to the root TFTP directory.
6. In the **Remote File Name** field, specify the name of the file to download from the TFTP server. You may enter up to 32 characters. A file name with a space is not accepted.
7. Select the **Start File Transfer** check box to initiate the file upload.
8. Click **Apply** to begin the file transfer or **Cancel** to abandon the transfer.

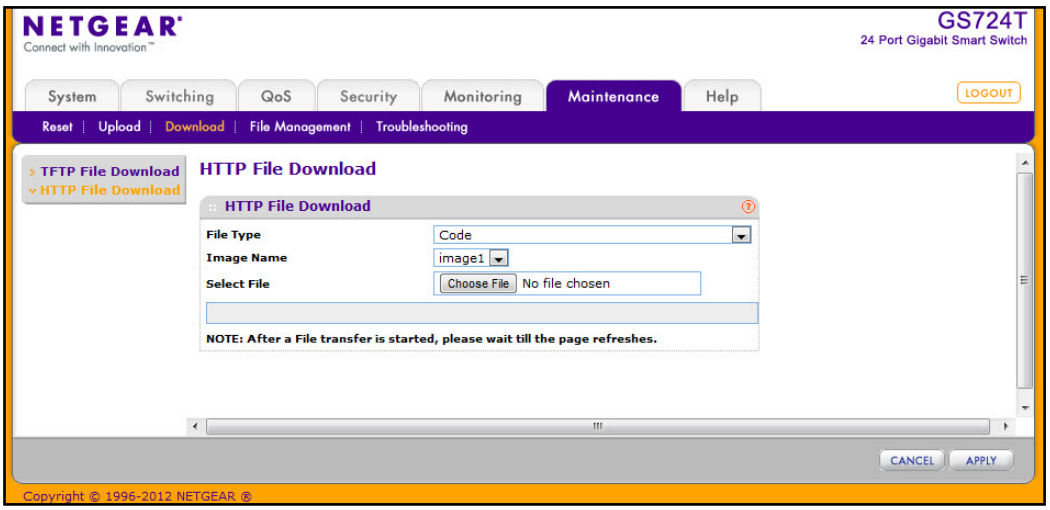
   The last row of the table displays information about the progress of the file transfer. The page refreshes automatically until the file transfer completes or fails.

To activate a software image that you download to the switch, see *File Management* on page 261.

# HTTP File Download

Use the HTTP File Download page to download files of various types to the switch using an HTTP session (for example, via your Web browser).

To display this page, click **Maintenance** > **Download** > **HTTP File Download**.




To download a file to the switch from by using HTTP:

1. From the **File Type** menu, Specify what type of file you want to download to the switch:
   - **Code**: The code is the system software image, which is saved in one of two flash sectors called images (image1 and image2). The active image stores the active copy; while the other image stores a second copy. The device boots and runs from the active image. If the active image is corrupt, the system automatically boots from the non-active image. This is a safety feature for faults occurring during the boot upgrade process.
   - **Text Configuration**: A text-based configuration file enables you to edit a configured text file (startup-config) offline as needed without having to translate the contents for the switch to understand. The most common usage of text-based configuration is to upload a working configuration from a device, edit it offline to personalize it for another similar device (for example, change the device name, serial number, IP address), and download it to that device.
   - **License Key**: The license key file that activates certain features on the switch.
   - **SSL Trusted Root Certificate PEM File**: SSL Trusted Root Certificate File (PEM Encoded).
   - **SSL Server Certificate PEM File**: SSL Server Certificate File (PEM Encoded).
   - **SSL DH Weak Encryption Parameter PEM File**: SSL Diffie-Hellman Weak Encryption Parameter File (PEM Encoded).
   - **SSL DH Strong Encryption Parameter PEM File**: SSL Diffie-Hellman Strong Encryption Parameter File (PEM Encoded).

2. If you are downloading an GS716T and GS724T image (Code), select the image on the switch to overwrite. This field is only visible when Code is selected as the File Type.

**Note:** It is recommended that you not overwrite the active image. The system will display a warning that you are trying to overwrite the active image.

3. Click **Browse** to open a file upload window to locate the file you want to download.
4. Click **Cancel** to cancel the operation on the screen and reset the data on the screen to the latest value of the switch.
5. Click the **Apply** button to initiate the file download.

**Note:** After a file transfer is started, please wait until the page refreshes. When the page refreshes, the *Select File* option will be blanked out. This indicates that the file transfer is done.

# File Management

The system maintains two versions of the GS716T and GS724T software in permanent storage. One image is the active image, and the second image is the backup image. The active image is loaded during subsequent switch restarts. This feature reduces switch down time when upgrading or downgrading the GS716T and GS724T software.

The **File Management** menu contains links to the following options:

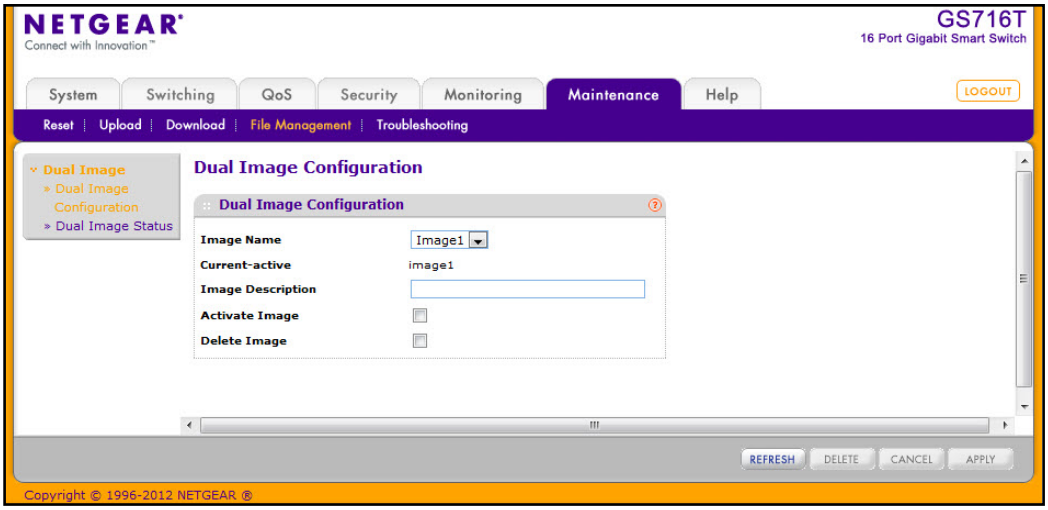
- *Dual Image Configuration* on page 261
- *Dual Image Status* on page 263

## Dual Image Configuration

The system running a legacy software version will ignore (not load) a configuration file created by the newer software version. When a configuration file created by the newer software version is discovered by the system running an older version of the software, the system will display an appropriate warning to the user.

Use the Dual Image Configuration page to set the boot image, configure an image description, or delete an image.

To display the Dual Image Configuration page, click **Maintenance** > **File Management** > **Dual Image** > **Dual Image Configuration**.




To configure Dual Image settings:

1. Select the image to configure.

   The **Current-active** field displays the name of the active image.
2. To configure a descriptive name for the selected software image, type the name in the **Image Description** field.
3. To set the selected image as the active image, select the **Active Image** check box.

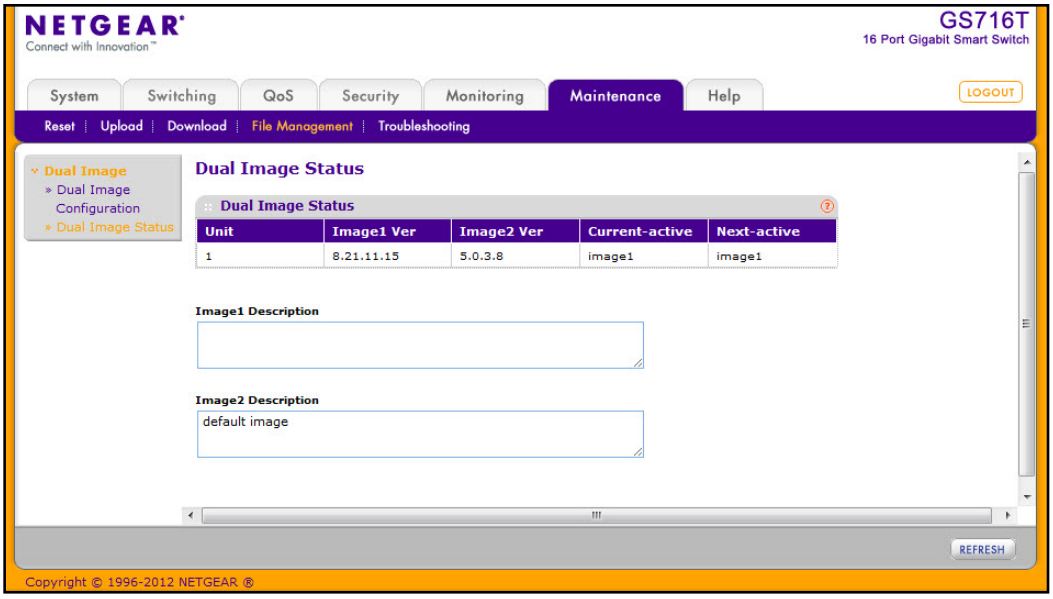
> **Note:** After activating an image, you must perform a system reset of the switch in order to run the new code.

