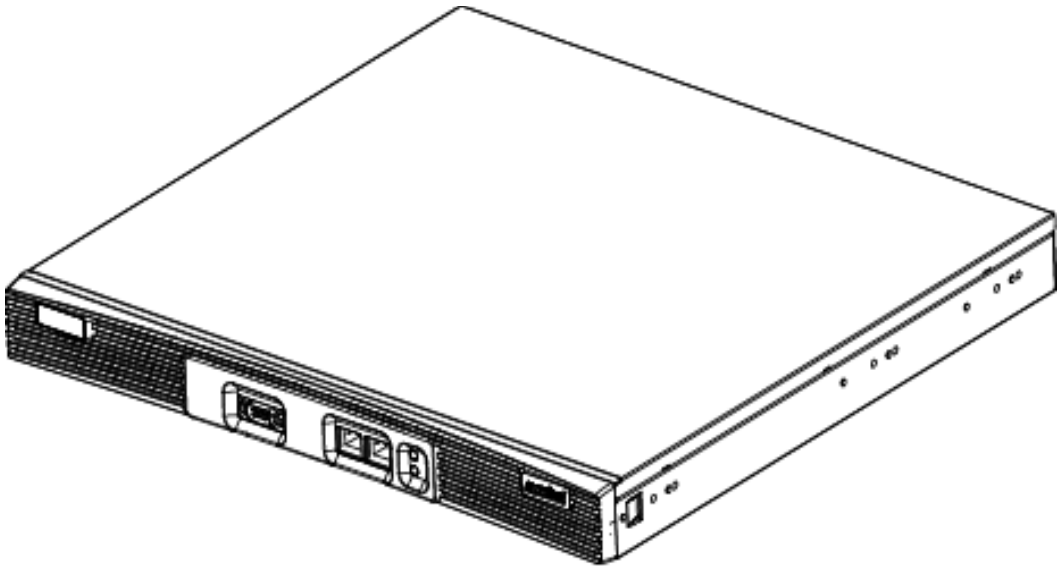
WS5100 Series Switch

System Reference Guide



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About This Guide

Introduction

This guide provides information about using the WS5100 Series Switch.

NOTE Screens and windows pictured in this guide are samples and can differ from actual screens.

Documentation Set

The documentation set for the WS5100 Series Switch is partitioned into the following guides to provide information for specific user needs.

- **WS5100 Installation Guide -** describes the basic setup and configuration required to transition to more advanced configuration of the switch.
- **WS5100 CLI/MIB Reference** - describes the *Command Line Interface* (CLI) and *Management Information Base* (MIB) commands used to configure the WS5100 Series Switch.
- **WS5100 Migration Guide** - provides upgrade instructions and new feature descriptions for legacy users of the WS5100 Series Switch.
- **WS5100 Troubleshooting Guide**- describes workarounds to known conditions the user may encounter.

Document Conventions

The following conventions are used in this document to draw your attention to important information:

NOTE Indicate tips or special requirements.

CAUTION Indicates conditions that can cause equipment damage or data loss.

WARNING! Indicates a condition or procedure that could result in personal injury or equipment damage.

Notational Conventions

The following additional notational conventions are used in this document:

- *Italics* are used to highlight the following:
  - Chapters and sections in this and related documents
  - Dialog box, window and screen names
  - Drop-down list and list box names
  - Check box and radio button names
  - Icons on a screen.
- **GUI** text is used to highlight the following:
  - Screen names
  - Menu items
  - Button names on a screen.
- bullets (•) indicate:
  - Action items
  - Lists of alternatives
  - Lists of required steps that are not necessarily sequential
- Sequential lists (e.g., those that describe step-by-step procedures) appear as numbered lists.

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1 Overview

The switch provides a centralized management solution for wireless networking components across the wired network infrastructure. The switch connects to legacy access ports through a Layer 2 switch/hub. The switch connects to non-legacy access ports through a Layer 3 interface.

The switch functions as the center of the wireless network. The access ports function as radio antennas for data traffic management and routing. All of the system configuration and intelligence for the wireless network resides in the switch.

The switch uses access ports to bridge data from associated wireless devices to the wireless switch. The wireless switch applies appropriate policies to the data packets before routing them to their destination. Data packets destined for devices on the wired network are processed by the switch, where appropriate policies are applied before they are encapsulated and sent to their destination.

Access port configuration is managed by the switch through the *Graphical User Interface* (GUI), SNMP or the *Command Line Interface* (CLI). The switch streamlines the management of a large wireless system and allows for *Quality of Service* (QoS), virtual WLANs and packet forwarding implementations.

1.1 Hardware Overview

The wireless switch is a rack-mountable device that manages all inbound and outbound traffic on the wireless network. It provides security, network service and system management applications.

Unlike traditional wireless infrastructure devices that reside at the edge of a network, the switch uses centralized, policy-based management to apply sets of rules or actions to all devices on the wireless network. It collects management "intelligence" from individual access points and moves the collected information into the centralized switch. Then, it replaces access points with "dumb" radio antennas called access ports.

Access ports (APs) are 48V power-over-Ethernet devices connected to the WS5100 Series Switch by an Ethernet cable. An access port receives 802.11x data from MUs and forwards the data to the switch which applies the appropriate policies and routes the packets to their destinations. Depending on the model, an AP can support as many as 16 WLANs.

Access ports do not have software or firmware upon initial receipt from the factory. When the access port is first powered on and cleared for the network, the switch initializes the access port and installs a small firmware file automatically. Therefore, installation and firmware upgrades are automatic and transparent.

1.1.1 Physical Specifications

The physical dimensions and operating parameters of the WS5100 Series Switch include:

Width	48.1 cm / 18.93 in. (with mounting brackets) 42.9 cm / 16.89 in. (without mounting brackets)
Height	4.39 cm / 1.73 in.
Depth	40.46 cm / 15.93 in.
Weight	6.25 kg / 13.75 lbs.
Max Power Consumption	100 VAC, 50/60 Hz, 3A 240 VAC, 50/60 Hz, 1.5A
Operating Temperature	10°C - 35°C / 50°F - 95°F
Operating Humidity	5% - 85% without condensation

1.1.1.1 Power Cord Specifications

A power cord is not supplied with the device. Use only a correctly rated power cord certified for the country of operation.

1.1.1.2 Power Protection

To best protect the WS5100 from unexpected power surges or other power-related problems, ensure the system installation meets the following power protection guidelines:

- *If possible, use a dedicated circuit to protect data processing equipment.* Commercial electrical contractors are familiar with wiring for data processing equipment and can help with the load balancing of dedicated circuits.
- *Install surge protection.* Use a surge protection device between the electricity source and the WS5100 Series Switch.
- *Install an Uninterruptible Power Supply (UPS).* A UPS provides continuous power during a power outage. Some UPS devices have integral surge protection. UPS equipment requires periodic maintenance to ensure reliability.

1.1.1.3 Cabling Requirements

Two Category 6 Ethernet cables (not supplied) are required to connect the switch to the LAN and the WLAN. The cables are used with the two Ethernet ports on the front panel of the switch.

The console cable that comes with the switch is used to connect the switch to a computer running a serial terminal emulator program to access the switch's *Command Line Interface* (CLI) for initial configuration. Initial configuration steps are described in the *WS5100 Series Switch Installation Guide*.

1.1.2 System Status LED Codes

A WS5100 Series Switch has two LEDs on the front panel (adjacent to the RJ45 ports). The System Status LEDs display three colors—blue, amber, or red —and three "lit" states—solid, blinking, or off.

1.1.2.1 Start Up

Event	Top LED	Bottom LED
Power off	Off	Off
Power On Self Test (POST) running	All colors in rotation	All colors in rotation
POST succeeded	Blue solid	Blue solid

1.1.2.2 Primary

Event	Top LED	Bottom LED
Active *(Continually Adopting Access Ports)*	Blue blinking	Blue solid
No License to Adopt	Amber blinking	Amber blinking

1.1.2.3 Standby

Event	Top LED	Bottom LED
Active *(Failed Over and Adopting Ports)*	Blue blinking	Blue blinking
Active *(Not Failed Over)*	Blue blinking	Amber solid

1.1.2.4 Error Codes

Event	Top LED	Bottom LED
POST failed (critical error)	Red blinking	Red blinking
Software initialization failed	Amber solid	Off
Country code not configured. **Note:** *During first time setup, the LEDs will remain in this state until the country code is configured.*	Amber solid	Amber blinking
No access ports have been adopted	Blue blinking	Amber blinking

1.1.3 10/100/1000 Port Status LED Codes

A WS5100 Series Switch has two LED indicators for its RJ-45 ports:

- Upper left (amber/green) for link rate
- Upper right (green) for link activity

Table 1.1 provides additional information about the status of the 10/100/1000 Port Status LEDs.

Table 1.1 10/100/1000 Port Status LED Codes

LED	State	Meaning
Upper left	Off	10 Mbps link rate
	Green steady	100 Mbps link rate
	Amber steady	1 Gigabit link rate
Upper right	Off	The port isn't linked
	Green steady	The port is linked
	Green blinking	The port is linked and active

1.2 Software Overview

WS5100 Series Switch includes a robust set of features.This section provides an overview of the WS5100 Series Switch software and features. The features are briefly listed and described in the following sections:

- *Infrastructure Features*
- *Wireless Switching*
- *Wired Switching*
- *Management Features*
- *Security Features*
- *Access Port Support*

1.2.1 Infrastructure Features

A WS5100 Series Switch includes the following Infrastructure features:

- *Installation Feature*
- *Licensing Support*
- *Configuration Management*
- *Diagnostics*
- *Serviceability*
- *Tracing / Logging*
- *Process Monitor*
- *Hardware Abstraction Layer and Drivers*
- *Redundancy*
- *Secure Network Time Protocol (SNTP)*
- *Password Recovery*

1.2.1.1 Installation Feature

The upgrade/downgrade of the switch can be performed at boot time using one of the following methods:

- Web UI
- DHCP
- CLI
- SNMP
- Patches

NOTE HTTPS must be enabled to access the switch Web UI. Ensure that HTTPS access has been enabled before using the login screen to access the switch Web UI.

The WS5100 platform has sufficient non-volatile memory to store multiple firmware images. The switch stores an active and a passive firmware image. The switch supports staged upgrade operations.

1.2.1.2 Licensing Support

The following licensing information is utilized when upgrading from non-WS5100 or WS5100 releases.

- The maximum numbers of AP licenses a switch can adopt is 48.
- You can install/remove AP licenses in batches of 6 APs at a time.
- The RADIUS server and VPN capability is not a part of the licenses feature.

1.2.1.3 Configuration Management

The system supports redundant storage of configuration files to protect against corruption during a write operation and ensures at any given time a valid configuration file exists. If a configuration file has failed to completely execute, it is rolled back and the pre-write file is used.

Text Based Configuration

The configuration is stored in human readable format. It is stored as a set of CLI commands.

1.2.1.4 Diagnostics

The following diagnostics are available for the WS5100 switch:

1. In-service Diagnostics – In-service diagnostics provide a range of automatic health monitoring features ensuring both the system hardware and software are in working order. The in-service-diagnostics continuously monitor any available physical characteristics (as detailed below) and issues log messages when either warning or error thresholds are reached. There are three types of in-service diagnostics:
   - Hardware– Ethernet ports, chip failures, system temperature via the temperature sensors provided by the hardware, etc.
   - Software– CPU load, memory usage, etc.
   - Environmental– CPU and air temperature, fans speed, etc.
2. Out-of-service Diagnostics – Out-of-service diagnostics are a set of intrusive tests run from the user interface. Out-of-service diagnostics cannot be run while the unit is in operation. The intrusive tests include:
   - Ethernet loopback tests

- RAM tests, Real Time Clock tests, etc.

3. Manufacturing Diagnostics – Manufacturing diagnostics are a set of diagnostics used by manufacturing to inspect quality of hardware.

1.2.1.5 Serviceability

A special set of Service CLI commands are available to provide additional troubleshooting capabilities for service personnel (for example, check the time critical processes were started), access to Linux services, panic logs, etc. Only authorized users or service personnel are provided access to the Service CLI.

A built-in Packet Sniffer allows service personnel to capture incoming and outgoing packets in a buffer.

The switch also maintains various statistics for RF activity, Ethernet ports etc. RF statistics include roaming stats, packet counters, octets tx/rx, signal, noise SNR, retry, and information for each MU.

1.2.1.6 Tracing / Logging

Log messages are well-defined and documented system messages with various destinations. They are numbered and referenced by ID. Each severity level group, can be configured separately to go to either the serial console, telnet interface, log file or remote syslog server.

Trace messages are more free-form and are used mainly by support personnel for tracking problems. They are enabled or disabled via CLI commands. Trace messages can go to a log file, the serial console, or the current tty.

Log and trace messages are interleaved in the same log file, so chronological order is preserved. Log and trace messages from different processes are similarly interleaved in the same file for the same reason.

Log message format is similar to the format used by syslog messages (RFC 3164). Log messages include message severity, source (facility), the time the message was generated and a textual message describing the situation triggering the event.

1.2.1.7 Process Monitor

The Process Monitor constantly checks to ensure processes under its control are up and running. Each monitored process sends the Process Monitor periodic heartbeat messages. A process that is down (due to a software crash or stuck in an endless loop) is detected when its heartbeat is not received. Such a process is terminated (if still running) and restarted (if configured) by the Process Monitor.

1.2.1.8 Hardware Abstraction Layer and Drivers

The *Hardware Abstraction Layer* (HAL) provides an abstraction library with an interface hiding hardware/ platform specific data. Drivers include platform specific components such as Ethernet, Flash Memory storage and thermal sensors.

1.2.1.9 Redundancy

Using the Warm Standby feature, two WLAN modules can be configured in a redundancy group (and thereby monitor each other). In the event of a failure, the other WLAN module takes control. Therefore, the system is always up and running even if one WLAN module fails or it is removed for maintenance or a software upgrade.

Switch redundancy enables one or more switches to be configured as members of a redundant group with minimal traffic disruption in the event of failure of a wireless switch in a group or intermediate network failure.

The following rules are applicable for clustering:

1. There can be up to 12 members in a cluster.
2. Each member of the cluster is able to use the same configuration file.
3. There is no runtime configuration syncing between the members of a cluster.
4. All members of a cluster are able to discover other members without additional configuration.

If two Primaries are configured within the same redundancy group, licenses are wasted. Symbol recommends only one Primary be installed (the module with the AP licenses) and one Standby be installed (the other module with no AP licenses).

1.2.1.10 Secure Network Time Protocol (SNTP)

Secure Network Time Protocol (SNTP) manages time and/or network clock synchronization within the switch managed network environment. SNTP is a client/server implementation. The switch (a SNTP client) periodically synchronizes its clock with a master clock (an NTP server). For example, the switch resets its clock to 07:04:59 upon reading a time of 07:04:59 from its designated NTP server. Time synchronization is recommended for the switch's network operations. The following additionally hold true:

- The switch can be configured to provide NTP services to NTP clients.
- The switch can provide NTP support for user authentication.
- *Secure Network Time Protocol* (SNTP) clients can be configured to synchronize switch time with an external NTP server.

1.2.1.11 Password Recovery

The switch has a provision enabling the switch to restore its factory default configuration if your password is lost. In doing so however the current configuration is erased and can be restored assuming if has been exported to a secure location. For information on password recovery, see
Switch Password Recovery on page 2-3.

1.2.2 Wireless Switching

A WS5100 Series Switch includes the following wireless switching features:

- *Physical Layer Features*
- *Rate Limiting*
- *Proxy-ARP*
- *HotSpot / IP Redirect*
- *IDM (Identity Driven Management)*
- *Voice Prioritization*
- *Self Healing*
- *Port/Switch Protocols*
- *Wireless Capacity*
- *AP and MU Load Balancing*
- *Wireless Roaming*
- *Power Save Polling*
- *QoS*
- *Wireless Layer 2 Switching*
- *Automatic Channel Selection*

- *WMM-Unscheduled APSD*

1.2.2.1 Physical Layer Features

802.11a

- DFS Radar Avoidance – *Dynamic Frequency Selection* (DFS) functionality is mandatory for WLAN equipment that is intended to operate in the frequency bands 5150 MHz to 5350 MHz and 5470 MHz to 5725 MHz when the equipment operates in the countries of EU.
  The purpose of DFS is:
  - Detect interference from other systems and avoid co-channeling with those systems, most notably radar systems.
  - Provide uniform loading of the spectrum across all devices.