4. To remove the selected image from permanent storage on the switch, select the **Delete Image** check box. You cannot delete the active image.
5. Click **Cancel** to cancel the operation on the screen and reset the data on the screen to the latest value of the switch.
6. Click **Apply** to apply the settings to the switch.

# Dual Image Status

You can use the Dual Image Status page to view information about the system images on the device.

To display the Dual Image Status page, click **Maintenance > File Management** > **Dual Image** > **Dual Image Status**.




The following table describes the information on the Dual Image Status page.

| Field | Description |
|---|---|
| Unit | The unit ID of the switch is always 1. |
| Image1 Ver | Displays the version of the image1 code file. |
| Image2 Ver | Displays the version of the image2 code file. |
| Current-active | Displays the currently active image on this switch. |
| Next-active | Displays the image to be used on the next restart of this switch. |
| Image1 Description | Displays the description associated with the image1 code file. |
| Image2 Description | Displays the description associated with the image2 code file. |

Click **Refresh** to display the latest information from the switch.

For information about how to update or change the system images, see *File Management* on page 261.

# Troubleshooting

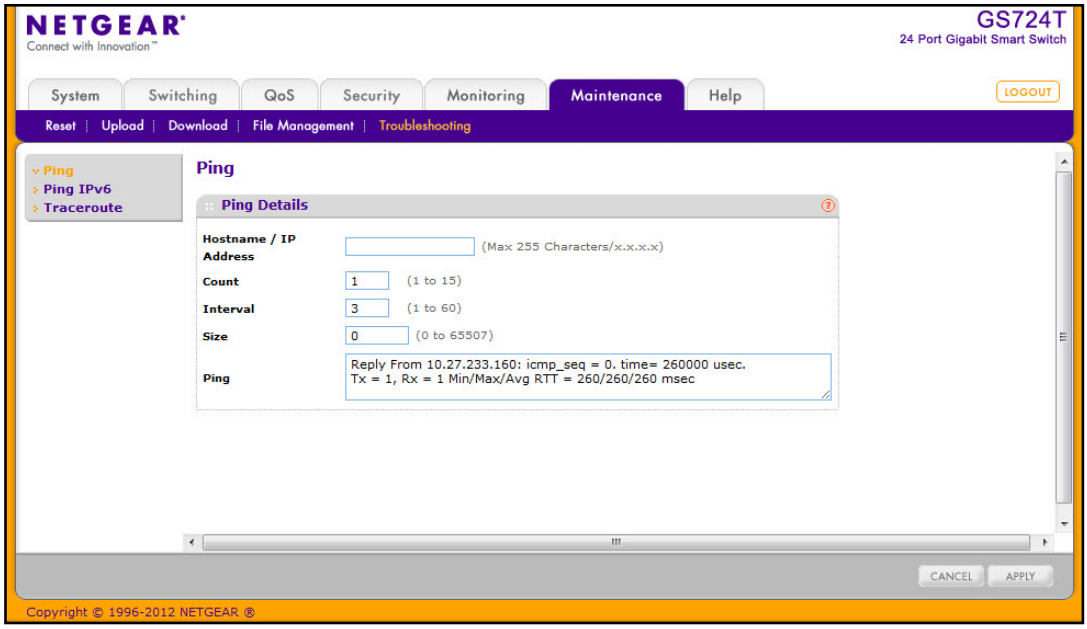
The **Troubleshooting** menu contains links to the following options:

- *Ping* on page 264
- *Ping IPv6* on page 266
- *Traceroute* on page 267

## Ping

Use the Ping page to tell the switch to send a Ping request to a specified IP address. You can use this feature to check whether the switch can communicate with a particular network host.

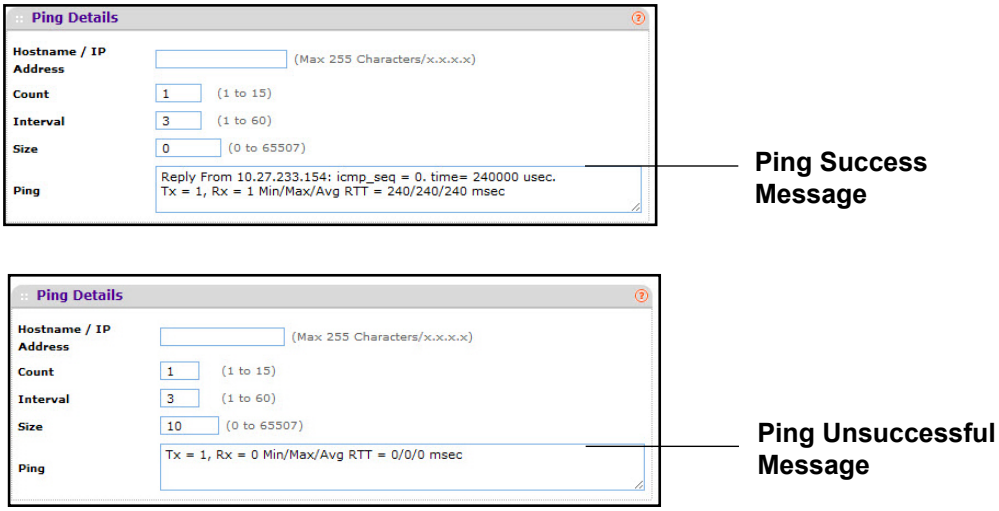
To access the Ping page, click **Maintenance** > **Troubleshooting** > **Ping**.




To configure the settings and ping a host on the network:

1. In the **Hostname/IP Address** field, specify the IP address or the hostname of the station you want the switch to ping. The initial value is blank. This information is not retained across a power cycle.
2. Optionally, configure the following settings:
   - **Count**. Specify the number of pings to send. The valid range is 1–15.
   - **Interval**. Specify the number of seconds between pings sent. The valid range is 1–60.
   - **Size**. Specify the size of the ping (ICMP) packet to send. The valid range is 0–65507.
3. Click **Cancel** to cancel the operation on the screen and reset the data on the screen to the latest value of the switch.

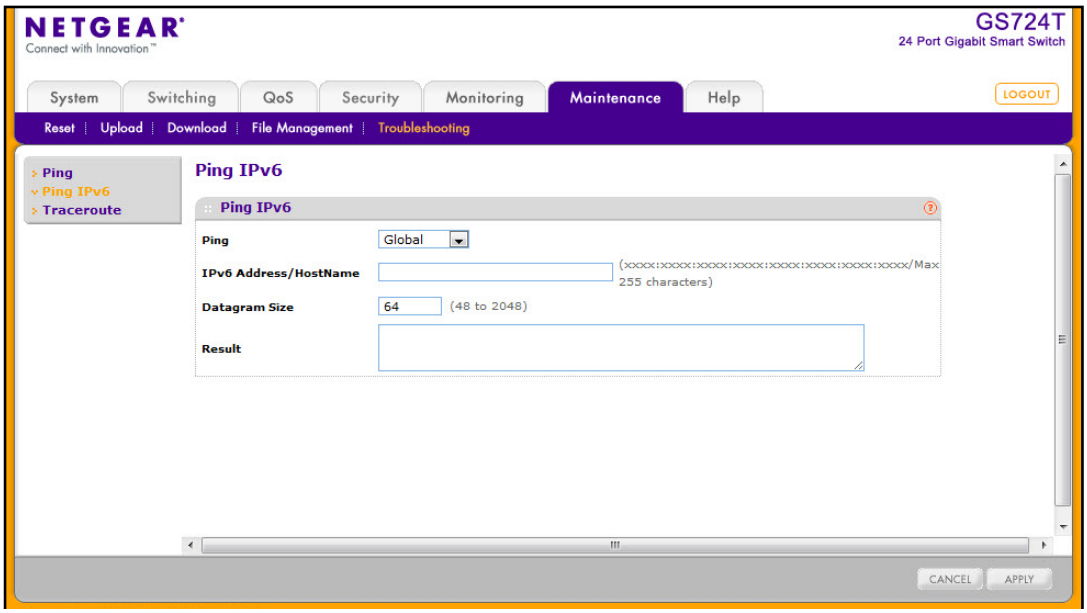
4. Click **Apply** to send the ping. The switch sends the number of pings specified in the **Count** field, and the results are displayed below the configurable data in the **Ping** area.
   - If successful, you will see “Reply From IP/Host: icmp_seq = 0. time = xx usec. Tx = x, Rx = x Min/Max/Avg RTT = x/x/x msec.”
   - If a reply to the ping is not received, you will see “Reply From IP/Host: Destination Unreachable. Tx = x, Rx = 0 Min/Max/Avg RTT = 0/0/0 msec”.



# Ping IPv6

Use the Ping IPv6 page to send a Ping request to a specified Hostname or IPv6 address. You can use this to check whether the switch can communicate with a particular IPv6 station. When you click the **Apply** button, the switch will send three pings and the results will be displayed below the configurable data.

To access the Ping IPv6 page, click **Maintenance** > **Troubleshooting** > **Ping IPv6**.