  This feature is enabled automatically when the country code indicates that DFS is required for at least one of the frequency bands that are allowed in the country.
- TPC – *Transmit Power Control* (TPC) meets the regulatory requirement for maximum power and mitigation for each channel. The TPC functionality is enabled automatically for every AP that operates on the channel.

802.11bg

- Dual mode b/g protection – The ERP builds on the payload data rates of 1 and 2 Mbit/s that use DSSS modulation and builds on the payload data rates of 1, 2, 5.5, and 11 Mbit/s, that use DSSS, CCK, and optional PBCC modulations. ERP provides additional payload data rates of 6, 9, 12, 18, 24, 36, 48, and 54 Mbit/s. Of these rates, transmission and reception capability for 1, 2, 5.5, 11, 6, 12, and 24 Mbit/s data rates is mandatory.
  Two additional optional ERP-PBCC modulation modes with payload data rates of 22 and 33 Mbit/s are defined. An ERP-PBCC station may implement 22 Mbit/s alone or 22 and 33 Mbit/s. An optional modulation mode known as DSSS-OFDM is also incorporated with payload data rates of 6, 9, 12, 18, 24, 36, 48, and 54 Mbit/s.
- Short slot protection – The slot time is 20 µs, except an optional 9 µs slot time may be used when the BSS consists of only ERP STAs capable of supporting this option. The optional 9 µs slot time should not be used if the network has one or more non-ERP STAs associated. For IBSS, the Short Slot Time field is set to 0, corresponding to a 20 µs slot time.

1.2.2.2 Rate Limiting

Rate limiting controls the maximum rate sent or received on a network. Rate limiting enables the proper allocation of bandwidth, based on the source MAC address, destination MAC address, source IP address, destination IP address and/or TCP/UDP port number. Rate limiting allows the definition of two rates: a guaranteed minimum bandwidth and a second burst size. For the WS5100 Series Switch, Rate limiting is performed as part of the flow control process (WISP protocol) between access ports and the switch.

1.2.2.3 Proxy-ARP

Proxy ARP is provided for MU's in PSP mode whose IP address is known. The WLAN generates an ARP reply on behalf of a MU, if the MU's IP address is known. The ARP reply contains the MAC address of the MU (not the MAC address of switch). Thus, the MU is not woken to send ARP replies (increasing battery life and conserving wireless bandwidth).

If an MU goes into PSP mode without transmitting at least one packet, its Proxy ARP will not work for such an MU.

1.2.2.4 HotSpot / IP Redirect

A hotspot is a Web page that users are forced to visit before they are granted access to the Internet. With the advent of Wi-Fi enabled client devices (such as laptops and PDAs) commercial hotspots are common and can be found at many airports, hotels and coffee shops.The Hotspot / IP Redirect feature allows the WS5100 to function as a single on-site switch supporting WLAN hotspots. The Hotspot feature re-directs user traffic (for a hotspot enabled WLAN) to a Web page that requires them to authenticate before granting access to the WLAN. The IP-Redirection requires no special software on the client but its does require the client be set to receive its IP configuration through DHCP. The following is a typical sequence of events for hotspot access:

1. A visitor with a laptop requires hotspot access at a site.
2. A user ID/ Password and the hotspot ESSID are issued by the site receptionist or IT staff.
3. The user connects their laptop to this ESSID
4. The laptop receives its IP configuration via DHCP. The DHCP service can be provided by an external DHCP server or provided by the internal DHCP server located on the switch.
5. The user opens a Web browser and connects to their home page.
6. The switch re-directs them to the hotspot Web page for authentication.
7. The user enters their User ID/ Password.
8. A Radius server authenticates the user.
9. Upon successful authentication, the user is directed to a Welcome Page that lists among other things an Acceptable Use Policy, connection time remaining and an I Agree button.
10. The user accepts by clicking the I Agree button and is granted access to the Internet. (or other network services).

To redirect user traffic from a default home page to a login page, the switch uses destination network address translation (destination NAT is similar to the source NAT/ PAT but the destination IP address and port get modified instead of the source as in traditional NAT). More specifically, when the switch receives an HTTP Web page request from the user (when the client first launches its browser after connecting to the WLAN), a protocol stack on the switch intercepts the request and sends back an HTTP response after modifying the network and port address in the packet. Therefore, acting like a proxy between the user and the Web site they are trying to access.

To setup a Hotspot on the switch, create a WLAN ESSID and select Hotspot authentication from the Authentication menu. This is simply another way to authenticate a WLAN user for it would be impractical to authenticate visitors using 802.1x authentications. For information on configuring hotspot support for the WLAN, see *Configuring Hotspots on page 4-30*. Symbol also recommends reviewing the *WS5100 Migration Guide* (available on the Symbol Web site) for a use case on hotspot deployment.

1.2.2.5 IDM (Identity Driven Management)

Radius authentication is performed for all protocols using a radius-based authentication scheme such as EAP. Identity driven management is provided using a Radius client. The following IDMs are supported:

- User based SSID authentication — Denies authentication to MUs if associated to a SSID configured differently in their Radius server.
- User based VLAN assignment — Allows the switch to extract VLAN information from the Radius server.
- User based QoS — Enables QoS for the MU based on settings in Radius Server.

1.2.2.6 Voice Prioritization

The WS5100 has the capability of having its QoS policy configured to prioritize network traffic requirements for associated MUs. Use QoS to enable voice prioritization for devices using voice as its transmission priority.

Voice prioritization allows you to assign priority to voice traffic over data traffic, and (if necessary) assign legacy voice supported devices (non WMM supported voice devices) additional priority.

Currently voice support implies the following:

- Spectralink voice prioritization - Spectralink sends packets that allow the switch to identify these MU's as voice MU's. Thereafter, any UDP packet sent by these MU's is prioritized ahead of data.
- Strict priority - The prioritization is strict.
- Multicast prioritization - Multicast frames that match a configured multicast mask bypass the PSP queue. This features permits intercom mode operation without delay (even in the presence of PSP MU's).

1.2.2.7 Self Healing

Self Healing is the ability to dynamically adjust the RF network by modifying transmit power and/or supported rates, based on an AP failure.

In a typical RF network deployment, the APs are configured for Transmit Power below its maximum level. This allows the Tx Power to be increased when there is a need to increase coverage whenever an AP fails.

When an AP fails, the Tx Power/Supported rates of APs neighboring the failed AP is adjusted. The Tx power is increased and/or Supported rates are decreased. When the failed AP becomes operational again, the Neighbor AP's Tx Power/Supported rates are brought back to the levels in operation before the self healing operation changed them.

The switch detects an AP failure when:

- AP stops sending heartbeats.
- AP beacons are no longer being sent.

Configure 0 (Zero) or more APs to act as either:

- Detector APs — Detector APs scan all channels and send beacons to the switch which uses the information for self-healing.
- Neighbor APs — When an AP fails, neighbor APs assist in self healing.
- Self Healing Actions — When an AP fails, actions are taken on the neighbor APs to do self-healing.

Detector APs

Configure an AP in either – Data mode (the regular mode) or Detector mode.

In Detector mode, the AP scans all channels at a configurable rate and forwards received beacons to the WS5100. The WS5100 uses the received information to establish a *receive signal strength baseline* over a period of time and initiates self-healing procedures (if necessary).

Neighbor Configuration

Neighbor detect is a mechanism allowing an AP to detect its neighbors and their signal strength. This enables you to verify your installation and configure it for self-healing when an AP fails.

Self Healing Actions

This mechanism allows you to assign a self healing action to an AP's neighbors, on a per-AP basis. If AP1 detects AP2 and AP3 as its neighbors, you can assign failure actions to AP2 and AP3 whenever AP1 fails.

You can assign four self healing actions:

- No action
- Decrease supported rates
- Increase Tx power
- Both 2 and 3.

You can also specify the Detector AP (AP2 or AP3) to stop detecting and adopt the RF settings of the failed AP.

1.2.2.8 Port/Switch Protocols

WS5100 supports the following two access-port/switch protocols:

- *WISP*
- *WISPe (WISP extended)*

This dual support is also available for older platforms that supports legacy access ports. Newer platforms using an AP300 (or newer) access port only support WISPe.

WISP

WISP is a legacy, layer 2 port/switch protocol used with all legacy platforms. It is available on the AP100, AP200, AP300 and a variety of access point conversions.

WISPe

WISPe is an extension of the original WISP protocol supporting layer 3 access-port/switch traffic and wireless bridging between access ports. WISPe is only available on the AP300 (or newer) access port.

WISP/WISPe Upgrade/Downgrade

The conversion of access ports from WISP to WISPe (and vice-versa) is transparent. AP300 access ports running WISP firmware can be adopted by a switch that only supports WISPe. When a WISP access port seeks adoption, the WISPe switch recognize it and sends firmware to it to convert it into a WISPe access port. Conversely, a WISPe access port (if deployed in an environment with WISP switches) discovers and adopts it to a WISP switch.

Access Port Support

Access ports vary by platform. Access port and access point conversion support is summarized in the following table:

AP types	**WS 5000 3.0**
AP300	WISPe
AP100	WISP
AP4131	WISP
AP200	Not Supported
AP4121	Not Supported

AP types	**WS 5000 3.0**
All other Access Point conversions	Not Supported

CAPWAP Compatibility

CAPWAP is a proposed standard for port/switch protocols. It is intended that WISPe be similar to CAPWAP. When the CAPWAP protocol is standardized, it is relatively easy to adapt the switch software so CAPWAP based 3rd party access points can be adopted.

1.2.2.9 Wireless Capacity

Wireless capacity specifies the maximum numbers of MUs, access ports and wireless networks usable by a given switch. Wireless capacity is largely independent of performance. Aggregate switch performance is divided among the switch clients (MUs and access ports) to find the performance experienced by a given user. Each switch platform is targeted at specific market segments, so the capacity of each platform is chosen appropriately. Wireless switch capacity is measured by:

- Maximum number of WLANs per switch
- Maximum number of access ports per Switch
- Maximum number of MUs per switch
- Maximum number of MUs per access port.

Up to 48 access ports are supported by the switch. The actual number of access ports adoptable by a switch is defined on a per platform basis and will typically be lower than 48.

1.2.2.10 AP and MU Load Balancing

Fine tune a network to evenly distribute the data and/or processing across available resources. The following 2 topics explain load balancing:

- *MU Balancing Across Multiple APs*
- *AP Balancing Across Multiple Switches*

MU Balancing Across Multiple APs

As per the 802.11 standard, AP and MU association is a process conducted independently of the switch. 802.11 provides message elements used by the MU firmware to influence the roaming decision. The switch implements the following MU load balancing techniques:

- 802.11e admission control — 1 byte: channel utilization % and 1 byte: MU count is sent in QBSS Load Element in beacons to MU.
- Symbol load balancing element (proprietary) — 2 byte: Kbps, 2 byte : Kbps and 2 byte : MU Count are sent in beacon to MU.

NOTE Each switch can support a maximum of 4096 MUs.

AP Balancing Across Multiple Switches

At adoption time, the AP solicits and receives multiple adoption responses from the switches on the network. These adoption responses contain preference and loading information the AP uses to select the optimum switch to be adopted by. Use this mechanism to define which APs are adopted by which switches. By default, the adoption algorithm generally distributes AP adoption evenly among the switches available.

NOTE Each switch can support a maximum of 48 access ports. However, port adoption per switch is determined by the number of licenses acquired.

1.2.2.11 Wireless Roaming

The following types of wireless roaming are supported by WS5100:

- *L3 Roaming*
- *Fast Roaming*
- *Interswitch Layer 2 Roaming*
- *International Roaming*
- *MU Move Command*
- *Virtual AP*

L3 Roaming

L3 roaming works with switches in the mobility domain to exchange mobility related control information. This includes IP addresses, *Media Access Control* (MAC) address information and the HS-VLAN-id of all MUs in the mobility-domain. A consistent peer configuration results in full-mesh sessions required for L3 roaming to work correctly. Peering sessions use *Transmission Control Protocol* (TCP) as the transport layer protocol to carry mobility update messages. TCP provides the following advantages:

- TCP retransmits lost messages thereby providing reliable connectivity
- TCP ensures ordered message delivery using sequenced numbers.
- TCP has a built-in “keep-alive” mechanism which helps detect loss of connectivity to the peer or peer failure.

Fast Roaming

MUs roam from AP to AP as an MU moves throughout a WLAN coverage area. To improve roaming performance, various fast roaming features are implemented:

- *Pairwise Master Key (*PMK) Caching — Caching credentials are in the AP, so the MU does not need to re- authenticate.
- PMK Opportunistic Caching — The MU starts transmitting on another AP in order for both AP's to connect to a common wireless switch.
- Switch to Switch Hand-Off — When an MU roams from a wireless switch in one subnet to a wireless switch in another subnet, the transport layer connections will be preserved as far as possible.
- PMK Pre-Authentication —The MU authenticates itself with the AP before roaming to it.

Interswitch Layer 2 Roaming

An associated MU (connected to a particular wireless switch) can roam to another access port connected to a different wireless switch. Both switches must be on the same L2 domain. Authentication information is not

shared between the switches, nor is buffered packets on one switch transferred to the other switch. Pre-authentication between the switch and MU allows faster roaming.

International Roaming

The wireless switch supports international roaming as per the 802.11d specification.

MU Move Command

As a value added proprietary feature between Symbol infrastructure products and Symbol MUs, a *move* command has been introduced. This command permits an MU to roam between ports connected to the same wireless switch without the need to perform the full association and authentication defined by the 802.11 standard. The *move* command is a simple packet up/packet back exchange with the access port. Verification of this feature is dependent on its implementation in one or more mobile units.

Virtual AP

The WS5100 supports multiple *Basic Service Set Identifiers* (BSSIDs). An access port capable of supporting multiple BSSID's generates multiple beacons, one per BSSID. Hence, an AP that supports 4 BSSID's can send 4 beacons. The basic requirement for supporting multiple BSSID's is multiple MAC addresses, since each BSSID is defined by its MAC address.

When multiple BSSID's are enabled, you cannot tell by snooping the air whether any pair of beacons is sent out by the same physical AP or different physical AP. Hence the term "virtual AP's"- each virtual AP behaves exactly like a single-BSSID AP.

Each BSSID supports 1 *Extended Service Set Identifier* (ESSID). Sixteen ESSIDs per switch are supported.

1.2.2.12 Power Save Polling

An MU uses *Power Save Polling* (PSP) to reduce power consumption. When an MU is in PSP mode, the switch buffers its packets and delivers them using the DTIM interval. The PSP-Poll packet polls the AP for buffered packets. The PSP null data frame is used by the MU to signal the current PSP state to the AP.

1.2.2.13 QoS

QoS provides the user a data traffic prioritization scheme. A QoS configuration scheme is useful in the case of congestion from excessive traffic or different data rates and link speeds.

If there is enough bandwidth for all users and applications (unlikely because excessive bandwidth comes at a very high cost), then applying QoS has very little value. QoS provides policy enforcement for mission-critical applications and/or users that have critical bandwidth requirements when the switch's total bandwidth is shared by different users and applications.

The objective of QoS is to ensure each WLAN configured on the switch receives a fair share of the overall bandwidth, either equally or as per the proportion configured. Packets directed towards MUs are classified into categories such as Management, Voice and Data. Packets within each category are processed based on the weights defined for each WLAN.

The WS5100 supports the following different QoS types:

802.11e QoS

802.11e enables real-time audio and video streams to be assigned a higher priority over regular data. The WS5100 supports the following 802.11e features:

- Basic WMM

- WMM Linked to 802.1p Priorities
- WMM Linked to DSCP Priorities
- Fully Configurable WMM
- Admission Control
- Unscheduled-APSD
- TSPEC Negotiation
- Block ACKQBSS Beacon Element

802.1p support

802.1p is a standard for providing QoS in 802-based networks. 802.1p uses three bits to allow switches to re-order packets based on priority level. 802.1p uses the *Generic Attributes Registration Protocol* (GARP) and the *GARP VLAN Registration Protocol* (GVRP). GARP allows MUs to request membership within a multicast domain, and GVRP lets them register to a VLAN.