To configure the settings and ping a host on the network:

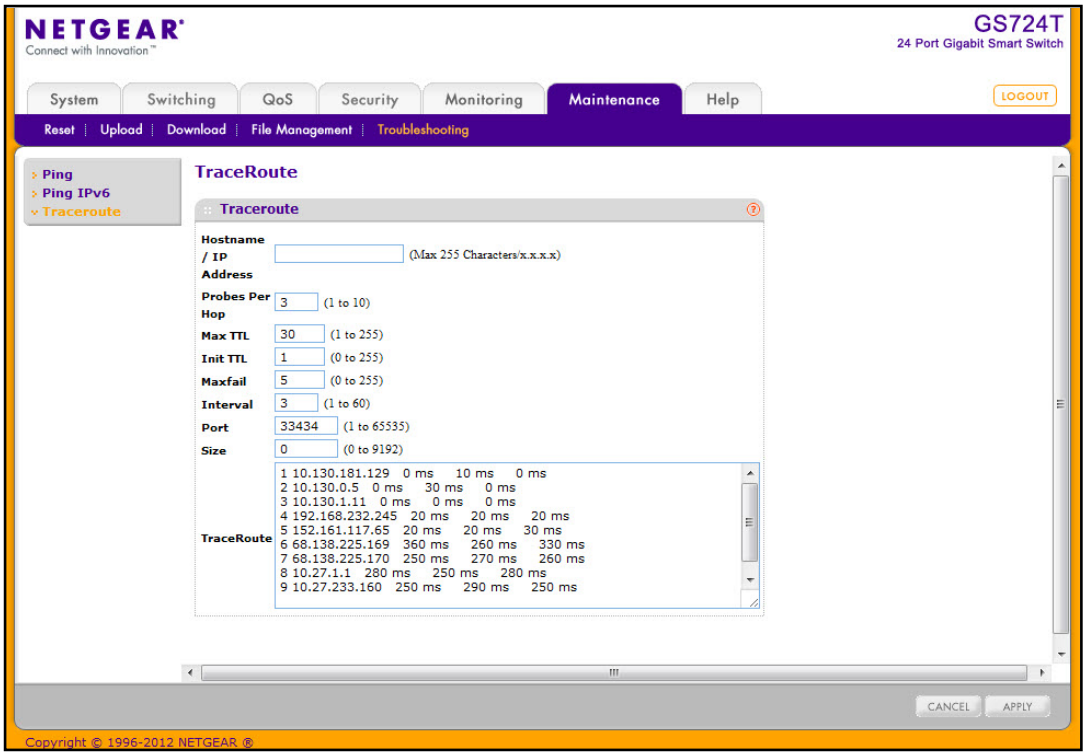
1. In the **Ping** field, select either Global or Link Global to select either the global IPv6 Address/Hostname or Link Local Address to ping.
2. In the **Hostname/IP Address** field, specify the IP address or the hostname of the station you want the switch to ping. The initial value is blank. This information is not retained across a power cycle.
3. Optionally, configure the following settings:
   - **Link Local Address**. Enter the link local address of the station you want the switch to ping. The initial value is blank. The Link Local Address you enter is not retained across a power cycle.
   - **IPv6 Address/Hostname**. Enter the IPv6 address or Hostname of the station you want the switch to ping. The initial value is blank. The IPv6 Address or Hostname you enter is not retained across a power cycle.
   - **Datagram Size**. Enter the datagram size. The valid range is 48–2048.
4. Click **Cancel** to cancel the operation on the screen and reset the data on the screen to the latest value of the switch.

5. Click **Apply** to send the ping. The switch sends the number of pings specified in the **Count** field, and the results are displayed below the configurable data in the **Result** area.
   - If successful, the output will be Send count=3, Receive count = *n* from (IPv6 Address).Average round trip time = *n* ms.
   - If a reply to the ping is not received, the following displays: “Reply From IP/Host: Destination Unreachable. Tx = x, Rx = 0 Min/Max/Avg RTT = 0/0/0 msec”.

## Traceroute

Use the Traceroute utility to discover the paths that a packet takes to a remote destination.

To display this page, click **Maintenance** > **Troubleshooting** > **Traceroute**.




To configure the Traceroute settings and send probe packets to discover the route to a host on the network:

1. In the **Hostname/IP Address** field, specify the IP address or the hostname of the station you want the switch to ping. The initial value is blank. This information is not retained across a power cycle.
2. Optionally, configure the following settings:
   - **Probes Per Hop**. Specify the number of times each hop should be probed. The valid range is 1–10.
   - **MaxTTL**. Specify the maximum time-to-live for a packet in number of hops. The valid range is 1–255.

- **InitTTL**. Specify the initial time-to-live for a packet in number of hops. The valid range is 0– 255.
- **MaxFail**. Specify the maximum number of failures allowed in the session. The valid range is 0–255.
- **Interval**. Specify the time between probes in seconds. The valid range is 1–60.
- **Port**. Specify the UDP destination port in probe packets. The valid range is 1–65535.
- **Size**. Specify the size of probe packets. The valid range is 0–9192.

3. Click **Cancel** to cancel the operation on the screen and reset the data on the screen to the latest value of the switch.
4. Click **Apply** to initiate the traceroute. The results display in the TraceRoute area.

# 8 Help

Use the features available from the Help tab to connect to online resources for assistance. The **Help** tab contains links to the following features:

- *Online Help* on page 269.
- *Registration* on page 271

## Online Help

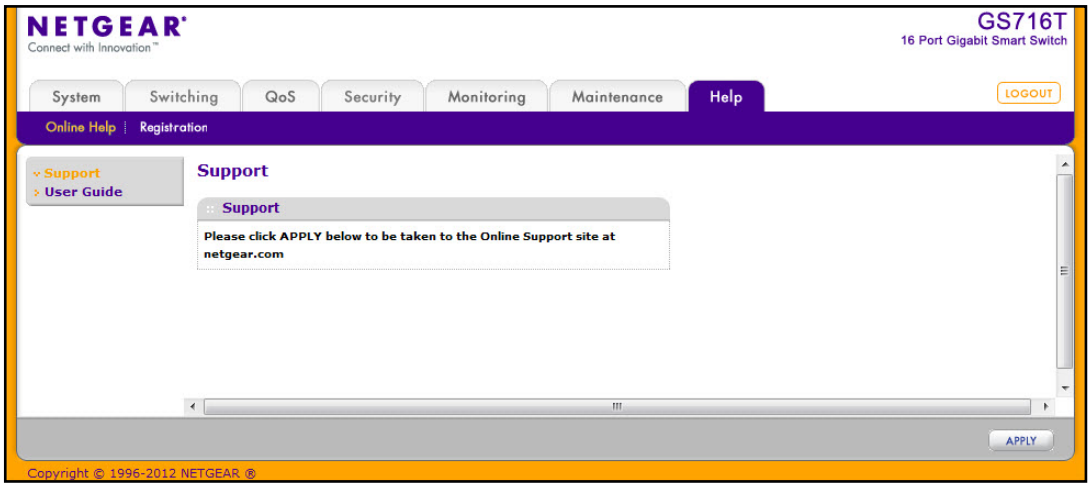
The Online Help includes the following pages:

- *Support* on page 269
- *User Guide* on page 270

### Support

Use the Support page to connect to the Online Support site at netgear.com.

To access the Support page, click **Help** > **Support**.

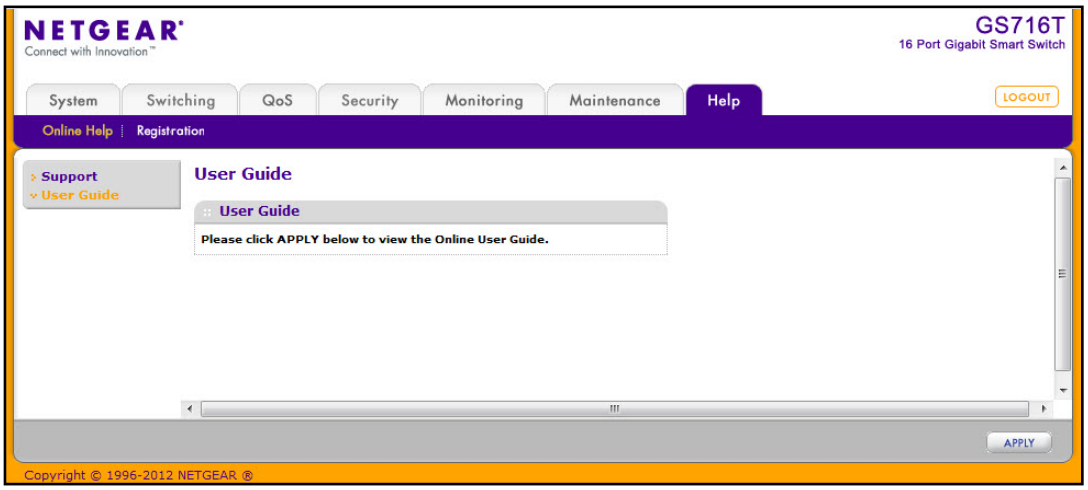



To connect to the NETGEAR support site for the GS716T and GS724T, click **Apply**.

# User Guide

Use the User Guide page to access the *GS716Tv2 and GS724Tv3 Software Administration Manual* (the guide you are now reading) that is available on the NETGEAR Website.

To access the User Guide page, click **Help** > **User Guide**.



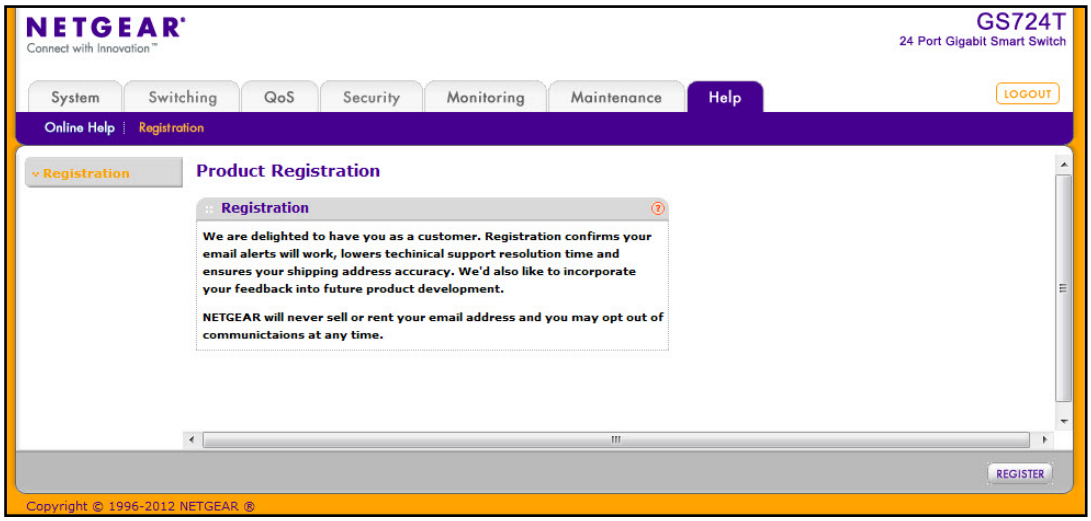

To access to the User Guide that is available online, click **Apply**.

# Registration

Use the Registration page to register your GS716T or GS724T switch. Completing the registration confirms your email address, lowers technical support resolution time, and ensures your shipping address accuracy. NETGEAR, Inc. would also like to incorporate your feedback into future product development.

**Note:** NETGEAR will never sell or rent your email address, and you may opt out of communications at any time.

To access the Registration page, click **Help** > **Registration**.



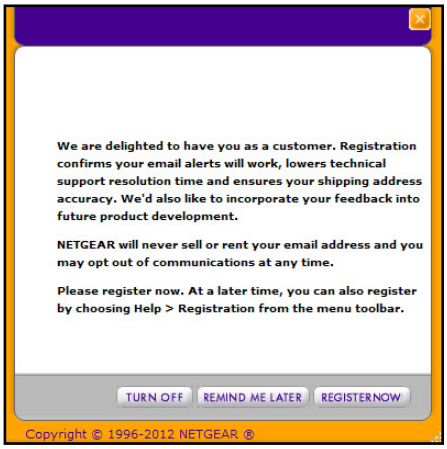

To register the switch, click **Register**. The switch attempts to contact the NETGEAR Registration Server.

For the product registration process to proceed, the administrative system running the browser must meet the following requirements:

- The administrative system must have Internet access.
- The browser must allow pop up windows.
- If the browser is Microsoft® Internet Explorer, ActiveX must be enabled.

If the switch successfully contacts the Registration Server, the NETGEAR Product Registration page opens in a new browser window. The product serial number and model number fields are pre populated. After you provide some basic information and click **Register**, the registration process is complete.

If you have not registered the product or have not disabled the registration reminders, the following pop-up window appears each time a user successfully logs on to the switch:




The registration pop-up window includes the following buttons:

- **TURN OFF**. Use this button to turn off the Product Registration feature and to prevent the registration reminder pop-up window from appearing on subsequent successful login sessions.
- **REMIND ME LATER**. The pop-up window is closed without taking any action, and the registration reminder pop-up appears on next successful login.
- **REGISTER NOW**. The NETGEAR Registration Server is contacted to initiate the registration process.

# Hardware Specifications and Default Values

A

## GS716T and GS724T Gigabit Smart Switches Specifications

The GS716T and GS724T Gigabit Smart Switches conform to the TCP/IP, UDP, HTTP, ICMP, TFTP, DHCP, IEEE 802.1D, IEEE 802.1p, and IEEE 802.1Q standards.

### GS716T Specifications

| Feature | Value |
|---|---|
| Interfaces | 16 10/100/1000 Ethernet ports |
| Flash memory size | 16 MB |
| SRAM size and type | 64 MB DDR |

### GS724T Specifications

| Feature | Value |
|---|---|
| Interfaces | 24 10/100/1000 Ethernet ports<br>Two 1000M SFP Gigabit Ethernet ports |
| Flash memory size | 16 MB |
| SRAM size and type | 64 MB DDR |

## GS716T and GS724T Switch Performance

| Feature | Value |
|---|---|
| Switching capacity | Non-Blocking Full WireSpeed on all packet sizes |
| Forwarding method | Store and Forward |
| Packet forwarding rate | 10M:14,880 pps/<br>100M:148,810 pps/<br>1G:1,488,000 pps |
| MAC addresses | 4K |
| Green Ethernet | Power consumption savings by cable length (<10m)<br>Automatic power down on port when link is down |

# GS716T and GS724T Switch Features and Defaults

## Port Characteristics

| Feature | Sets Supported | Default |
|---|---|---|
| Auto negotiation/static speed/duplex | All ports | Auto negotiation |
| Auto MDI/MDIX | N/A | Enabled |
| 802.3x flow control/back pressure | 1 (per system) | Disabled |
| Port mirroring | 1 | Disabled |
| Port trunking (aggregation) | 4 | Pre-configured |
| 802.1D spanning tree | 1 | Disabled |
| 802.1w RSTP | 1 | Disabled |
| 802.1s spanning tree | 3 instances | Disabled |
| Static 802.1Q tagging | 64 | VID = 1 |
| Learning process | Supports Static and dynamic MAC entries | Dynamic learning is enabled by default |

# Traffic Control

| Feature | Sets Supported | Default |
|---|---|---|
| Storm control | All ports | Disabled |
| Jumbo frame | All ports | Disabled<br>Max = 9216 bytes |

# Quality Of Service

| Feature | Sets Supported | Default |
|---|---|---|
| Number of queues | 4 | N/A |
| Port based | N/A | N/A |
| 802.1p | 1 | Enabled |
| DSCP | 1 | Disabled |
| Rate limiting | All ports | Disabled |
| Auto-QoS | All ports | Disabled |

# Security

| Feature | Sets Supported | Default |
|---|---|---|
| 802.1X | All ports | Disabled |
| MAC ACL | 100 (Shared with IPv4/IPv6 ACLs) | All MAC packets allowed |
| IPv4 access list | 100 (shared with MAC ACL, IPv6 ACL) | All IP packets allowed |
| IPv6 access list | 100 (shared with MAC ACL, IPv6 ACLs) | All IPv6 packets allowed |
| Password control access | 1 | Idle timeout = 5 mins.<br>Password = “password” |
| Management security | 1 profile with 20 rules for HTTP/HTTPS/SNMP access to allow/deny an IP address/subnet | All IP addresses allowed |
| Port MAC lock down | All ports | Disabled |

# System Setup

| Feature | Sets Supported | Default |
|---|---|---|
| Boot code update | 1 | N/A |
| DHCP/manual IP | 1 | DHCP enabled/192.168.0.239 |
| Default gateway | 1 | 192.168.0.254 |
| System name configuration | 1 | NULL |
| Configuration save/restore | 1 | N/A |
| Firmware upgrade | 1 | N/A |
| Restore defaults | 1 (Web and front-panel button) | N/A |
| Dual image support | 1 | Enabled |
| Factory reset | 1 | N/A |

# Management

| Feature | Sets Supported | Default |
|---|---|---|
| Multi-session Web connections | 16 | Enabled |
| SNMPv1/V2c<br>SNMP v3 | Max 5 community entries | Enabled (read, read-write communities) |
| Time control | 1 (Local or SNTP) | Local Time enabled |
| LLDP/LLDP-MED | All ports | Disabled |
| Logging | 3 (Memory/Flash/Server) | Memory Log enabled |
| MIB support | 1 | Disabled |
| Smart Control Center | N/A | Enabled |
| Statistics | N/A | N/A |
| IPv6 management (IPv6 networking, DHCPv6, IPv6 DNS host, IPv6 ping, etc.) | N/A | N/A |

# Other Features

| Feature | Sets Supported | Default |
|---|---|---|
| IGMP snooping v1/v2 | All ports | Disabled |
| Configurations upload/download | 1 | N/A |
| EAPoL flooding | All ports | Disabled |
| BPDU flooding | All ports | Disabled |
| Static multicast groups | 8 | Disabled |
| Filter multicast control | 1 | Disabled |

# Configuration Examples

# B

This chapter contains information about how to configure the following features:



## Virtual Local Area Networks (VLANs)

A local area network (LAN) can generally be defined as a broadcast domain. Hubs, bridges, or switches in the same physical segment or segments connect all end node devices. End nodes can communicate with each other without the need for a router. Routers connect LANs together, routing the traffic to the appropriate port.