Voice QoS

When switch resources are shared between a *Voice over IP* (VoIP) conversation and a file transfer, bandwidth is normally exploited by the file transfer, thus reducing the quality of the conversation or even causing it to disconnect. With QoS, the VoIP conversation (a real-time session), receives priority, maintaining a high level of voice quality. The voice QoS used by the WS5100 ensures:

- Strict Priority
- Spectralink Prioritization
- VOIP Prioritization (IP ToS Field)
- Multicast Prioritization

Data QoS

The WS5100 ensures the following for Data QoS:

- Egress Prioritization by WLAN
- Egress Prioritization by ACL

DCSCP to AC Mapping

The WS5100 provides for the arbitrary mapping between *Differentiated Services Code Point* (DCSCP) values and WMM Access Categories. This mapping can be set manually.

1.2.2.14 Wireless Layer 2 Switching

The WS5100 supports the following layer 2 wireless switching techniques:

- WLAN to VLAN
- MU User to VLAN
- WLAN to GRE

1.2.2.15 Automatic Channel Selection

Automatic channel selection works as follows:

1. When a new AP is adopted, it scans each channel. However, the switch does not forward traffic at this time.

2. The switch then selects the least crowded channel based on the noise and traffic detected on each channel.
3. The algorithm used is a simplified maximum entropy algorithm for each radio, where the signal strength from adjoining AP's/MU's associated to adjoining AP's is minimized.
4. The algorithm ensures adjoining AP's are as far away from each other as possible in terms of channel assignment.

NOTE Individual radios can be configured to perform automatic channel selection.

1.2.2.16 WMM-Unscheduled APSD

This feature is also known as WMM Power Save or WMM-UPSD (Unscheduled Power Save Delivery). WMM-UPSD defines an unscheduled service period, which are contiguous periods of time during which the switch is expected to be awake. If the switch establishes a downlink flow and specifies UPSD power management, then it requests and the AP delivers buffered frames associated with that flow during an unscheduled service period. The switch initiates an unscheduled service period by transmitting a trigger frame, where a trigger frame is defined as a data frame (e.g. an uplink voice frame) associated with an uplink flow having UPSD enabled. After the AP acknowledges the trigger frame, it transmits the frames in its UPSD power save buffer addressed to the triggering switch.

UPSD is well suited to support bi-directional frame exchanges between a voice STA and its AP

1.2.3 Wired Switching

The switch includes the following wired switching features:

- *DHCP Servers*
- *DDNS*
- *GRE Tunneling*
- *VLAN Enhancements*
- *Interface Management*
- *Multiple WLAN Support*

1.2.3.1 DHCP Servers

Dynamic Host Configuration Protocol (DHCP) allows hosts on an IP network to request and be assigned IP addresses, and discover information about the network to which they are attached. Configure address pools for each subnet, and whenever a DHCP client in that subnet requests an IP address, the DHCP server assigns an IP address from the address pool configured for that subnet.

When a DHCP server allocates an address for a DHCP client, the client is assigned a lease, which expires after an pre-determined interval. Before a lease expires, clients (to which leases are assigned) are expected to renew them to continue to use the addresses. Once the lease expires, the client is no longer permitted to use the leased IP address.

1.2.3.2 DDNS

Dynamic DNS is a method of keeping a domain name linked to a changing IP address. Typically, when a user connects to a network, the user's ISP assigns it an unused IP address from a pool of IP addresses. This address is only valid for a short period. Dynamically assigning IP addresses increases the pool of assignable IP

addresses. DNS maintains a database to map a given name to an IP address used for communication on the Internet. The dynamic assignment of IP addresses makes it necessary to update the DNS database to reflect the current IP address for a given name. Dynamic DNS updates the DNS database to reflect the correct mapping of a given name to an IP address.

1.2.3.3 GRE Tunneling

GRE tunnelling extends a WLAN across a Layer 3 network using standards based GRE tunneling technology.

- GRE tunnels need to be explicitly provisioned on the switch as well as the tunnel termination device present at the other end of the Layer 3 network.
- One or more WLANS on the switch are then mapped to the GRE tunnel interface. The configuration is very similar to mapping WLANs to VLANs.
- All IP packets received from MUs on the WLAN are encapsulated in GRE and sent across the Layer 3 network. The tunnel termination device at the other end decapsulates the GRE header and routes the inner IP packet to its original destination.
- When packets are received on the GRE tunnel interface by the switch, the switch decapsulates the GRE header and forwards the IP packet to the MU based on the destination IP address. The MAC address of the MU is obtained from the MU table.

1.2.3.4 VLAN Enhancements

The WS5100 has incorporated the following VLAN enhancements:

- Physical port (L2) is now operated in Trunk Mode or Access Mode.
- VLAN now allows an AP to receive and send only untagged packets. All tagged packets received by the AP are discarded. The untagged traffic received is internally placed in an “access vlan”.
- A trunk port can now receive, both tagged and untagged packets. Only one native VLAN per trunk port is supported. All untagged traffic received on is placed into a “native vlan”.
- You can now configure a set of allowed VLANS on a trunk port. Packets received on this port that belong to other VLANs are discarded.

1.2.3.5 Interface Management

The WS5100 permits a physical interface to Auto Negotiate, Full Duplex or Half Duplex. The WS5100 also allows:

- Manual bandwidth configuration of a physical interface to 10/100/1000Mbps. This is only permitted if duplex is not set to Auto-Negotiate.
- Manual configuration of administrative shutdown of a physical interface.

1.2.3.6 Multiple WLAN Support

The WS5100 supports 32 WLANS.

1.2.4 Management Features

The WS5100 Series Switch includes the following management features:

- Secure browser-based management console
- *Command Line Interface* (CLI) accessible via the serial port or through a *Secure Shell* (SSH) application

- CLI Service mode enables the capture of system status information that can be sent to Symbol personnel for use in problem resolution
- Support for *Simple Network Management Protocol* (SNMP) version 3 as well as SNMP version 2
- TFTP upload and download of access port firmware and configuration files
- Graphing of wireless statistics
- Dashboard summary of system state in the Web UI
- Multi switch management via MSP application
- Heat Map support for RF deployment
- Secure Guest Access
- Switch Discovery enabling users to discover each Symbol switch on the specified network.

1.2.5 Security Features

WS5100 switch security can be classified into wireless security and wired security

A WS5100 Series Switch includes the following Wireless Security features:

- *Encryption and Authentication*
- *MU Authentication*
- *Secure Beacon*
- *MU to MU Allow*
- *MU to MU Disallow*
- *Switch - to - Wired*
- *802.1x Authentication*
- *IEEE 802.1AB LLDP*
- *WIDS*
- *Rogue AP Detection*

The switch includes the following wired security features:

- *ACLs*
- *Local Radius Server*
- *IPSec VPN*
- *NAT*
- *Certificate Management*

1.2.5.1 Encryption and Authentication

The switch can implement the following encryption and authentication types:

- *WEP*
- *WPA*
- *WPA2*
- *Keyguard-WEP*

WEP

Wired Equivalent Privacy (WEP) is an encryption scheme used to secure wireless networks. WEP was intended to provide comparable confidentiality to a traditional wired network, hence the name. WEP had many serious

weaknesses and hence was superseded by *Wi-Fi Protected Access* (WPA). Regardless, WEP still provides a level of security that can deter casual snooping.

WEP uses passwords entered manually at both ends (Pre Shared Keys). Using the RC4 encryption algorithm, WEP originally specified a 40-bit key, but was later boosted to 104 bits. Combined with a 24-bit initialization vector, WEP is often touted as having a 128-bit key

WPA

WPA is designed for use with an 802.1X authentication server, which distributes different keys to each user; however, it can also be used in a less secure *pre-shared key* (PSK) mode, where every user is given the same passphrase.

WPA uses *Temporal Key Integrity Protocol* (TKIP), which dynamically changes keys as the system is used. When combined with the much larger Initialization Vector, it defeats well-known key recovery attacks on WEP.

WPA2

WPA2 uses a sophisticated key hierarchy that generates new encryption keys each time a MU associates with an access point. Protocols including 802.1X, EAP and RADIUS are used for strong authentication. WPA2 also supports the TKIP and AES-CCMP encryption protocols.

Keyguard-WEP

KeyGuard is Symbols proprietary dynamic WEP solution. Symbol (upon hearing of the vulnerabilities of WEP) developed a non standard method of rotating keys to prevent compromises. Basically, KeyGuard is TKIP without the message integrity check MIC. KeyGuard is proprietary to Symbol MUs only.

1.2.5.2 MU Authentication

The WS5100 switch uses the following authentication schemes for MU association:

- *Kerberos*
- *802.1x EAP*
- *MAC ACL*

Refer to *Editing the WLAN Configuration on page 4-23* to WLAN MU authentication.

Kerberos

Kerberos allows for mutual authentication and end-to-end encryption. All traffic is encrypted and security keys are generated on a per-client basis. Keys are never shared or reused, and are automatically distributed in a secure manner.

802.1x EAP

802.1x EAP is the most secure authentication mechanism for wireless networks and includes EAP-TLS, EAP-TTLS and PEAP. The switch is a proxy for radius packets. An MU does a full 802.11 authentication and association and begins transferring data frames. The switch realizes the MU needs to authenticate with a RADIUS server and denies any traffic not RADIUS related. Once RADIUS completes its authentication process, the MU is allowed to send other data traffic. You can use either an onboard RADIUS server or internal Radius Server for authentication purpose.

MAC ACL

The MAC ACL feature is basically a dynamic MAC ACL where MUs are allowed/denied access to the network based on their configuration on the Radius server. The switch allows 802.11 authentication and association, then checks with the Radius server to see if the MAC address is allowed on the network. The Radius packet

uses the MAC address of the MU as both the username and password (this configuration is also expected on the Radius server). MAC-Auth supports all encryption types, and (in case of 802.11i) the handshake is allowed to be completed before the Radius lookup begins.

1.2.5.3 Secure Beacon

All the devices in a wireless network use *Service Set Identifiers* (SSIDs) to communicate. An SSID is a text string up to 32 bytes long. An AP in the network announces its status by using beacons. To avoid others from accessing the network, the most basic security measure adopted is to change the default SSID to one not easily recognizable, and disable the broadcast of the SSID.

The SSID is a code attached to all packets on a wireless network to identify each packet as part of that network. All wireless devices attempting to communicate with each other must share the same SSID. Apart from identifying each packet, the SSID also serves to uniquely identify a group of wireless network devices used in a given service set.

1.2.5.4 MU to MU Allow

MU to MU allow enables frames from one MU (where the destination MAC is that of another MU) to be switched to the second MU.

1.2.5.5 MU to MU Disallow

Use MU to MU Disalllow to restrict MU to MU communication within a WLAN. The default is 'no', which allows MUs to exchange packets with other MUs. It does not prevent MUs on other WLANs from sending packets to this WLAN. You would have to enable MU to MU Disallow on the other WLAN.

1.2.5.6 Switch - to - Wired

The MU frames are switched out to the wired network (out of the switch). Another upstream device decides whether the frame should be sent back to the second MU, and if so it sends the frame back to the switch, and it is switched out just like any other frame on the wire. This allows a drop/allow decision to be made by a device other than the wireless switch.

1.2.5.7 802.1x Authentication

802.1x Authentication cannot be disabled (its always enabled). A factory delivered out-of-the-box AP300 supports 802.1x authentication using a default username and password. EAP-MD5 is used for 802.1x.

- The default username is ***admin***
- The default password is ***symbol***

When you initially switch packets on an out-of-the-box AP300 port, it immediately attempts to authenticate using 802.1x. Since 802.1x supports *supplicant initiated* authentication, the AP300 attempts to initiate the authentication process.

On reset (all resets including power-up), the AP300 sends an EAPOL start message every time it sends a Hello message (periodically every 1 second). The *EAPOL start* is the *supplicant initiated* attempt to become authenticated.

If an appropriate response is received in response to the *EAPOL start* message, the AP300 attempts to proceed with the authentication process to completion. Upon successful authentication, the AP300 transmits the Hello message and the download proceeds the way as it does today.

If no response is received from the *EAPOL start* message, or if the authentication attempt is not successful, the AP300 continues to transmit *Hello* messages followed by *LoadMe* messages. If a parent reply is received

in response to the *Hello*, then downloading continue normally - without authentication. In this case, you need not enable or disable the port authentication.

802.1x authentication is conducted:

- At power up
- At an AP300 operator initiated reset (such as pulling Ethernet cable)
- When the switch administrator initiates a reset of the AP300.
- When re-authentication is initiated by the Authenticator (say the switch in between)

Change Username/Password after AP Adoption

Once the AP300 is adopted using 802.1x authentication (say default username/password) OR using a non-secure access method (hub or switch without 802.1x enabled), use the CLI/SNMP/UI to reconfigure the username/password combination.

Reset Username/Password to Factory Defaults

To restore the AP300 username/password to factory defaults, adopt the AP300 using a non-secure access method (a hub or switch without 802.1x enabled), then reconfigure the username/password combination.

The access port does not make use of any parameters (such as MAC based authentication, VLAN based etc.) configured on RADIUS Server.

1.2.5.8 IEEE 802.1AB LLDP

The access port implements a *Link Layer Discovery Protocol* (LLDP) agent and operates in Transmit- mode only (it only transmits the information about the capabilities and the current status of the local system).

The following modes are not supported:

- Receive-only mode — The LLDP agent can only receive information about the capabilities and the current status of the remote systems
- Transmit and receive mode — The LLDP agent can transmit the local system capabilities and status information as well as receive remote system's capabilities and status information.

The LLDP agent uses a high frequency (sending LLDP advertisements every 1 second) only until the AP receives Hello Response i.e. after the AP sees Hello Response, no LLDPDUs are transmitted by the access port. After AP has been adopted, the LLDP advertisements are sent at lower frequency (sending LLDP advertisements every 30 seconds).

On reset (all resets including power-up), an access port sends a LLDP advertisement every time it sends the "Hello" message. This is in addition to 802.1x EAPOL messages.

NOTE LLDPDUs are transmitted untagged.

LLDP is always enabled and cannot be disabled.

1.2.5.9 WIDS

The Symbol *Wireless Intrusion Detection System* (WIDS) monitors for any presence of unauthorized rogue access points. Unauthorized attempts to access the WLAN is generally accompanied by anomalous behavior as intruding MUs try to find network vulnerabilities. Basic forms of this behavior can be monitored and reported

without needing a dedicated WIDS. When the parameters exceed a configurable threshold, the switch generates an SNMP trap and reports the result via the management interfaces. Basic WIDS functionality does not require monitoring APs and does not perform off-channel scanning.

NOTE When converting an AP300 (with WISPe support) to an Intrusion Detection Sensor, the conversion requires approximatly 60 seconds.

1.2.5.10 Rogue AP Detection

The WS5100 supports the following methods for Rogue AP detection:

- *RF scan by Access Port on one channel*
- *RF scan by Access Port on all channels*
- *SNMP Trap on discovery*
- *Authorized AP Lists*
- *Rogue AP Report*

RF scan by Access Port on one channel

This process requires an access port to assist in Rogue AP detection. It functions as follows:

- The WS5100 sends a new WISP Configuration message to the adopted AP informing it to detect Rogue APs.
- The access port listens for beacons on its present channel.
- It passes the beacons to WS5100 wireless switch as it receives them without any modification.
- WS5100 wireless switch processes these beacon messages to generate the list of APs

This process of detecting a Rogue AP will be a non-disruptive and none of the MU will be disassociated during this process. The access port will only scan on its present channel. AP300 provides this support.

By choosing this option for detection, all capable access ports will be polled for getting the information. You can configure how frequently this needs to be performed.

RF scan by Access Port on all channels

This process uses Auto Channel Select (called Detector AP assist) to scan for Rogue APs on all available channels. It functions as follows:

- The WS5100 sends a WISP Configuration message (with the ACS bit set and channel dwell time) to the access port.
- An access port starts scanning each channel and passes the beacons it hears on each channel to the switch.
- An access port resets itself after scanning all channels.
- An switch then processes this information

The process of detecting a Rogue AP is disruptive, as connected MUs loose association. MUs need to reconnect once the access port resets.

SNMP Trap on discovery

An SNMP trap is sent for each detected and Rogue AP. Rogue APs are only detected, and notification is provided via a SNMP trap.