A virtual LAN (VLAN) is a local area network with a definition that maps workstations on some basis other than geographic location (for example, by department, type of user, or primary application). To enable traffic to flow between VLANs, traffic must go through a router, just as if the VLANs were on two separate LANs.

A VLAN is a group of PCs, servers, and other network resources that behave as if they were connected to a single network segment—even though they might not be. For example, all marketing personnel might be spread throughout a building. Yet if they are all assigned to a single VLAN, they can share resources and bandwidth as if they were connected to the same segment. The resources of other departments can be invisible to the marketing VLAN members, accessible to all, or accessible only to specified individuals, depending on how the IT manager has set up the VLANs.

VLANs have a number of advantages:

- It is easy to do network segmentation. Users that communicate most frequently with each other can be grouped into common VLANs, regardless of physical location. Each group's traffic is contained largely within the VLAN, reducing extraneous traffic and improving the efficiency of the whole network.
- They are easy to manage. The addition of nodes, as well as moves and other changes, can be dealt with quickly and conveniently from a management interface rather than from the wiring closet.
- They provide increased performance. VLANs free up bandwidth by limiting node-to-node and broadcast traffic throughout the network.
- They ensure enhanced network security. VLANs create virtual boundaries that can be crossed only through a router. So standard, router-based security measures can be used to restrict access to each VLAN.

Packets received by the switch are treated in the following way:

- When an untagged packet enters a port, it is automatically tagged with the port's default VLAN ID tag number. Each port has a default VLAN ID setting that is user configurable (the default setting is 1). The default VLAN ID setting for each port can be changed in the Port PVID Configuration screen. See *Port VLAN ID Configuration* on page 92.
- When a tagged packet enters a port, the tag for that packet is unaffected by the default VLAN ID setting. The packet proceeds to the VLAN specified by its VLAN ID tag number.
- If the port through which the packet entered does not have membership with the VLAN specified by the VLAN ID tag, the packet is dropped.
- If the port is a member of the VLAN specified by the packet's VLAN ID, the packet can be sent to other ports with the same VLAN ID.
- Packets leaving the switch are either tagged or untagged, depending on the setting for that port's VLAN membership properties. A U for a given port means that packets leaving the switch from that port are untagged. Inversely, a T for a given port means that packets leaving the switch from that port are tagged with the VLAN ID that is associated with the port.

The example given in this section comprises numerous steps to illustrate a wide range of configurations to help provide an understanding of tagged VLANs.

# VLAN Example Configuration

This example demonstrates several scenarios of VLAN use and describes how the switch handles tagged and untagged traffic.

In this example, you create two new VLANs, change the port membership for default VLAN 1, and assign port members to the two new VLANs:

1. In the Basic VLAN Configuration screen (see *VLAN Configuration* on page 89), create the following VLANs:
   - A VLAN with VLAN ID 10.
   - A VLAN with VLAN ID 20.
2. In the VLAN Membership screen (see *VLAN Membership Configuration* on page 90) specify the VLAN membership as follows:
   - For the default VLAN with VLAN ID 1, specify the following members: port 7 (U) and port 8 (U).
   - For the VLAN with VLAN ID 10, specify the following members: port 1 (U), port 2 (U), and port 3 (T).
   - For the VLAN with VLAN ID 20, specify the following members: port 4 (U), port 5 (T), and port 6 (U).
3. In the Port PVID Configuration screen (see *Port VLAN ID Configuration* on page 92), specify the PVID for ports g1 and g4 so that packets entering these ports are tagged with the port VLAN ID:
   - Port g1: PVID 10
   - Port g4: PVID 20
4. With the VLAN configuration that you set up, the following situations produce results as described:
   - If an untagged packet enters port 1, the switch tags it with VLAN ID 10. The packet has access to port 2 and port 3. The outgoing packet is stripped of its tag to leave port 2 as an untagged packet. For port 3, the outgoing packet leaves as a tagged packet with VLAN ID 10.
   - If a tagged packet with VLAN ID 10 enters port 3, the packet has access to port 1 and port 2. If the packet leaves port 1 or port 2, it is stripped of its tag to leave the switch as an untagged packet.
   - If an untagged packet enters port 4, the switch tags it with VLAN ID 20. The packet has access to port 5 and port 6. The outgoing packet is stripped of its tag to become an untagged packet as it leaves port 6. For port 5, the outgoing packet leaves as a tagged packet with VLAN ID 20.

# Access Control Lists (ACLs)

ACLs ensure that only authorized users have access to specific resources while blocking off any unwarranted attempts to reach network resources.

ACLs are used to provide traffic flow control, restrict contents of routing updates, decide which types of traffic are forwarded or blocked, and provide security for the network. ACLs are normally used in firewall routers that are positioned between the internal network and an external network, such as the Internet. They can also be used on a router positioned between two parts of the network to control the traffic entering or exiting a specific part of the internal network. The added packet processing required by the ACL feature does not affect switch performance. That is, ACL processing occurs at wire speed.

Access lists are a sequential collection of permit and deny conditions. This collection of conditions, known as the filtering criteria, is applied to each packet that is processed by the switch or the router. The forwarding or dropping of a packet is based on whether or not the packet matches the specified criteria.

Traffic filtering requires the following two basic steps:

1. Create an access list definition.

   The access list definition includes rules that specify whether traffic matching the criteria is forwarded normally or discarded. Additionally, you can assign traffic that matches the criteria to a particular queue or redirect the traffic to a particular port. A default *deny all* rule is the last rule of every list.

2. Apply the access list to an interface in the inbound direction.

The GS716T and GS724T Smart Switches allows ACLs to be bound to physical ports and LAGs.The switch software supports MAC ACLs and IP ACLs.

## MAC ACL Example Configuration

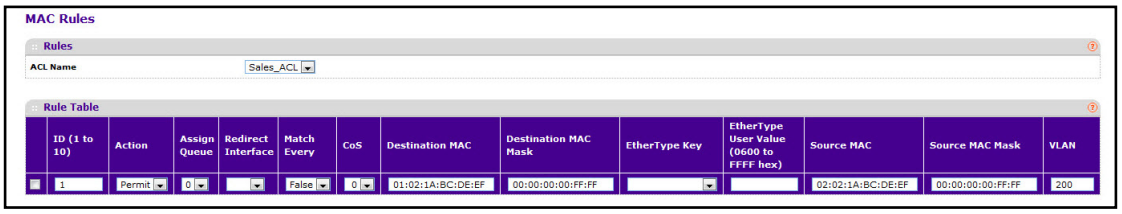
The following example shows how to create a MAC-based ACL that permits Ethernet traffic from the Sales department on specified ports and denies all other traffic on those ports.

1. From the MAC ACL screen, create an ACL with the name Sales_ACL for the Sales department of your network (See *MAC ACL* on page 211).

   By default, this ACL will be bound on the inbound direction, which means the switch will examine traffic as it enters the port.

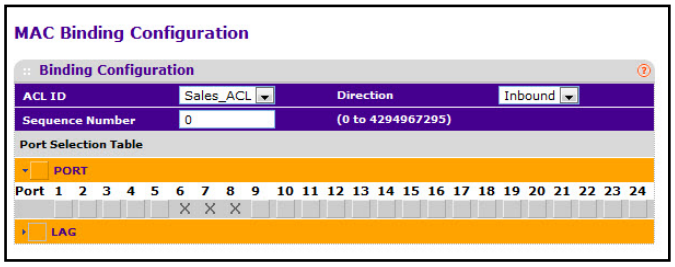
2. From the MAC Rules screen, create a rule for the Sales_ACL with the following settings:
   - ID: 1
   - Action: Permit
   - Assign Queue: 0
   - Match Every: False
   - CoS: 0
   - Destination MAC: 01:02:1A:BC:DE:EF

- Destination MAC Mask: 00:00:00:00:FF:FF
- Source MAC: 02:02:1A:BC:DE:EF
- Source MAC Mask: 00:00:00:00:FF:FF
- VLAN ID: 200




For detailed information about MAC ACL rules, see *MAC Rules* on page 212.

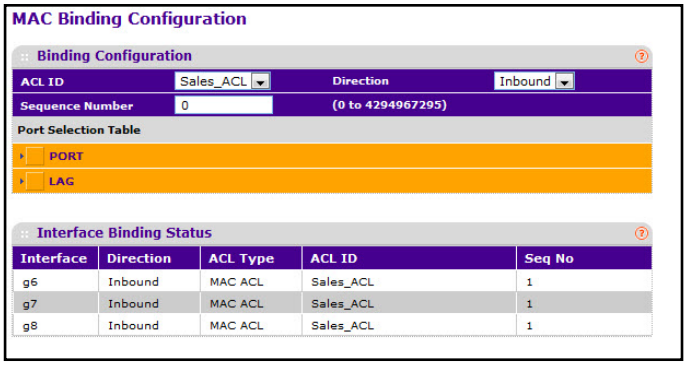
3. From the MAC Binding Configuration screen, assign the Sales_ACL to Ethernet ports 6, 7, and 8, and then click **Apply** (See *MAC Binding Configuration* on page 214).




You can assign an optional sequence number to indicate the order of this access list relative to other access lists if any are already assigned to this interface and direction.