NOTE Wired side scanning for Rogue APs using WNMP is not supported. Similarly, RADIUS lookup for approved AP is not provided.

Authorized AP Lists

The switch allows you to configure a list of authorized access ports based on their MAC addresses. The switch evaluates the APs against the configured authorized list after obtaining Rogue AP information from one of the 2 mechanisms as mentioned in *Rogue AP Detection on page 1-22*.

Rogue AP Report

After determining which are authorized APs and which are Rogue, the switch prepares a report.

1.2.5.11 ACLs

ACLs control access to the network through a set of rules. Each rule specifies an action taken when a packet matches the given set of rules. If the action is deny, the packet is dropped, if the action is permit, the packet is allowed, if the action is to mark, the packet is tagged for priority. The WS5100 supports the following types of ACLs:

- IP Standard ACLs
- IP Extended ACLs
- MAC Extended ACLs

ACLs are identified by either a number or a name (the exception being MAC extended ACLs which take only name as their identifier). Numbers are predefined for IP Standard and Extended ACLs, whereas a name can be any valid alphanumeric string not exceeding 64 characters. In numbered ACLs, the rule parameters have to be specified on the same command line along with the ACL identifier. For named ACLs, rules are configured within a separate CLI context.

1.2.5.12 Local Radius Server

RADIUS is a common authentication protocol utilized by the 802.1x wireless security standard. RADIUS improves the WEP encryption key standard, in conjunction with other security methods such as EAP-PEAP.

The WS5100 has one onboard RADIUS server with the following configurable parameters:

- hostname /IP address
- Port
- Shared Secret Key
- List of RADIUS clients
- Authentication Mechanism
- Database source - LDAP/Local
- Certificates
- Proxy

1.2.5.13 IPSec VPN

IP Sec is a security protocol providing authentication and encryption over the Internet. Unlike SSL (which provides services at layer 4 and secures two applications), IPsec works at layer 3 and secures everything in the network. Also unlike SSL (which is typically built into the Web browser), IPsec requires a client installation. IPsec can access both Web and non-Web applications, whereas SSL requires workarounds for non-Web access such as file sharing and backup.

A VPN is used to provide secure access between two subnets separated by an unsecured network. There are two types of VPNs:

- Site-Site VPN — For example, a company branching office traffic to another branch office traffic with an unsecured link between the two locations.
- Remote VPN — Provides remote user ability to access company resources from outside the company premises.

The switch supports:

- IPSec termination for site to site
- IPSec termination for remote access
- IPSec traversal of firewall filtering
- IPSec traversal of NAT
- IPSec/L2TP (client to switch)

1.2.5.14 NAT

NAT (Network Address Translation) is supported for non-IPSec packets which are routed by the switch. The following types of NAT are supported:

- Port NAT– Port NAT (also known as NAPT) entails multiple local addresses are mapped to single global address and a dynamic port number. The user is not required to configure any NAT IP address. Instead IP address of the public interface of the switch is used to NAT packets going out from private network and vice versa for packets entering private network.
- Static NAT– Static NAT is similar to Port NAT with the only difference that it allows the user to configure a source NAT IP address and/or destination NAT IP address to which all the packets will be NATted to. The source NAT IP address will be used when hosts on a private network are trying to access a host on a public network. Destination NAT IP address can be used for public hosts to talk to a host on the private network.

1.2.5.15 Certificate Management

Certificate Management is used to provide a standardized procedure to

- Generate a Server certificate request and upload the server certificate signed by certificate authority (CA).
- Uploading of CA's root certificate.
- Creating a self-signed certificate

Certificate management will be used by the applications HTTPS, VPN, HOTSPOT and RADIUS.

1.2.6 Access Port Support

Access ports work on any VLAN with connectivity to the wireless switch. The WS5100 Series Switch supports the following access ports:

- AP100 (supports 802.11b)
- AP300 (supports 802.11a/b/g)
- Access points converted to access ports, including:
  - AP-4131

2

Switch Web UI Access and Image Upgrades

2.1 Accessing the Switch Web UI

2.1.1 Web UI Requirements

The switch Web UI is accessed using Internet Explorer version 5.5 (or later) and SUN JRE (Java Runtime Environment) 1.5 (or later). Refer to the Sun Microsystems Web site for information on downloading JRE.

NOTE To successfully access the switch Web UI through a firewall, UDP port 161 must be open in order for the switch's SNMP backend to function.

To prepare Internet Explorer to run the Web UI:

1. Open IE's **Tools** > **Internet Options** panel and select the **Advanced** tab.
2. Uncheck the following checkboxes:

- Use HTTP 1.1
- Java console enabled (requires restart)
- Java logging enabled
- JIT compiler for virtual enabled (requires restart).

2.1.2 Connecting to the Switch Web UI

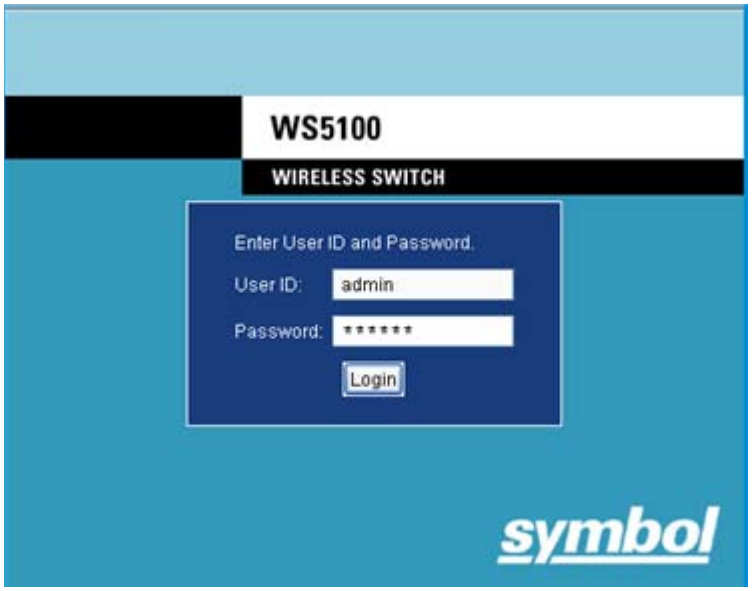
To display the Web UI, launch a Web browser on a computer with the capability of accessing the switch.

NOTE Ensure you have HTTP connectivity to the switch, as HTTP is a required to launch the switch Web UI from a browser.

To display the switch Web UI:

1. Point the browser to the IP address assigned to the wired Ethernet port (port 2). Specify a secure connection using the **https://** protocol.

   The switch login screen displays:



2. Enter the User ID **admin,** and Password **superuser.** Both are case-sensitive. Click the **Login** button.

NOTE If using HTTP to login into the switch, you may encounter a Warning screen if a self-signed certificate has not been created and implemented for the switch. This warning screen will continue to display on future login attempts until a self-signed certificate is implemented. Symbol recommends only using the default certificate for the first few login attempts until a self-signed certificate can be generated.

NOTE If your password is lost, there is a means to access the switch, but you are forced to revert the switch back to its factory default settings and lose your existing configuration (unless saved to a secure location). Consequently, Symbol recommends keeping the password in a secure location so it can be retrieved. For information on password recovery, see *Switch Password Recovery on page 2-3*.

Once the Web UI is accessed, the Switch main menu item displays a configuration tab with high-level switch information. Click the **Show Dashboard** button to display an overall indicator of switch health. Once the switch is fully configured, the dashboard is the central display for the user to view the version of firmware running on the switch, quickly assess the last 5 alarms generated by the switch, view the status of the switch's Ethernet connections and view switch CPU and memory utilization statistics.

NOTE The chapters within this *System Reference Guide* are arranged to be complimentary with the main menu items in the menu tree of the switch Web UI. Refer to this content to configure switch network addressing, security and diagnostics as required.

2.2 Switch Password Recovery

If the switch Web UI password is lost, you cannot get passed the Web UI login screen for any viable switch configuration activity. Consequently, a password recovery login must be used that will default your switch back to its factory default configuration.

To access the switch using a password recovery username and password:

CAUTION Using this recovery procedure erases the switch's current configuration and data files from the switch /flash dir. Only the switch's license keys are retained. You should be able to log in using the default username and password (admin/superuser) and restore the switch's previous configuration (only if it has been exported to a secure location before the password recovery procedure was invoked).

1. Point the browser to the IP address assigned to the wired Ethernet port (port 2).

   The switch login screen displays:

2. Enter a password recovery username of **restore** and password recovery password of **restoreDefaultPassword**. Click the **Login** button.

   The switch will login into the Web UI with its reverted default configuration. If you had exported the switch's previous configuration to an external location, it now can be imported back to the switch. For information on importing switch configuration files, see *Transferring a Config File on page 3-17*.

2.3 Upgrading the Switch Image

The WS510 Series Switch ships with a factory installed firmware image with the full feature functionality described in this System Reference Guide. However, Symbol periodically releases switch firmware that includes enhancements or resolutions to known issues. Verify your current switch firmware version with the latest version available from the Symbol Web site before determining if your system requires an upgrade.

Additionally, legacy users running either the 1.4.x or 2.x version switch firmware may want to upgrade to the new 3.0 baseline to take complete advantage of the new diverse feature set available to them. This chapter describes the method to upgrade from either the 1.4.x or 2.x baseline to the new 3.0 baseline.

CAUTION Symbol recommends caution when upgrading your WS5100 switch image to the 3.0 baseline as portions of your configuration will be lost and unrecoverable. Ensure that you have exported your switch configuration to a secure location before upgrading your switch. The upgrade.log file will contain a list of issues found in the conversion of the configuration file to the new format.

CAUTION If using a 1.4.x or 2.x admin user password shorter than 8 characters (such as the default symbol password), the password will be converted to the 3.0 baseline admin password of “password” upon a successful update to the 3.0 baseline. Ensure your existing 1.4.x or 2.x admin password is longer than 8 characters before updating, or leave as is and use “superuser” to login into an updated 3.0 baseline.

CAUTION After upgrading the switch baseline from 1.4.x or 2.x to the 3.0 baseline, applet caching can produce unpredictable results and contents. After the upgrade, ensure your browser is restarted. Otherwise, the credibility of the upgrade can come into question.

2.3.1 Upgrading the Switch Image from 1.4.x or 2.x to Version 3.0

To upgrade a switch running either a 1.4.x or 2.x version to the latest 3.0 version switch firmware:

1. Execute the PreUpgradeScript utility (or use the CLI) to ensure there is enough space on your system to perform the upgrade. The PreUpgradeScript utility should be in the same directory as the upgrade files.
2. Install the **Cfgupgrade1.x-setup** utility on a Windows desktop system by double clicking the Cfgupgrade 1.x-setup file.

   Follow the prompts displayed by the installer to install Cfgupgrade 1.x-setup.

   A **WS5100 Configuration Upgrade** icon gets created within the Program Files folder. The icon can be optionally created on your Windows desktop as well.
3. From the WS5100 running either 1.4.x or 2.x, create a configuration and save it on the switch.

   ```
   WS5100# save  <file name> <.cfg>
   ```

   This is the configuration that will be upgraded to the new 3.0 baseline.

NOTE Symbol recommends saving a copy of the switch configurartion to a secure location before the upgrade. If an error occurs with the upgrade a viable configuration will be needed to restore on the switch.

4. Copy the configuration file <.cfg> from the legacy WS5100 to the Windows system where the conversion utility resides.

   Use ftp or tftp to transfer the file.

5. Click on the **WS5100 configuration Upgrade** icon (from the Windows system).

6. Select the config file copied on to the windows system and run it.

   A folder having the same name as the config file is created. The folder contains the converted startup-config file (in the new upgraded format) along with other log files.

7. Copy the startup-config file back to the WS5100 running using either tftp or ftp.

8. Download or copy the image file <WS5100-3.0.0.0-XX.v1> or <WS5100-3.0.0.0-XX.v2> to the WS5100 running the legacy switch firmware.

NOTE If upgrading a 1.4.x version WS5100 to the new 3.0 baseline, be sure you are using the <WS5100-3.0.0.0-XX.v1> image file. If upgrading a 2.x version WS5100 to the new 3.0 baseline, be sure you are using the <WS5100-3.0.0.0-XX.v2> image file.

9. On the WS5100, type:

```
WS5100#service
WS5100#password "password"
exec
```

   Upon reboot, the switch runs the 3.0 image using startup-config as the running configuration.

10. Repeat the instructions above for additional switch upgrades, ensuring <WS5100-3.0.0.0-XX.v1> is used for 1.4.x version upgrades, and <WS5100-3.0.0.0-XX.v2> is used for 2.x version upgrades.

2.4 Downgrading the Switch Image from Version 3.0 to 1.4.x or 2.x

If for some reason you want to downgrade your WS5100 back down to a 1.4.x or 2.x version firmware image, use one of the two following image files:

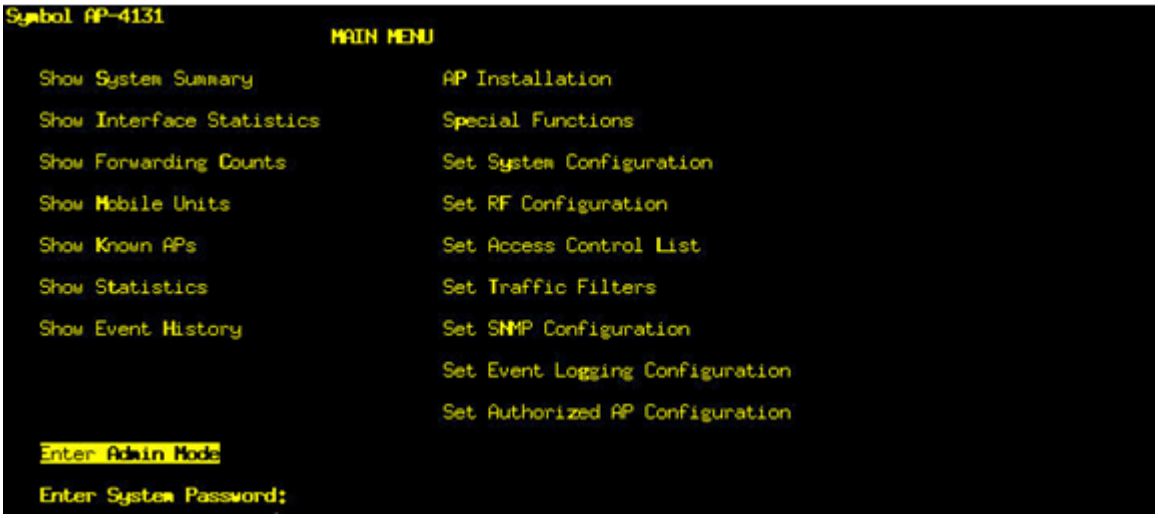
- WS5100-1.4.3.0-012R.img
- WS5100-2.1.0.0-029R.img

2.5 AP-4131 Access Point to Access Port Conversion

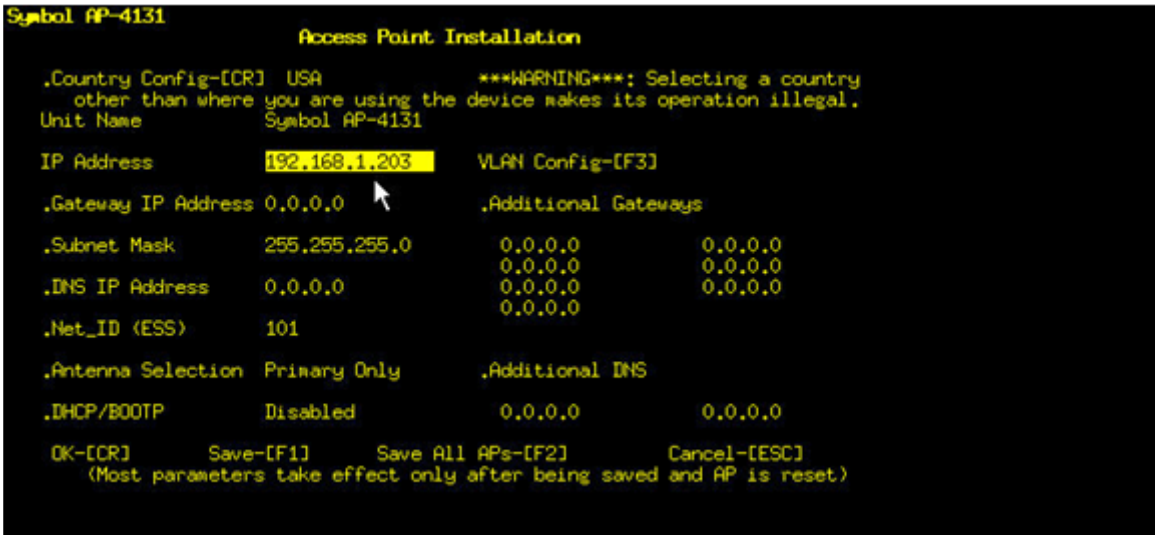
To convert an AP-4131 "fat" access point to a "thin" AP-4131 access port you need to load the port conversion version firmware. Refer to the files available with you Symbol Web site download package.

To convert an AP-4131 access point

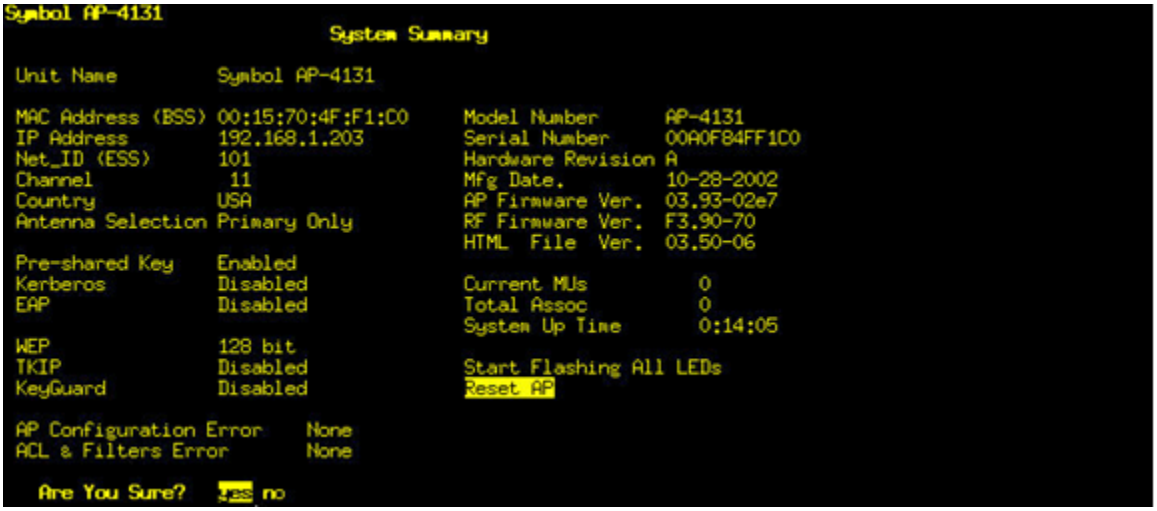
1. Verify a TFTP server is up and running and the firmware you are going to install is in the root directory of the TFTP server.
2. Log in to the AP-4131 as **Admin**. The default password is **Symbol**.



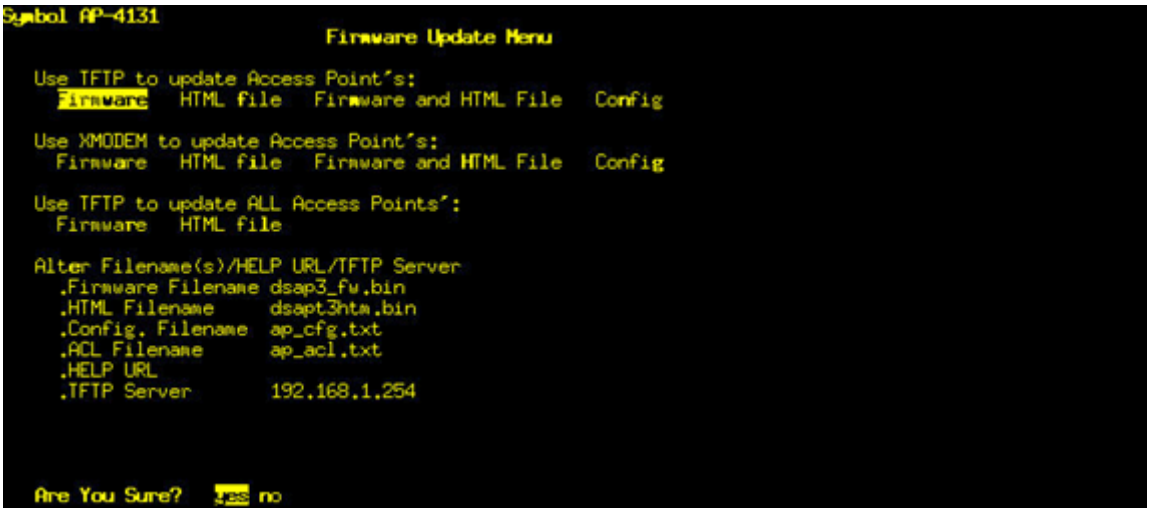
3. Select the **AP Installation** main menu item.
4. From the **IP Address** field, enter a new IP address (if required) and select **Save-[F1]** to save the change. If the IP address was changed, you will need to reset the AP for the change to be implemented.



5. Reset the AP if you changed the AP's IP address, buy displaying the **System Summary** and selecting the **Reset AP** option. If you reset the AP-4131 you will need to login as Admin again.



6. Select the **Special Functions** main menu item.
7. Select the **Firmware Update Menu-[F3]** menu item
8. Select the **Alter Filename(s)/HELP URL/TFTP Server** menu item.
   a. Confirm that the Firmware File Name is correct, make changes as needed.
   b. Enter the IP address of your TFTP server, select enter.
   c. Select F1 to save your changes.
9. Select **Firmware** under the **Use TFTP to update Access Point's** option.



10. Select **yes** when asked to confirm.
11. The AP-4131 will now reset, download and install the desired firmware.
12. Once the firmware download is complete, connect the AP-4131 to the PoE switch and WS5100. The AP-4131 should adopt and operate as a "thin" access port.

3

Switch Information

This chapter describes the Switch main menu information used to configure the switch. This chapter consists of the following sections:

NOTE HTTPS must be enabled to access the switch applet. Ensure that HTTPS access has been enabled before using the login screen to access the switch applet.

3.1 Viewing the Switch Interface

The **Switch** screen provides high-level system, switch name and address information accessible from one location. The values within the screen can be defined in numerous locations throughout the applet.

It consists of the following two tabs:

- *Viewing the Switch Configuration*
- *Viewing Switch Statistics*

NOTE When the switch's configuration is successfully updated (using the Web UI), the effected screen is closed without informing the user their change was successful. However, if an error were to occur, the error displays within the effected screen's Status field and the screen remains displayed. In the case of file transfer operations, the transfer screen remains open during the transfer operation and remains open upon completion (with status displayed within the Status field).

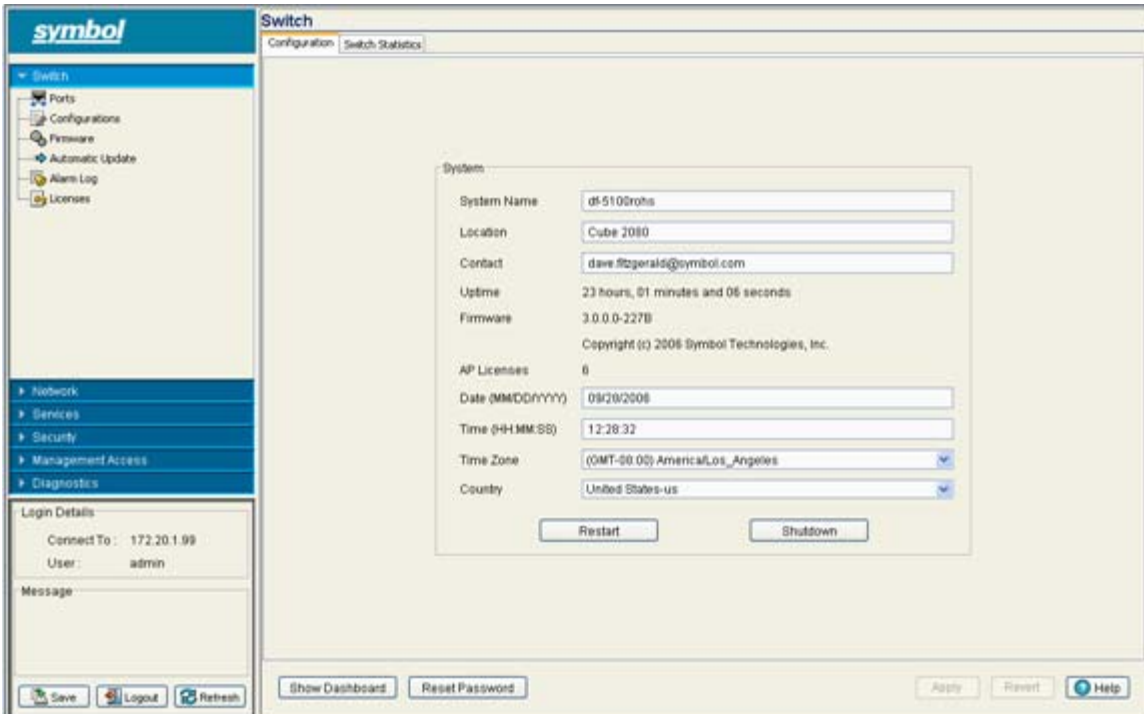
3.1.1 Viewing the Switch Configuration

The system prompts you to enter the correct country code after the first login. A warning message may display stating that an incorrect country setting will lead to the illegal use of the switch. Hence, selecting the correct country is extremely important. Each country has its own regulatory restrictions concerning electromagnetic emissions (channel range) and the maximum RF signal strength transmitted. To ensure compliance with national and local laws, be sure to set the **Country** field correctly.

The **Configuration** screen displays high-level system settings for system name, location and contact information.

To view a high-level display of the switch configuration:

1. Select **Switch** from the main menu tree.
2. Click the **Configuration** tab



3. Refer the **System** field to view or define the following information:

Country	The system prompts the user for the correct **Country** code after the first login. A warning message could display stating that an incorrect country setting will lead to an illegal use of the switch. Selecting the correct country is extremely important. Each country has its own regulatory restrictions concerning electromagnetic emissions (channel range) and the maximum RF signal strength transmitted. To ensure compliance with national and local laws, be sure to set the Country field correctly.
System Name	Displays the designated read-only system name. Select a system name serving as a reminder of the user base the switch supports (engineering, retail, etc.).
Location	The **Location** is used to define the location of the switch. The Location parameter acts as a reminder of where the switch can be found. Use the System Name field as a specific identifier of the switch's location. Use the System Name and Location fields together to optionally define the switch name by the radio coverage type it supports and specific physical location. For example, "second floor engineering."
Contact	Displays the **Contact** value for contact information for system administration and troubleshooting.
Uptime	Displays the current operational time for the device name defined within the System Name field. Uptime is the cumulative time since the switch was last rebooted or lost power.
Firmware	Displays the current firmware version running on the switch.
AP Licenses	Displays the number of Access Port licenses currently available for the switch. In other words, the maximum number of Access Ports that the switch is licensed to adopt.
Date (MM/DD/YYYY)	Displays the day, month and year currently used with the switch.
Time	Displays the time of day used by the switch.
Time Zone	Use the Time Zone drop-down menu to specify the time zone used to with the switch. Adjusting the time zone will in turn, cause an adjustment to the time displayed in the Time field/
Country	Use the drop-down menu to specify the correct country of operation. Selecting the country incorrectly could render your switch as operating illegally.

4. Click the **Restart** button to reboot the switch. The switch itself does not include a hardware feature for this purpose.

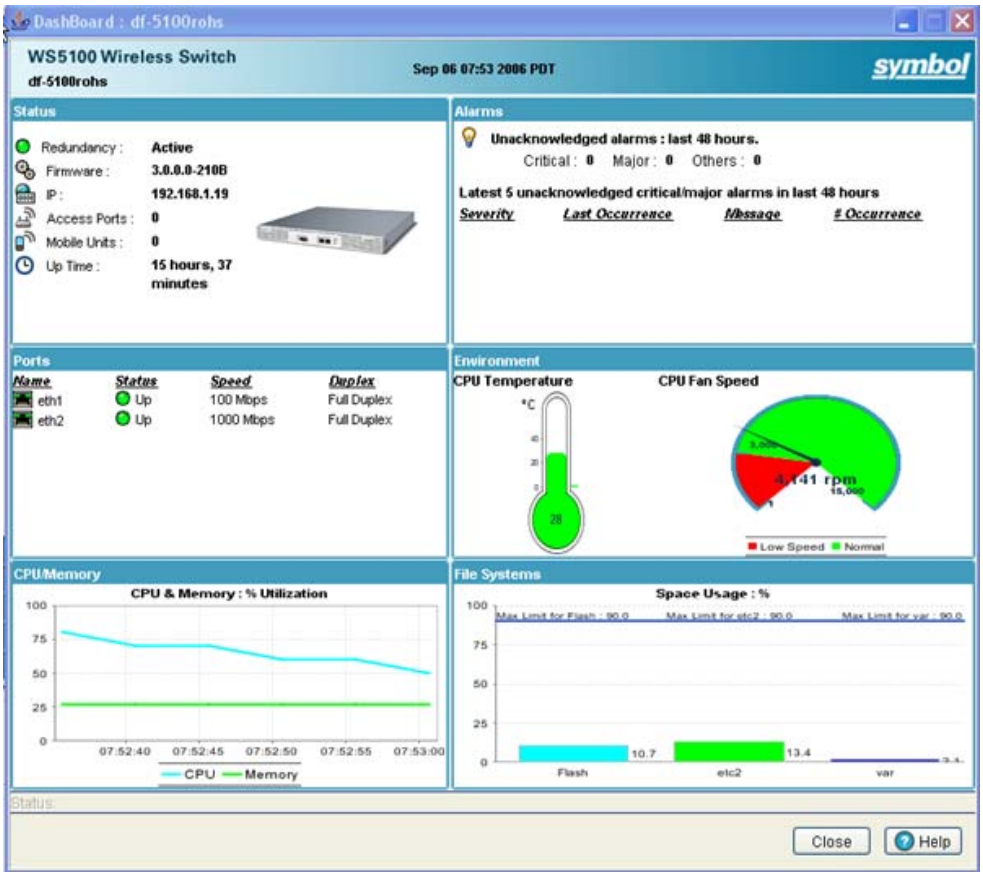
CAUTION When restarting or rebooting the switch, the Radius server will also be restarted regardless of its state before the reboot.

5. Click the Shutdown button to halt (stop) the switch.
6. Click the **Show Dashboard** button to display a screen with indicators of switch health and status. For more information, see *Viewing Dashboard Details on page 3-4*.

7. Click the **Apply** button to save the updates (to Time Zone or Country).
8. Click the **Revert** button to undo any changes. Revert sets the values for the screen back to the last saved configuration.

3.1.1.1 Viewing Dashboard Details

Click the **Show Dashboard** button (within the Switch screen's Configuration tab) to display the current health of the switch.



The **Dashboard** screen displays the current health of the switch and is divided into the following fields:

- Alarms
- Ports
- Environment
- CPU Memory
- File Systems

Apart from the sections mentioned above, it also displays the following:

Displays the status of the switch. The status can be either Active or Inactive.

- Active — Is denoted with a green dot.
- Standby— Is denoted with a red dot.

Displays the current Firmware value of the current software running on the wireless switch.

Displays the Management IP Address of the switch.

Displays the status of the Ethernet Port 1 and Ethernet Port 2. The status of the port can be either:

- Up — Port in use.
- Down — Port not in use.

Displays the total number of access ports adopted by the switch.

Displays the total number of MUs associated with the switch.

Displays the actual switch uptime. The **Uptime** is the current operational time of the device defined within the System Name field. Uptime is the cumulative time since the switch was last rebooted or lost power.

1. Refer to the **Alarms** field for details of all the unacknowledged alarms generated during the past 48 hours. The alarms are classified as:
   - Critical — Denoted by a red legend.
   - Major — Denoted by a yellow legend.
   - Others — Denoted by a blue legend.