4. Click **Apply** (See *MAC Binding Configuration* on page 214).

   The MAC Binding Table displays the interface and MAC ACL binding information (See *MAC Binding Table* on page 215).




The ACL named Sales_ACL looks for Ethernet frames with destination and source MAC addresses and MAC masks defined in the rule. Also, the frame must be tagged with VLAN ID 2, which is the Sales department VLAN. The CoS value of the frame must be 0, which is the default value for Ethernet frames. Frames that match this criteria are permitted on interfaces 6, 7, and 8 and are assigned to the hardware egress queue 0, which is the default queue. All other traffic is explicitly denied on these interfaces. To allow additional traffic to enter these ports, you must add a new *permit* rule with the desired match criteria and bind the rule to interfaces 6, 7, and 8.

## Standard IP ACL Example Configuration

The following example shows how to create an IP-based ACL that prevents any IP traffic from the Finance department from being allowed on the ports that are associated with other departments. Traffic from the Finance department is identified by each packet's network IP address.

1. From the IP ACL screen, create a new IP ACL with an IP ACL ID of 1 (See *IP ACL* on page 216).
2. From the IP Rules screen, create a rule for IP ACL 1 with the following settings:
   - Rule ID: 1
   - Action: Deny
   - Assign Queue ID: 0 (optional: 0 is the default value)
   - Match Every: False
   - Source IP Address: 192.168.187.0
   - Source IP Mask: 255.255.255.0

   For additional information about IP ACL rules, see *IP Rules* on page 217.
3. Click **Add**.

4. From the IP Rules screen, create a second rule for IP ACL 1 with the following settings:
   - Rule ID: 2
   - Action: Permit
   - Match Every: True
5. Click **Add**.
6. From the IP Binding Configuration page, assign ACL ID 1 to the Ethernet ports 2, 3, and 4, and assign a sequence number of 1 (See *IP Binding Configuration* on page 226).

   By default, this IP ACL is bound on the inbound direction, so it examines traffic as it enters the switch.
7. Click **Apply**.
8. Use the IP Binding Table screen to view the interfaces and IP ACL binding information (See *IP Binding Table* on page 227).

The IP ACL in this example matches all packets with the source IP address and subnet mask of the Finance department's network and deny it on the Ethernet interfaces 2, 3, and 4 of the switch. The second rule permits all non-Finance traffic on the ports. The second rule is required because there is an explicit *deny all* rule as the lowest priority rule.

# Differentiated Services (DiffServ)

Standard IP-based networks are designed to provide *best effort* data delivery service. *Best effort* service implies that the network deliver the data in a timely fashion, although there is no guarantee that it will. During times of congestion, packets may be delayed, sent sporadically, or dropped. For typical Internet applications, such as e-mail and file transfer, a slight degradation in service is acceptable and in many cases unnoticeable. However, any degradation of service has undesirable effects on applications with strict timing requirements, such as voice or multimedia.

Quality of Service (QoS) can provide consistent, predictable data delivery by distinguishing between packets that have strict timing requirements from those that are more tolerant of delay. Packets with strict timing requirements are given special treatment in a QoS-capable network. With this in mind, all elements of the network must be QoS-capable. If one node is unable to meet the necessary timing requirements, this creates a deficiency in the network path and the performance of the entire packet flow is compromised.

There are two basic types of QoS:

- **Integrated Services**: network resources are apportioned based on request and are reserved (resource reservation) according to network management policy (RSVP, for example).
- **Differentiated Services**: network resources are apportioned based on traffic classification and priority, giving preferential treatment to data with strict timing requirements.

The GS716T and GS724T Smart Switches supports DiffServ.

The DiffServ feature contains a number of conceptual QoS building blocks you can use to construct a differentiated service network. Use these same blocks in different ways to build other types of QoS architectures.

There are 3 key QoS building blocks needed to configure DiffServ:

- Class
- Policy
- Service (i.e., the assignment of a policy to a directional interface)

## Class

You can classify incoming packets at layers 2, 3, and 4 by inspecting the following information for a packet:

- Source/destination MAC address
- EtherType
- Class of Service (802.1p priority) value (first/only VLAN tag)
- VLAN ID range (first/only VLAN tag)
- IP Service Type octet (also known as: ToS bits, Precedence value, DSCP value)
- Layer 4 protocol (TCP, UDP etc.)
- Layer 4 source/destination ports
- Source/destination IP address

From a DiffServ point of view, there are two types of classes:

- DiffServ traffic classes
- DiffServ service levels/forwarding classes

## DiffServ Traffic Classes

With DiffServ, you define which traffic classes to track on an ingress interface. You can define simple BA classifiers (DSCP) and a wide variety of multifield (MF) classifiers:

- Layer 2; Layers 3, 4 (IP only)
- Protocol-based
- Address-based

You can combine these classifiers with logical AND or OR operations to build complex MF-classifiers (by specifying a class type of *all* or *any*, respectively). That is, within a single class, multiple match criteria are grouped together as an AND expression or a sequential OR expression, depending on the defined class type. Only classes of the same type can be nested; class nesting does not allow for the negation (i.e., *exclude* option) of the referenced class.

To configure DiffServ, you must define service levels, namely the forwarding classes/PHBs identified by a given DSCP value, on the egress interface. These service levels are defined by configuring BA classes for each.

# Creating Policies

Use DiffServ policies to associate a collection of classes that you configure with one or more QoS policy statements. The result of this association is referred to as a policy.

From a DiffServ perspective, there are two types of policies:

- **Traffic Conditioning Policy**: a policy applied to a DiffServ traffic class
- **Service Provisioning Policy**: a policy applied to a DiffServ service level

You must manually configure the various statements and rules used in the traffic conditioning and service provisioning policies to achieve the desired Traffic Conditioning Specification (TCS) and the Service Level Specification (SLS) operation, respectively.

## *Traffic Conditioning Policy*

Traffic conditioning pertains to actions performed on incoming traffic. There are several distinct QoS actions associated with traffic conditioning:

- **Dropping**: drop a packet upon arrival. This is useful for emulating access control list operation using DiffServ, especially when DiffServ and ACL cannot co-exist on the same interface.
- **Marking IP DSCP or IP Precedence**: marking/re-marking the DiffServ code point in a packet with the DSCP value representing the service level associated with a particular DiffServ traffic class. Alternatively, the IP Precedence value of the packet can be marked/re-marked.
- **Marking CoS (802.1p)**: sets the three-bit priority field in the first/only 802.1p header to a specified value when packets are transmitted for the traffic class. An 802.1p header is inserted if it does not already exist. This is useful for assigning a layer 2 priority level based on a DiffServ forwarding class (i.e., DSCP or IP Precedence value) definition to convey some QoS characteristics to downstream switches which do not routinely look at the DSCP value in the IP header.
- **Policing**: a method of constraining incoming traffic associated with a particular class so that it conforms to the terms of the TCS. Special treatment can be applied to out-of-profile packets that are either in excess of the conformance specification or are non-conformant. The DiffServ feature supports the following types of traffic policing treatments (actions):
  - drop: the packet is dropped
  - mark cos: the 802.1p user priority bits are (re)marked and forwarded
  - mark dscp: the packet DSCP is (re)marked and forwarded
  - mark prec: the packet IP Precedence is (re)marked and forwarded
  - send: the packet is forwarded without DiffServ modification

Color Mode Awareness: Policing in the DiffServ feature uses either *color blind* or *color aware* mode. Color blind mode ignores the coloration (marking) of the incoming packet. Color aware mode takes into consideration the current packet marking when determining the policing outcome. An auxiliary traffic class is used in conjunction with the policing definition to specify a value for one of the 802.1p, IP DSCP, or IP Precedence fields designating the incoming color value to be used as the conforming color. The color of exceeding traffic may be optionally specified as well.

- **Counting**: updating octet and packet statistics to keep track of data handling along traffic paths within DiffServ. In this DiffServ feature, counters are not explicitly configured by the user, but are designed into the system based on the DiffServ policy being created. See the Statistics section of this document for more details.
- **Assigning QoS Queue**: directs traffic stream to the specified QoS queue. This allows a traffic classifier to specify which one of the supported hardware queues are used for handling packets belonging to the class.
- **Redirecting**: forces classified traffic stream to a specified egress port (physical or LAG). This can occur in addition to any marking or policing action. It may also be specified along with a QoS queue assignment.

## DiffServ Example Configuration

To create a DiffServ Class/Policy and attach it to a switch interface, follow these steps:

1. From the QoS Class Configuration screen, create a new class with the following settings:
   - Class Name: Class1
   - Class Type: All

   For more information about this screen, see *Class Configuration* on page 161.
2. Click the Class1 hyperlink to view the DiffServ Class Configuration screen for this class.
3. Configure the following settings for Class1:
   - Protocol Type: UDP
   - Source IP Address: 192.12.1.0
   - Source Mask: 255.255.255.0
   - Source L4 Port: Other, and enter 4567 as the source port value
   - Destination IP Address: 192.12.2.0
   - Destination Mask: 255.255.255.0
   - Destination L4 Port: Other, and enter 4568 as the destination port value

   For more information about this screen, see *Class Configuration* on page 161.
4. Click **Apply**.

5. From the Policy Configuration screen, create a new policy with the following settings:
   - Policy Selector: Policy1
   - Member Class: Class1

   For more information about this screen, see *Policy Configuration* on page 167.
6. Click **Add** to add the new policy.
7. Click the Policy1 hyperlink to view the Policy Class Configuration screen for this policy.
8. Configure the Policy attributes as follows:
   - Assign Queue: 3
   - Policy Attribute: Simple Policy
   - Color Mode: Color Blind
   - Committed Rate: 1000000 Kbps
   - Committed Burst Size: 128 KB
   - Confirm Action: Send
   - Violate Action: Drop

   For additional information about this screen, see *Policy Configuration* on page 167.
9. From the Service Configuration screen, select the check box next to interfaces g7 and g8 to attach the policy to these interfaces, and then click **Apply** (See *Service Configuration* on page 170).

All UDP packet flows destined to the 192.12.2.0 network with an IP source address from the 192.12.1.0 network that have a Layer 4 Source port of 4567 and Destination port of 4568 from this switch on ports 7 and 8 are assigned to hardware queue 3.

On this network, traffic from streaming applications uses UDP port 4567 as the source and 4568 as the destination. This real-time traffic is time sensitive, so it is assigned to a high-priority hardware queue. By default, data traffic uses hardware queue 0, which is designated as a best-effort queue.

Also the *confirmed action* on this flow is to send the packets with a committed rate of 1,000,000 Kbps and burst size of 128 KB. Packets that violate the committed rate and burst size are dropped.

# 802.1X

Local Area Networks (LANs) are often deployed in environments that permit unauthorized devices to be physically attached to the LAN infrastructure, or permit unauthorized users to attempt to access the LAN through equipment already attached. In such environments, it may be desirable to restrict access to the services offered by the LAN to those users and devices that are permitted to use those services.

Port-based network access control makes use of the physical characteristics of LAN infrastructures in order to provide a means of authenticating and authorizing devices attached to a LAN port that has point-to-point connection characteristics and of preventing access to that port in cases in which the authentication and authorization process fails. In this context, a port is a single point of attachment to the LAN, such as ports of MAC bridges and associations between stations or access points in IEEE 802.11 Wireless LANs.

The IEEE 802.11 standard describes an architectural framework within which authentication and consequent actions take place. It also establishes the requirements for a protocol between the authenticator (the system that passes an authentication request to the authentication server) and the supplicant (the system that requests authentication), as well as between the authenticator and the authentication server.

The GS716T and GS724T Smart Switches supports a guest VLAN, which allows unauthenticated users to have limited access to the network resources.

**Note:** You can use QoS features to provide rate limiting on the guest VLAN to limit the network resources the guest VLAN provides.

Another 802.1X feature is the ability to configure a port to Enable/Disable EAPoL packet forwarding support.You can disable or enable the forwarding of EAPoL when 802.1X is disabled on the device.

The ports of an 802.1X authenticator switch provide the means in which it can offer services to other systems reachable via the LAN. Port-based network access control allows the operation of a switch’s ports to be controlled in order to ensure that access to its services is only permitted by systems that are authorized to do so.

Port access control provides a means of preventing unauthorized access by supplicants to the services offered by a system. Control over the access to a switch and the LAN to which it is connected can be desirable in order to restrict access to publicly accessible bridge ports or to restrict access to departmental LANs.

Access control is achieved by enforcing authentication of supplicants that are attached to an authenticator's controlled ports. The result of the authentication process determines whether the supplicant is authorized to access services on that controlled port.

A Port Access Entity (PAE) is able to adopt one of two distinct roles within an access control interaction:

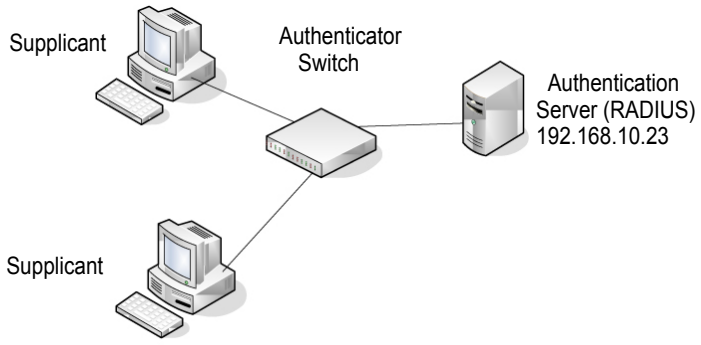
1. **Authenticator**: A Port that enforces authentication before allowing access to services available via that Port.
2. **Supplicant**: A Port that attempts to access services offered by the Authenticator.

Additionally, there exists a third role:

3. **Authentication server**: Performs the authentication function necessary to check the credentials of the Supplicant on behalf of the Authenticator.

All three roles are required in order to complete an authentication exchange.

The GS716T and GS724T Smart Switches supports the Authenticator role only, in which the PAE is responsible for communicating with the Supplicant. The Authenticator PAE is also responsible for submitting the information received from the Supplicant to the Authentication Server in order for the credentials to be checked, which will determine the authorization state of the Port. The Authenticator PAE controls the authorized/unauthorized state of the controlled Port depending on the outcome of the RADIUS-based authentication process.




# 802.1X Example Configuration

This example shows how to configure the switch so that 802.1X-based authentication is required on the ports in a corporate conference room (g1–g8). These ports are available to visitors and need to be authenticated before granting access to the network. The authentication is handled by an external RADIUS server. When the visitor is successfully authenticated, traffic is automatically assigned to the guest VLAN. This example assumes that a VLAN has been configured with a VLAN ID of 150 and VLAN Name of Guest.

1. From the Port Authentication screen, select ports g1 through g8.
2. From the Port Control menu, select Unauthorized.

   The Port Control setting for all other ports where authentication is not needed should Authorized. When the Port Control setting is Authorized, the port is unconditionally put in a force-Authorized state and does not require any authentication. When the Port Control setting is Auto, the authenticator PAE sets the controlled port mode.

3. In the Guest VLAN field for ports g1–g8, enter 150 to assign these ports to the guest VLAN.

   You can configure additional settings to control access to the network through the ports. See *Port Security Interface Configuration* on page 205 for information about the settings.

4. Click **Apply**.
5. From the 802.1X Configuration screen, set the Port Based Authentication State and Guest VLAN Mode to Enable, and then click **Apply** (See *Port Security Configuration* on page 204).

   This example uses the default values for the port authentication settings, but there are several additional settings that you can configure. For example, the EAPOL Flood Mode field allows you to enable the forwarding of EAPoL frames when 802.1X is disabled on the device.

6. From the RADIUS Server Configuration screen, configure a RADIUS server with the following settings:
   - Server Address: 192.168.10.23
   - Secret Configured: Yes
   - Secret: secret123
   - Active: Primary

   For more information, see *RADIUS Configuration* on page 175.

7. Click **Add**.
8. From the Authentication List screen, configure the default List to use RADIUS as the first authentication method (See *Authentication List Configuration* on page 184).

This example enables 802.1X-based port security on the GS716T and GS724T switch and prompts the hosts connected on ports g1–g8 for an 802.1X-based authentication. The switch passes the authentication information to the configured RADIUS server.

# MSTP

Spanning Tree Protocol (STP) runs on bridged networks to help eliminate loops. If a bridge loop occurs, the network can become flooded with traffic. IEEE 802.1s Multiple Spanning Tree Protocol (MSTP) supports multiple instances of Spanning Tree to efficiently channel VLAN traffic over different interfaces. Each instance of the Spanning Tree behaves in the manner specified in IEEE 802.1w, Rapid Spanning Tree, with slight modifications in the working but not the end effect (chief among the effects is the rapid transitioning of the port to the Forwarding state).

The difference between the RSTP and the traditional STP (IEEE 802.1D) is the ability to configure and recognize full duplex connectivity and ports that are connected to end stations, resulting in rapid transitioning of the port to the Forwarding state and the suppression of Topology Change Notification. These features are represented by the parameters *pointtopoint* and *edgeport*. MSTP is compatible to both RSTP and STP. It behaves appropriately to STP and RSTP bridges.

A MSTP bridge can be configured to behave entirely as a RSTP bridge or a STP bridge. So, an IEEE 802.1s bridge inherently also supports IEEE 802.1w and IEEE 802.1D.

The MSTP algorithm and protocol provides simple and full connectivity for frames assigned to any given VLAN throughout a Bridged LAN comprising arbitrarily interconnected networking devices, each operating MSTP, STP or RSTP. MSTP allows frames assigned to different VLANs to follow separate paths, each based on an independent Multiple Spanning Tree Instance (MSTI), within Multiple Spanning Tree (MST) Regions composed of LANs and or MSTP Bridges. These Regions and the other Bridges and LANs are connected into a single Common Spanning Tree (CST). [IEEE DRAFT P802.1s/D13]

MSTP connects all Bridges and LANs with a single Common and Internal Spanning Tree (CIST). The CIST supports the automatic determination of each MST region, choosing its maximum possible extent. The connectivity calculated for the CIST provides the CST for interconnecting these Regions, and an Internal Spanning Tree (IST) within each Region. MSTP ensures that frames with a given VLAN ID are assigned to one and only one of the MSTIs or the IST within the Region, that the assignment is consistent among all the networking devices in the Region and that the stable connectivity of each MSTI and IST at the boundary of the Region matches that of the CST. The stable active topology of the Bridged LAN with respect to frames consistently classified as belonging to any given VLAN thus simply and fully connects all LANs and networking devices throughout the network, though frames belonging to different VLANs can take different paths within any Region, per IEEE DRAFT P802.1s/D13.