   It also displays details of the 5 most recent unacknowledged critical/major alarms raised during the past 48 hours in a tabular format. The table displays the following details:

Severity	Displays the severity of the alarm. It can be either Critical or Major.
Last Occurrence	Displays the time when the alarm was reported
Message	Displays the message associated with the alarm.
# Occurrences	Displays the number of times during the past 48 hours such an alarm was generated.

2. Refer to the **Ports** field for link, speed, duplex, POE Status of each physical port on the front panel. It displays the following details in a tabular format:

Name	Displays the name of the port, either—Ethernet1 or Ethernet 2
Status	Displays the status of the port, either— Up or Down
Speed	Displays the speed at which the port transmits or receives data.
Duplex	Displays the status of the port, either— Full Duplex or Unknown.

3. The **Environment** section displays the CPU temperature and switch fan speed. It displays the valid threshold range set by the user.
4. The **CPU/Memory** section displays the free memory available with the RAM.
5. The **File Systems** section displays the free file system available with:

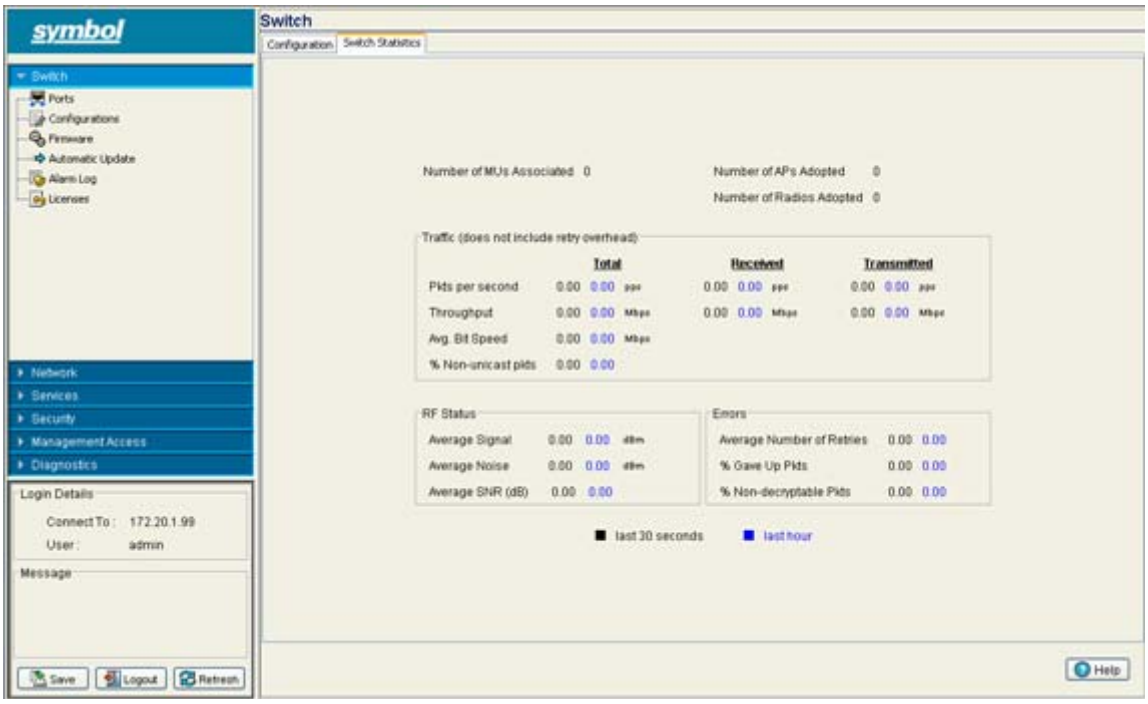
a. Root file system usage (/flash)
b. RAM file system usage (/var)
c. etc2 file system usage (/etc2)

3.1.2 Viewing Switch Statistics

The **Switch Statistics** screen displays an overview of the recent network traffic and RF status for the switch.

To display the main Switch Statistics tab:

1. Select **Switch** from the main menu tree.
2. Click the **Switch Statistics** tab at the top of the Switch screen.



3. Refer to the **Switch Statistics** area for the following read-only information about associated MUs:

Number of MUs Associated	Displays the total number of MUs currently associated to switch.
Number of APs Adopted	Displays the total number of access ports currently adopted by the switch.
Number of Radios Adopted	Displays the total number of radios currently adopted by the switch.

4. Refer to the **Traffic** section for read-only network traffic information for associated APs and radios:

Pkts per second	Displays the packet transmission rate for received and transmitted packets over last 30 seconds and 1 hour.
Throughput	Displays the traffic throughput for packets received, packets transmitted and total packets over last 30 seconds and 1 hour. The throughput value can help identify network bandwidth and utilization issues negatively impacting performance.

Avg. Bit Speed	Displays the average bit speed for the switch over last 30 seconds and 1 hour. Use the average bit speed value to help determine overall network speeds and troubleshoot network congestion.
% Non-unicast pkts	Displays the percentage of non-unicast packets seen (received & transmitted) by the switch over last 30 seconds and 1 hour. Non-unicast traffic includes both multicast and broadcast traffic.

5. The **RF Status** section displays the following read-only RF radio signal information for associated APs and radios:

Avg Signal	Displays the average signal strength for MUs associated with the switch over the last 30 seconds and 1 hour. The higher the signal, the closer the MU.
Avg Noise	Displays the average RF noise for all MUs associated with the selected WLAN. MU noise for the last 30 seconds is displayed in black and the number in blue represents MU noise for the last hour. If MU noise is excessive, consider moving the MU closer to the access port, or in area with less conflicting network traffic. Excessive noise may also be an indication of network interference.
Avg SNR	Displays the average *Signal to Noise Ratio* (SNR) for all MUs associated with the switch. The Signal to Noise Ratio is an indication of overall RF performance on your wireless network.

6. Refer to the **Errors** section for the following read-only packet error and loss information for associated access ports and radios:

Average Number of Retries	Displays the average number of retries for all MUs associated with the switch. The number in black represents average retries for the last 30 seconds and the number in blue represents average retries for the last hour.
% Gave Up Pkts	Displays the percentage of packets which the switch gave up on for all MUs associated with the switch. The number in black represents this statistic for the last 30 seconds and the number in blue represents this statistic for the last hour.
% Non-decryptable Pkts	Displays the percentage of undecryptable packets for all MUs associated with the switch. The number in black represents undecryptable pkts for the last 30 seconds and the number in blue represents undecryptable pkts for the last hour.

3.2 Viewing Switch Port Information

The **Port** screen displays the configuration, runtime status and statistics of the Ethernet Port 1 and Ethernet port 2. It consists of the following tabs:

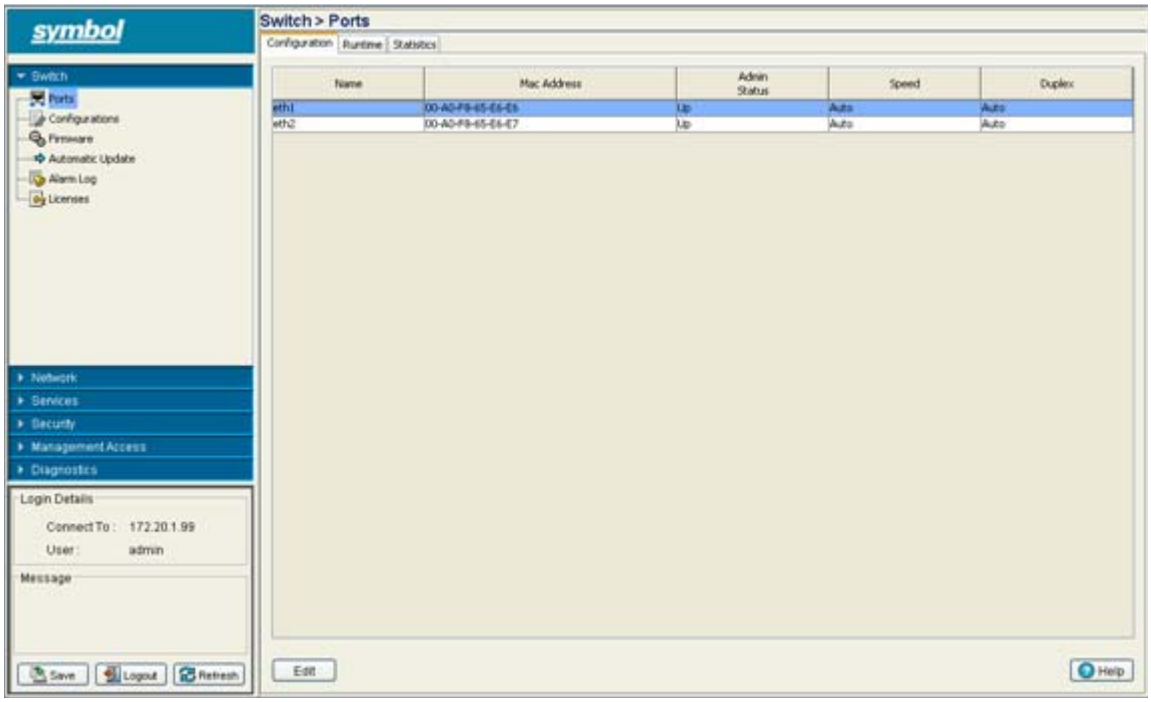
- Configuration
- Runtime
- Statistics

3.2.1 Viewing the Port Configuration

The **Configuration** screen displays the current configuration for the switch ports. This screen has a Filter option, which can be either displayed or hidden. Use this information to determine whether an existing port configuration can be used as is or requires modification to be valid for use within the switch managed network.

To view configuration details for the uplink and downlink ports:

1. Select **Switch** > **Port** from the main menu tree.
2. Select the **Configuration** tab to display the following read-only information:



Name	Displays the current port name.
MAC Address	Displays the port's MAC Address. This value is read-only, set at the factory and cannot be modified.
Admin Status	Displays whether the port is currently Up or Down.
Speed	Displays the current speed of the data transmitted and received over the port.
Duplex	Displays the port as either half or full duplex.

3. Select a port and click the **Edit** button to modify the port configuration. For additional information, see *Editing the Port Configuration on page 3-9*.

3.2.1.1 Editing the Port Configuration

To modify the port configuration:

1. Select a port from the table displayed within the Configuration screen.
2. Click the **Edit** button.
3. A **Port Change Warning** screen displays, stating any change to the port setting could disrupt access to the switch. Communication errors may occur even if the modification made are successful.
4. Click the **OK** button to continue.
5. Use the **Edit** screen to modify the following port configurations for the selected port.

Name — If necessary, modify the read-only name assigned to the port.

Description — Enter a brief description for the port.

Admin Status — Either Enable (activate) or Disable (inactivate) the admin status of the port.

Speed — Select the speed at which the port can receive and transmit the data. You can select from either of the following ranges:

- 10 Mbps
- 100 Mbps
- 1000 Mbps
- Auto

Duplex — Modify the duplex status of the switch by selecting one of the following options:

- Half
- Full
- Auto

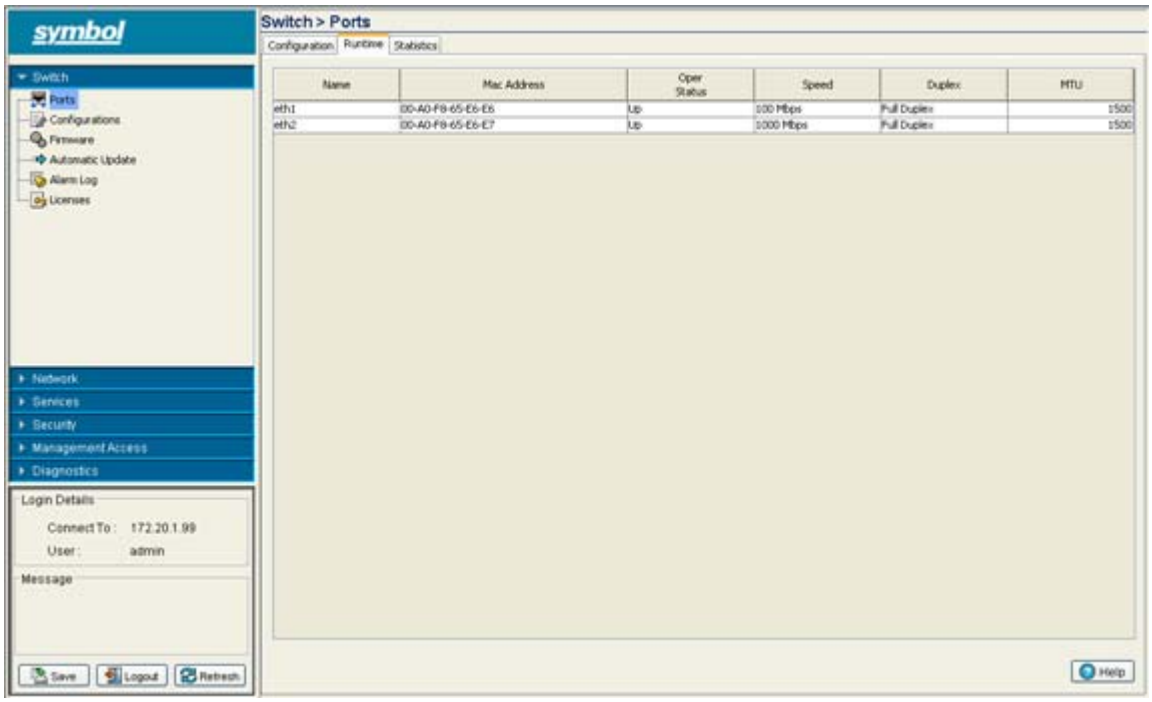
6. Click the **OK** button to commit the changes made to the port configurations.
7. Click **Cancel** to disregard any changes and revert back to the last saved configuration.

3.2.2 Viewing the Ports Runtime Status

The Configuration screen displays the read-only runtime configuration for uplink and downlink ports. This screen has a Filter option (which can be either displayed or hidden).

To view the runtime configuration details of the uplink and downlink ports:

1. Select **Switch** > **Port** from the main menu tree.



2. Select the **Runtime** tab to display the following read-only information:

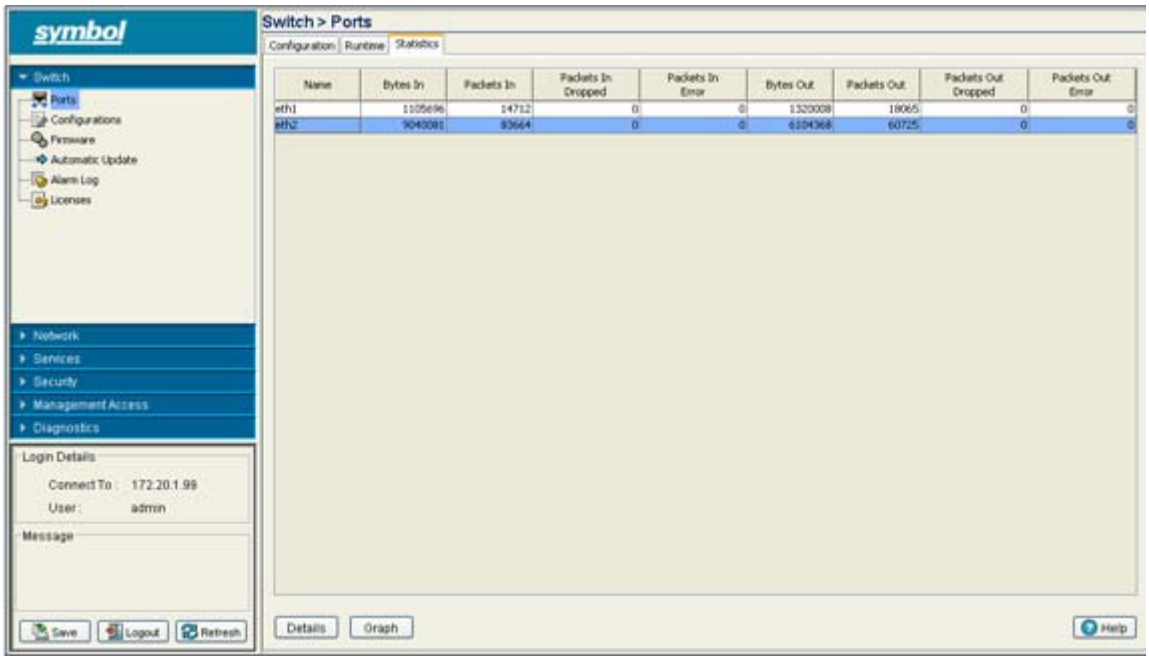
Name	Displays the ports current name.
MAC Address	Displays the port's MAC Address. This value is read-only, set at the factory and cannot be modified.
Oper Status	Displays the operational status of the port. The port status can be either Up or Down.
Speed	Displays the current speed of the data transmitted and received over the port.
Duplex	Displays the port as either half or full duplex.
MTU	Displays the MTU setting configured on the port. MTU stands for maximum transmission unit. The MTU value represents the largest packet size that can be sent over a link. The MTU is determined by the underlying network, but must be taken into account at the IP level. IP packets (which can be up to 64K bytes each) must be packaged into lower-level packets of the appropriate size for the underlying network(s) and re-assembled on the other end. 10/100 Ethernet ports have a maximum MTU setting of 1500.

3.2.3 Viewing the Ports Statistics

The **Statistics** screen displays read-only statistics for uplink and downlink ports. Use this information to assess if configuration changes are required to improve network performance. This screen has a Filter option, which can be either displayed or hidden.

To view the runtime configuration details of the uplink and downlink ports:

1. Select **Switch** > **Port** from the main menu tree.
2. Select the **Statistics** tab.



3. Refer to the Statistics tab to display the following read-only information:

Name	Defines the port name (as either uplink or downlink).
Bytes In	Displays the total number of bytes received by the port.
Packets In	Displays the total number of packets received by the port.
Packets In Dropped	Displays the number of packets dropped by the port. If the number appears excessive, a different port could be required.
Packets In Error	Displays the number of erroneous packets received by the port. If the number appears excessive, a different port could be required.
Bytes Out	Displays the total number of bytes transmitted by the port.
Packets Out	Displays the total number of packets transmitted (sent) by the port. A low value could be an indication of a network problem.
Packets Out Dropped	Displays the total number of transmitted packets dropped. A high value may be an indication of network issues.
Packets Out Error	Displays the total number of erroneous transmitted packets.

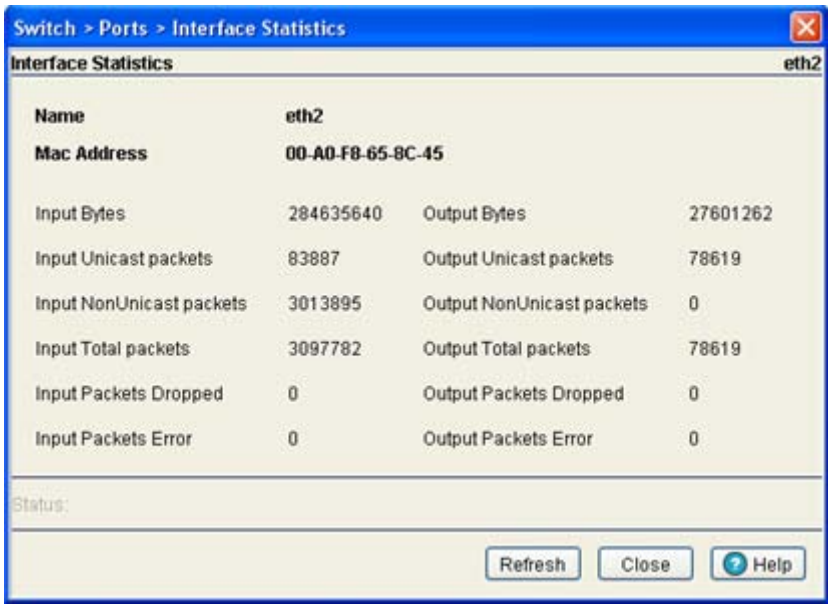
4. Select a port and click on **Details** button to see the detailed port statistics. For more information, refer to *Detailed Port Statistics on page 3-12*.

5. Select a port and click on **Graph** button to view the port statistics in a graphical format. For more information, refer to *Viewing the Port Statistics Graph on page 3-14*.

3.2.3.1 Detailed Port Statistics

To view detailed statistics for a port:

1. Select a port from the table displayed within the Statistics screen.
2. Click the **Details** button.



3. The **Interface Statistics** screen displays. This screen displays the following statistics for the selected port:

Name	Displays the port name.
MAC Address	Displays the physical address information associated with the interface. This address is read-only (hard-coded at the factory) and cannot be modified.
Input Bytes	Displays the number of bytes received in the interface.
Input Unicast Packets	Displays the number of unicast packets (packets directed towards the interface) received in the interface.
Input NonUnicast Packets	Displays the number of NonUnicast Packets (Multicast and Broadcast Packets) received at the interface.
Input Total Packets	Displays the total number of packets received at the interface.
Input Packets Dropped	Displays the number of received packets dropped at the interface by the input Queue of the hardware unit /software module associated with the VLAN interface. Packets are dropped when the input Queue of the interface is full or unable to handle incoming traffic.

Input Packets Error	Displays the number of received packets with errors at the interface. Input Packet Errors are input errors occurring due to; no buffer space/ignored packets due to broadcast storms, packets larger than maximum packet size, framing errors, input rate exceeding the receiver's date handling rate or cyclic redundancy check errors. In all these cases, an error is reported.
Output Bytes	Displays the number of bytes transmitted from the interface.
Output Unicast Packets	Displays the number of unicast packets (packets directed towards a single destination address) transmitted from the interface.
Output NonUnicast Packets	Displays the number of unicast packets transmitted from the interface.
Output Total Packets	Displays the total number of packets transmitted from the interface.
Output Packets Dropped	Displays the number of transmitted packets dropped at the interface. Output Packets Dropped are the packets dropped when the output queue of the physical device associated with interface is saturated.
Output Packets Error	Displays the number of transmitted packets with errors at the interface. Output Packet Errors are the sum of all the output packet errors, malformed packets and misaligned packets received on an interface.

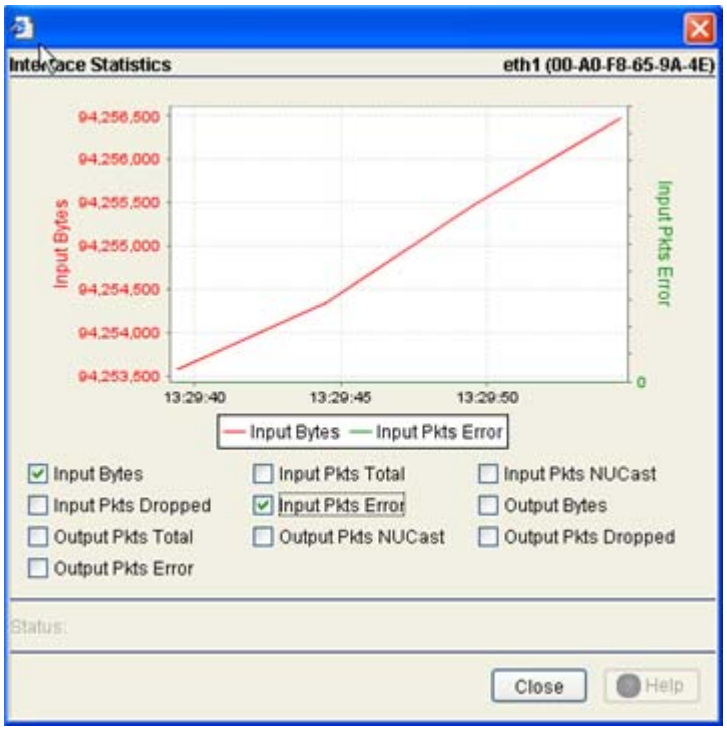
4. The **Status** is the current state of the requests made from the applet. Requests are any "SET/GET" operation from the applet. The Status field displays error messages if something goes wrong in the transaction between the applet and the switch.
5. Click on the **Refresh** button to refresh the port statistics.
6. Click on the **Close** button to exit out of the screen.

3.2.3.2 Viewing the Port Statistics Graph

The Web UI continuously collects data for port statistics. Even when the port statistics graph is closed, data is still tallied. Periodically display the port statistics graph for assessing the latest information.

To view a detailed graph for a port:

1. Select a port from the table displayed in the Statistics screen.
2. Click the **Graph** button.



The **Interface Statistics** screen displays for the selected port. The screen provides the option to view statistics for the following:

- Input Bytes
- Input Pkts Dropped
- Output Pkts Total
- Output Pkts Error
- Input Pkts Total
- Input Pkts Error
- Output Pkts NUCast
- Input Pkts NUCast
- Output Bytes
- Output Pkts Dropped

3. Select any of the above parameters by selecting the checkbox associated with it.

NOTE You are not allowed to select more than four parameters at any given time.

4. Click on the **Close** button to exit out of the screen.

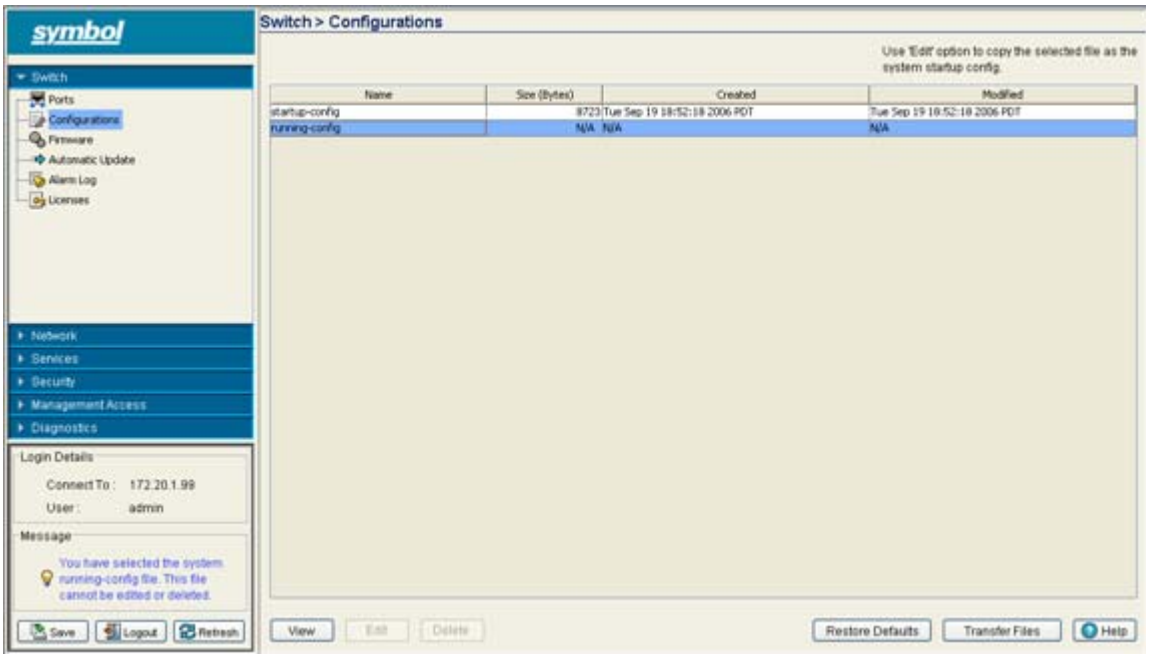
3.3 Viewing Switch Configurations

Use the **Configurations** screen to review the configuration files available to the switch. The details of each file can be viewed individually. Optionally, you can edit the file to modify its name or use the file as the startup configuration. A file can be deleted from the list of available configurations or transferred to a user specified location.

NOTE If you would like to view the entire switch configuration using SNMP, the switch CLI provides a better medium to review the entire switch configuration.

To view the Configuration files available to the switch:

1. Select **Switch** > **Configurations** from the main menu tree.



The following information is displayed in a tabular format. Each file can be edited, viewed or deleted.

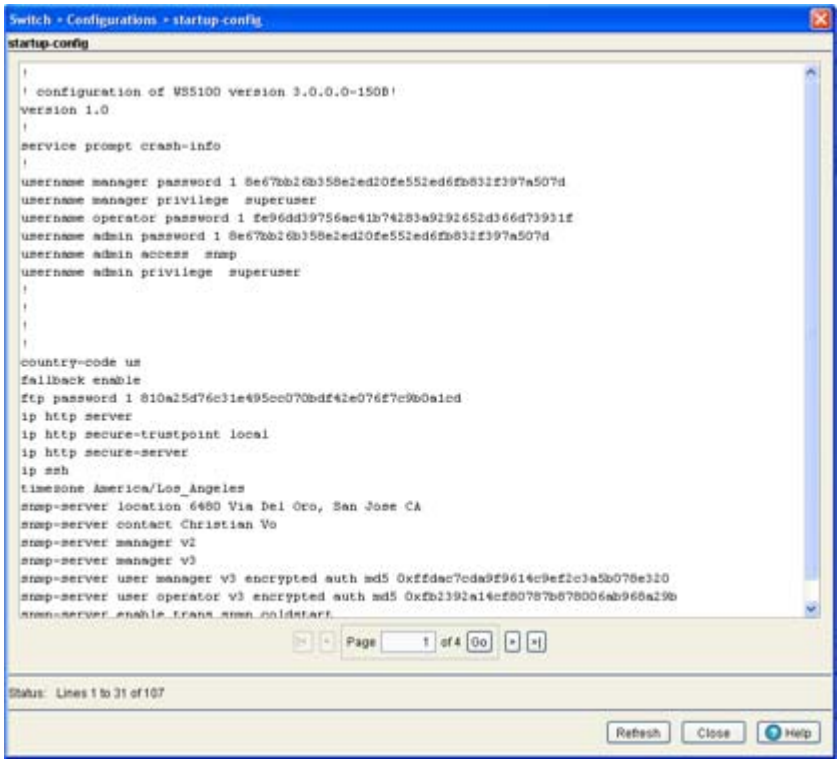
Name	Displays a list of existing configuration files that can used with the switch.
Size (Bytes)	Displays the size (in bytes) of each available switch configuration file.
Created	Displays the date and time each configuration file was created. Use this information as a baseline for troubleshooting problems by comparing event log data with configuration file creation data.
Modified	Displays the date and time each configuration file was last modified. Compare this column against the Created column to discern which files were modified and make informed decisions whether existing files should be further modified or deleted.

2. To view the entire contents of a config file in detail, select a config file by selecting a row from the table and click the **View** button. For more information, see *Viewing the Detailed Contents of a Config File on page 3-16*.
3. To modify a configuration file name and/or use it as the configuration at startup, select a row from the table and click the **Edit** button. For more information, see *Editing a Config File on page 3-17*.
4. To permanently remove a file from the list of configurations available to the switch, select a configuration file name from the table and click the **Delete** button.
5. To restore the system's default configuration file and revert the settings back to their factory default, click the **Restore Defaults** button.
6. Click the Transfer Files button to move a target configuration file to a secure location for later use. For more information, see *Transferring a Config File on page 3-17*.

3.3.1 Viewing the Detailed Contents of a Config File

The View screen displays the entire contents of a configuration file. Symbol recommends a file be reviewed carefully from the View screen before it is selected from the Config Files screen for edit or designation as the switch startup configuration.

1. Select a configuration file from the Configuration screen by highlighting the file.
2. Click the **View** button to see the contents of the selected configuration file.



3. The **Main** screen displays the contents of the configuration file.

   Use the up and down navigation facilities on the right-hand side of the screen to view the entire page.
4. The **Page** parameter displays the portion of the configuration file currently displayed in the main viewing area.

   The total number of pages in the file are displayed to the right of the current page. The total number of lines in the file display in the Status field at the bottom of the screen.

Scroll to corresponding pages as required to view the entire contents of the file. To navigate to a specific page, enter the page number in the text area (next to Page item) and click on the **Go** button. The source parameter differs depending on the source selected.

5. Refer to the **Status** field for the current state of the requests made from the applet. Requests are any "SET/GET" operation from the applet. The Status field displays error messages if something goes wrong in the transaction between the applet and the switch.
6. Click the **Refresh** button to get the most recent updated version of the configuration file.
7. Click **Close** to close the dialog without committing updates to the running configuration.

3.3.2 Editing a Config File

Configuration files display in the **Name** field within the Configuration tab. If necessary, change the name of the file to meet the needs of the revised configuration.