All bridges, whether they use STP, RSTP or MSTP, send information in configuration messages via Bridge Protocol Data Units (BPDUs) to assign port roles that determine each port’s participation in a fully and simply connected active topology based on one or more spanning trees. The information communicated is known as the spanning tree priority vector. The BPDU structure for each of these different protocols is different. A MSTP bridge will transmit the appropriate BPDU depending on the received type of BPDU from a particular port.

An MST Region comprises of one or more MSTP Bridges with the same MST Configuration Identifier, using the same MSTIs, and which have no Bridges attached that cannot receive and transmit MSTP BPDUs. The MST Configuration Identifier has the following components:

1. Configuration Identifier Format Selector
2. Configuration Name
3. Configuration Revision Level
4. Configuration Digest: 16-byte signature of type HMAC-MD5 created from the MST Configuration Table (a VLAN ID to MSTID mapping)

As there are Multiple Instances of Spanning Tree, there is a MSTP state maintained on a per-port, per-instance basis (or on a per port per VLAN basis: as any VLAN can be in one and only one MSTI or CIST). For example, port A can be forwarding for instance 1 while discarding for instance 2. The port states have changed since IEEE 802.1D specification.

To support multiple spanning trees, a MSTP bridge has to be configured with an unambiguous assignment of VLAN IDs (VIDs) to spanning trees. This is achieved by:

1. Ensuring that the allocation of VIDs to FIDs is unambiguous.
2. Ensuring that each FID supported by the Bridge is allocated to exactly one Spanning Tree Instance.

The combination of VID to FID and then FID to MSTI allocation defines a mapping of VIDs to spanning tree instances, represented by the MST Configuration Table.

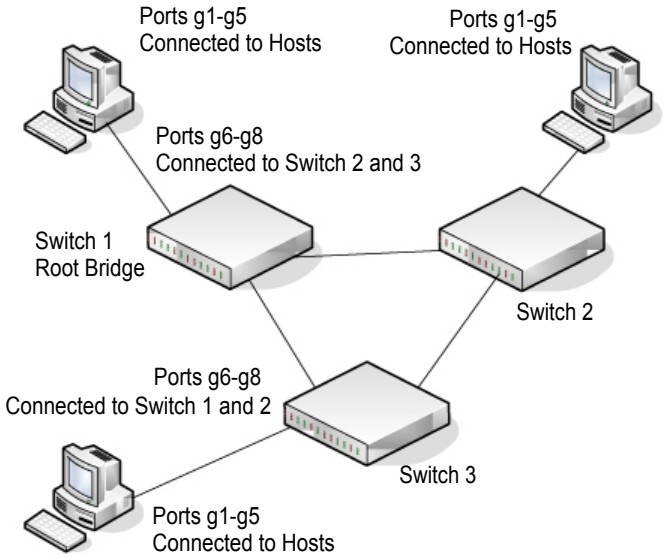
With this allocation we ensure that every VLAN is assigned to one and only one MSTI. The CIST is also an instance of spanning tree with a MSTID of 0.

An instance may occur that has no VIDs allocated to it, but every VLAN must be allocated to one of the other instances of spanning tree.

The portion of the active topology of the network that connects any two bridges in the same MST Region traverses only MST bridges and LANs in that region, and never Bridges of any kind outside the Region, in other words connectivity within the region is independent of external connectivity.

# MSTP Example Configuration

This example shows how to create an MSTP instance from the GS716T and GS724T switch. The example network has three different GS716T and GS724T switches that serve different locations in the network. In this example, ports g1–g5 are connected to host stations, so those links are not subject to network loops. Ports g6–g8 are connected across switches 1, 2, and 3.




Perform the following procedures on each switch to configure MSTP:

1. Use the VLAN Configuration screen to create VLANs 300 and 500 (see *VLAN Configuration* on page 89).
2. Use the VLAN Membership screen to include ports g1–g8 as tagged (T) or untagged (U) members of VLAN 300 and VLAN 500 (see *VLAN Membership Configuration* on page 90).
3. From the STP Configuration screen, enable the Spanning Tree State option (see *STP Switch Configuration* on page 100).
4. In the Configuration Name field on the STP Configuration page, configure the name so that it is the same on each switch, for example netgear-stp. By default, the Configuration Name is the switch MAC address which means that it is unique for each switch.
5. From the CST Configuration screen, set the Bridge Priority value for each of the three switches to force Switch 1 to be the root bridge:
   - Switch 1: 4096
   - Switch 2: 12288
   - Switch 3: 20480

**Note:** Bridge priority values are multiples of 4096.

If you do not specify a root bridge and all switches have the same Bridge Priority value, the switch with the lowest MAC address is elected as the root bridge (see *CST Configuration* on page 102).

6. From the CST Port Configuration screen, select ports g1–g8 and select Enable from the STP Status menu (see *CST Port Configuration* on page 103).
7. Click **Apply**.
8. Select ports g1–g5 (edge ports), and select Enable from the Fast Link menu.

   Since the edge ports are not at risk for network loops, ports with Fast Link enabled transition directly to the Forwarding state.
9. Click **Apply**.

   You can use the CST Port Status screen to view spanning tree information about each port.
10. From the MST Configuration screen, create a MST instances with the following settings:
    - MST ID: 1
    - Priority: Use the default (32768)
    - VLAN ID: 300

    For more information, see *MST Configuration* on page 107.
11. Click **Add**.
12. Create a second MST instance with the following settings
    - MST ID: 2
    - Priority: 49152
    - VLAN ID: 500
13. Click **Add**.

In this example, assume that Switch 1 has become the Root bridge for the MST instance 1, and Switch 2 has become the Root bridge for MST instance 2. Switch 3 has hosts in the Sales department (ports g1, g2, and g3) and in the HR department (ports g4 and g5). Switches 1 and 2 also have hosts in the Sales and Human Resources departments. The hosts connected from Switch 2 use VLAN 500, MST instance 2 to communicate with the hosts on Switch 3 directly. Likewise, hosts of Switch 1 use VLAN 300, MST instance 1 to communicate with the hosts on Switch 3 directly.

The hosts use different instances of MSTP to effectively use the links across the switch. The same concept can be extended to other switches and more instances of MSTP.

# Notification of Compliance

C

## NETGEAR Wired Products

### Regulatory Compliance Information

This section includes user requirements for operating this product in accordance with National laws for usage of radio spectrum and operation of radio devices. Failure of the end-user to comply with the applicable requirements may result in unlawful operation and adverse action against the end-user by the applicable National regulatory authority.

This product's firmware limits operation to only the channels allowed in a particular Region or Country.  Therefore, all options described in this user's guide may not be available in your version of the product.

### FCC Requirements for Operation in the United States

#### FCC Information to User

This product does not contain any user serviceable components and is to be used with approved antennas only. Any product changes or modifications will invalidate all applicable regulatory certifications and approvals

This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

#### FCC Guidelines for Human Exposure

This equipment complies with FCC radiation exposure limits set forth for an uncontrolled environment. This equipment should be installed and operated with minimum distance of 20 cm between the radiator and your body.

This transmitter must not be co-located or operating in conjunction with any other antenna or transmitter.

#### FCC Declaration Of Conformity

We, NETGEAR, Inc., 350 East Plumeria Drive, San Jose, CA 95134, declare under our sole responsibility that the GS716T and GS724T Gigabit Smart Switches complies with Part 15 of FCC Rules.

Operation is subject to the following two conditions:

- This device may not cause harmful interference, and

- This device must accept any interference received, including interference that may cause undesired operation.

#### FCC Radio Frequency Interference Warnings & Instructions

This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation.

If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following methods:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and the receiver.
- Connect the equipment into an electrical outlet on a circuit different from that which the radio receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

Modifications made to the product, unless expressly approved by NETGEAR, Inc., could void the user's right to operate the equipment.

### Canadian Department of Communications Radio Interference Regulations

This digital apparatus, GS716T and GS724T Gigabit Smart Switches, does not exceed the Class B limits for radio-noise emissions from digital apparatus as set out in the Radio Interference Regulations of the Canadian Department of Communications.

This Class [B] digital apparatus complies with Canadian ICES-003.

Cet appareil numérique de la classe [B] est conforme à la norme NMB-003 du Canada

### European Union

The GS716T and GS724T Gigabit Smart Switches complies with essential requirements of EU EMC Directive 2004/108/EC and Low Voltage Directive 2006/95/EC as supported by applying the following test methods and standards:

- EN55022: 2006 / A1: 2007
- EN55024: 1998 / A1: 2001 / A2 : 2003
- EN60950-1: 2005 2nd Edition
- EN 61000-3-2:2006
- EN 61000-3-3:1995 w/A1: 2001+A2: 2005

## GPL License Agreement

GPL may be included in this product; to view the GPL license agreement go to
*ftp://downloads.netgear.com/files/GPLnotice.pdf*
For GNU General Public License (GPL) related information, visit
*http://support.netgear.com/app/answers/detail/a_id/2649*

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