To Edit the contents of a configuration file:

1. Select **Switch** > **Configurations** from the main menu tree.
2. Select a configuration file from those displayed within the configuration screen and click the **Edit** button.
3. Select the **Copy this file as the system startup config** checkbox to use this configuration file as the switch configuration on the next boot. Ensure this file meets the switch's initial (startup) configuration requirements before selecting this option.
4. Refer to the **Status** field for the current state of the requests made from the applet. Requests are any "SET/GET" operation from the applet. The Status field displays error messages if something goes wrong in the transaction between the applet and the switch.
5. Click **OK** to save and add the changes to the running configuration and close the dialog.
6. Click **Cancel** to close the dialog without committing updates to the running configuration

3.3.3 Transferring a Config File

Transfer a configuration file to and from the switch using the **Transfer** screen. Transferring the switch configuration is recommended to keep viable configurations available in a secure location. The following file transfer configurations are possible:

- switch to switch, server or local disk
- server to switch
- local disk to switch

To transfer the contents of a configuration file:

1. Click the **Transfer Files** button on the bottom of the Configuration screen.

2. Refer to the **Source** field to define the location and address information for the source config file.

From	Select the location representing the source file's current location using the **From** drop-down menu. Options include **Server, Local Disk** and **Switch**.
File	Specify a source file for the file transfer. If the switch is selected, the file used at startup automatically displays within the File parameter.
Using	Use the **Using** drop down-menu to configure whether the log file transfer is conducted using FTP or TFTP.
IP Address	Enter the **IP Address** of the server or system receiving the source configuration. Ensure the IP address is valid or risk jeopardizing the success of the file transfer.
User ID	Enter the **User ID** credentials required to transfer the configuration file from a FTP server.
Password	Enter the **Password** required to send the configuration file from an FTP server.
Path	Specify the appropriate **Path** name to the target directory on the local system disk or server. The Target options are different depending on the target selected.

3. Refer to the **Target** field to specify the details of the target file.

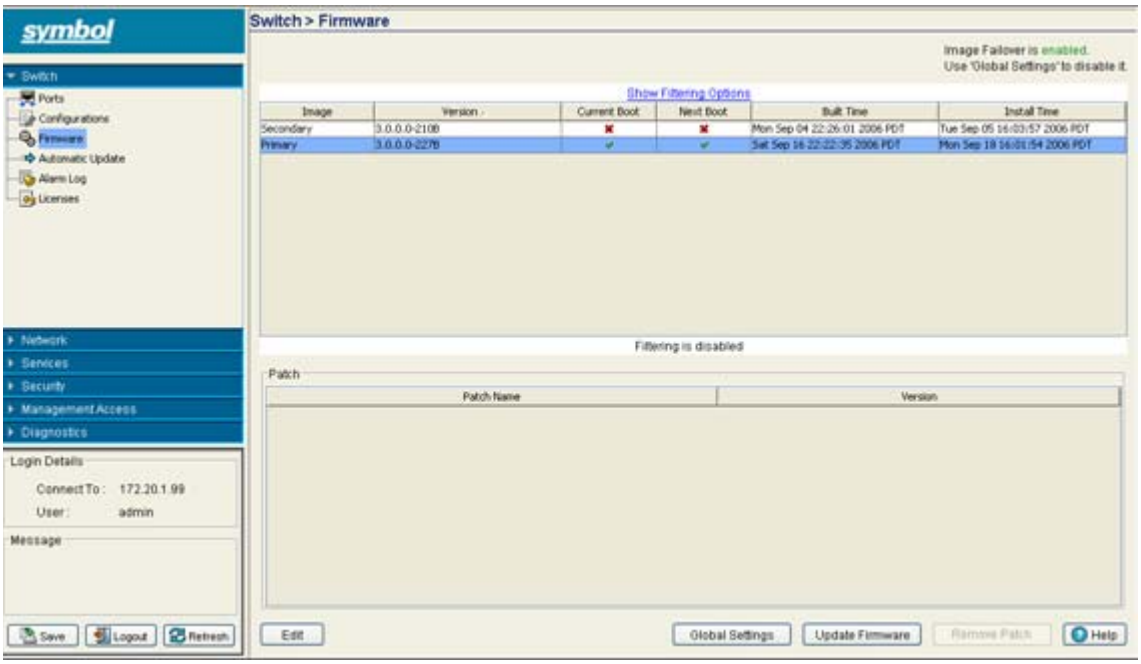
To	Use the **To** drop-down menu to define the location of the configuration file. Options include the switch (default location), external server or local disk.
File	Use the **Browse** button to browse to a target file for the file transfer. If the switch is selected from the **From** drop-down menu (within the Source field), the file used at startup automatically displays.

4. Click the **Transfer** button when ready to move the target file to the specified location. Repeat the process as necessary to move each desired log file to the specified location.
5. Refer to the **Status** field for the current state of the requests made from the applet. Requests are any "SET/GET" operation from the applet. The Status field displays error messages if something goes wrong in the transaction between the applet and the switch.

6. Click the **Close** button to exit the Transfer screen and return to the Config Files screen. Once a file is transferred, there is nothing else to be saved within the Transfer screen.

3.4 Viewing Switch Firmware Information

The switch can store two software versions. Information about the two versions displays within the **Firmware** screen. The **Version** column displays the version string. The **Build Time** is the date and time each version was generated. **Install** represents the date and time the upgrade was performed. **Next Boot** indicates which version should be used on the next reboot. The Next Boot version should match the **Running Version**, unless the system has failed over to another version.



To view the firmware files available to the switch:

1. Select **Switch** > **Firmware** from the main menu tree.
2. Refer to the following information displayed within the Firmware screen:

Image	Displays whether a firmware image is the primary image or a secondary image. The primary image is typically the image loaded when the switch boots.
Version	Displays a unique alphanumeric version name for each firmware version listed.
Current Boot	A check mark within this column designates this version as the version used by the switch the last time it was booted. An "**X**" in this column means this version was not used the last time the switch was booted.
Next Boot	A check mark within this column designates this version as the version to be used the next time the switch is booted. An "**X**" in this column means this version will not be used the next time the switch is booted. To change the boot designation, highlight an image and click the Edit button.

Built Time	Displays the time the version was created (built). Do not confuse the Built Time with the time the firmware was last loaded on the switch.
Install Time	The Install Time is the time this version was loaded with on the switch.

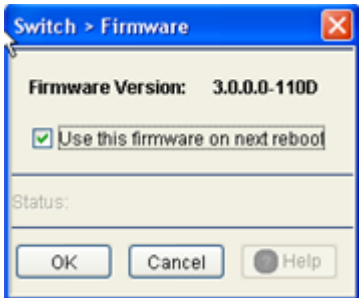
3. Select an existing firmware version and click the **Edit** button to change the firmware version that will be used when the switch is booted the next time. For more information, see *Editing the Switch Firmware on page 3-20*.
4. Click on the **Global Settings** button to specify a firmware version for use with the failover image. For more information, see *Enabling Global Settings for the Failover Image on page 3-22*.
5. Click on the **Update Firmware** button to update the firmware file loaded onto the switch. For more information, see *Updating the Switch Firmware on page 3-22*.

3.4.1 Editing the Switch Firmware

The Edit screen enables the user to select a firmware version and designate it as the version used the next time the switch is booted.

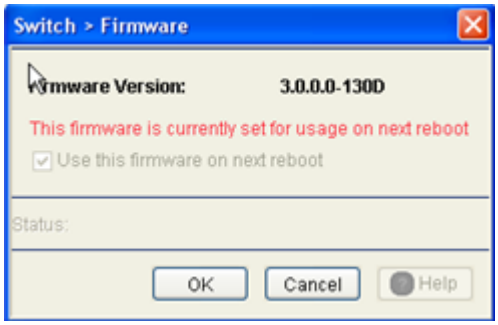
1. Select the primary firmware image from the Firmware screen.
2. Click the **Edit** button.

   The **Firmware** screen displays the current firmware version and whether this version is used for the next reboot.



3. Select the checkbox to use this version on the next boot of the switch.
4. To edit the secondary image, select the secondary image, click the **Edit** button and select the **Use this firmware on next reboot** checkbox.

   This firmware version will now be the file initiated after the next reboot of the switch.



5. Refer to the **Status** field for the current state of the requests made from the applet. Requests are any "SET/GET" operation from the applet. The Status field displays error messages if something goes wrong in the transaction between the applet and the switch.

6. Click the **OK** button to commit the changes made and exit the screen.

3.4.2 Enabling Global Settings for the Failover Image

Use the **Global Settings** screen to specify a firmware version for use with the failover image.

1. Select an image from the table in the Firmware screen.
2. Click the **Global Settings** button.

3. Select the **Enable Image Failover** checkbox to load an alternative firmware version if the WLAN module fails to load the selected version successfully after 2 reboot attempts.
4. Refer to the **Status** field for the current state of the requests made from the applet. Requests are any "SET/GET" operation from the applet. The Status field displays error messages if something goes wrong in the transaction between the applet and the switch.
5. Click **OK** to save and add the changes to the running configuration and close the dialog.

3.4.3 Updating the Switch Firmware

Use the **Update** screen to update the firmware version currently used by the switch.

NOTE When performing a firmware update using the switch CLI, use the following syntax (specific to FTP) ftp://username:password@ipaddress:port/path/filename. If using TFTP, use tftp://ipaddress/path/filename.

1. Select an image from the table in the Firmware screen.
2. Click the **Update Firmware** button.

3. Use the **From** drop-down menu to specify the location from which the file is sent.
4. Enter the name of the file containing the firmware update in the **File** text field.

This is the file that will append the file currently in use.

5. From the **Using** drop down menu, select either FTP or TFTP as a medium to update the firmware.
   a. Use **FTP** to get the firmware update from a *File Transfer Protocol* (FTP) server. A user account must be established on the FTP server that is specified for the firmware update.
   b. Use **TFTP** to get the firmware update from a *Trivial File Transfer Protocol* (TFTP) server.
6. Enter the IP address for the FTP or TFTP server in the **IP address** field.
7. Enter the username for FTP server login in the **User ID** field.
8. Enter the password for FTP server login in the **Password** field.
9. Enter the complete file path for the file that contains the firmware update in the **Path** field.
10. Click the **Do Update** button to initiate the update.

    A warning prompt displays. Upon confirming the firmware update, the switch reboots and completes the firmware update.

CAUTION When restarting or rebooting the switch, the Radius server will also be restarted regardless of its state before the reboot.

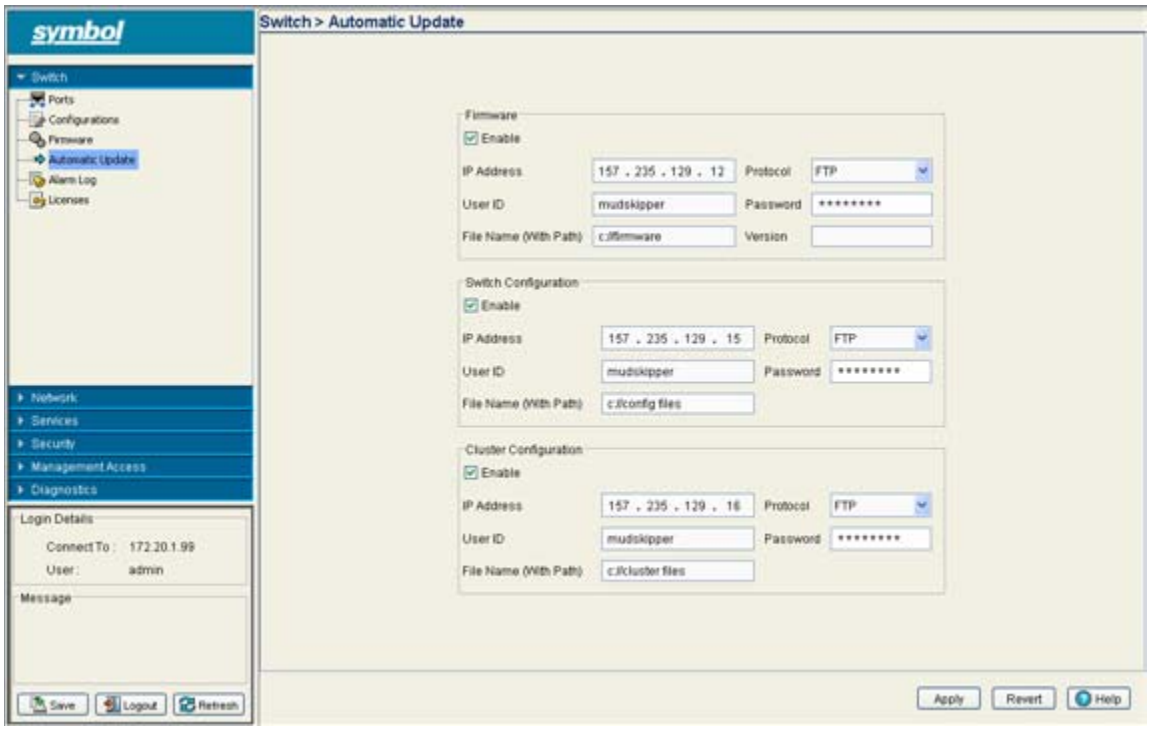
11. Click **OK** to save and add the changes to the running configuration and close the dialog.
12. Refer to the **Status** field for the current state of the requests made from the applet. Requests are any "SET/GET" operation from the applet. The Status field displays error messages if something goes wrong in the transaction between the applet and the switch.
13. Click **Cancel** to close the dialog without committing updates to the running configuration.

3.5 Configuring Automatic Updates

The **Automatic Updates** screen allows you to enable a facility that will poll a server address (you designate) when the switch is booted. If updates to are found since the last time the switch was booted, the updated version is uploaded to the switch to use the next time the switch is booted. Enable this option for either the firmware, configuration file or cluster configuration file when you always want to use the most recent versions available to the switch. Symbol recommends leaving this setting disabled if a review of a new file is required before it is automatically used by the switch.

To enable and configure the automatic update feature for switch firmware, configuration files and cluster configurations:

1. Select **Switch** > **Automatic Updates** from the main menu tree.



2. Refer to the **Firmware** field to enable and define the configuration for automatic firmware updates. If enabled, the located (updated) switch firmware will be used with the switch the next time the switch boots

Enable	Select the **Enable** checkbox to allow an automatic firmware update when a new (updated) version is detected (upon the boot of the switch) at the specified IP address.
IP Address	Define the **IP address** of the server where the firmware files reside. If a new version is detected when the switch is booted it will be uploaded to the switch and used upon the next boot of the switch.
User ID	Enter the **User ID** required to access the FTP or TFTP server.
File Name (With Path)	Provide the complete and accurate path to the location of the firmware files on the server. This path must be accurate to ensure the file is retrieved.

Protocol	Use the **Protocol** drop-down menu to specify the **FTP** or **TFTP** medium used for the file update from the server.
Password	Enter the password required to access the server.

3. Refer to the **Switch Configuration** field to enable and define the configuration for automatic configuration file updates. If enabled, the located (updated) configuration file will be used with the switch the next time the switch boots.

Enable	Select the **Enable** checkbox to allow an automatic configuration file update when a new (updated) file is detected (upon the boot of the switch) at the specified IP address.
IP Address	Define the **IP address** of the server where the configuration files reside. If a new version is detected when the switch is booted it will be uploaded to the switch and used upon the next boot of the switch.
User ID	Enter the **User ID** required to access the FTP or TFTP server.
File Name (With Path)	Provide the complete and accurate path to the location of the configuration files on the server. This path must be accurate to ensure the most recent file is retrieved.
Protocol	Use the **Protocol** drop-down menu to specify the **FTP** or **TFTP** medium used for the file update from the server.
Password	Enter the password required to access the server.

4. Refer to the **Cluster Configuration** field to enable and define the configuration for automatic cluster file updates.

Enable	Select the **Enable** checkbox to allow an automatic cluster file update when a new (updated) file is detected (upon the boot of the switch) at the specified IP address.
IP Address	Define the **IP address** of the server where the cluster files reside. If a new version is detected when the switch is booted it will be uploaded to the switch and used upon the next boot of the switch.
User ID	Enter the **User ID** required to access the FTP or TFTP server.
File Name (With Path)	Provide the complete and accurate path to the location of the cluster files on the server. This path must be accurate to ensure the most recent file is retrieved.
Protocol	Use the **Protocol** drop-down menu to specify the **FTP** or **TFTP** medium used for the file update from the server.
Password	Enter the password required to access the server.

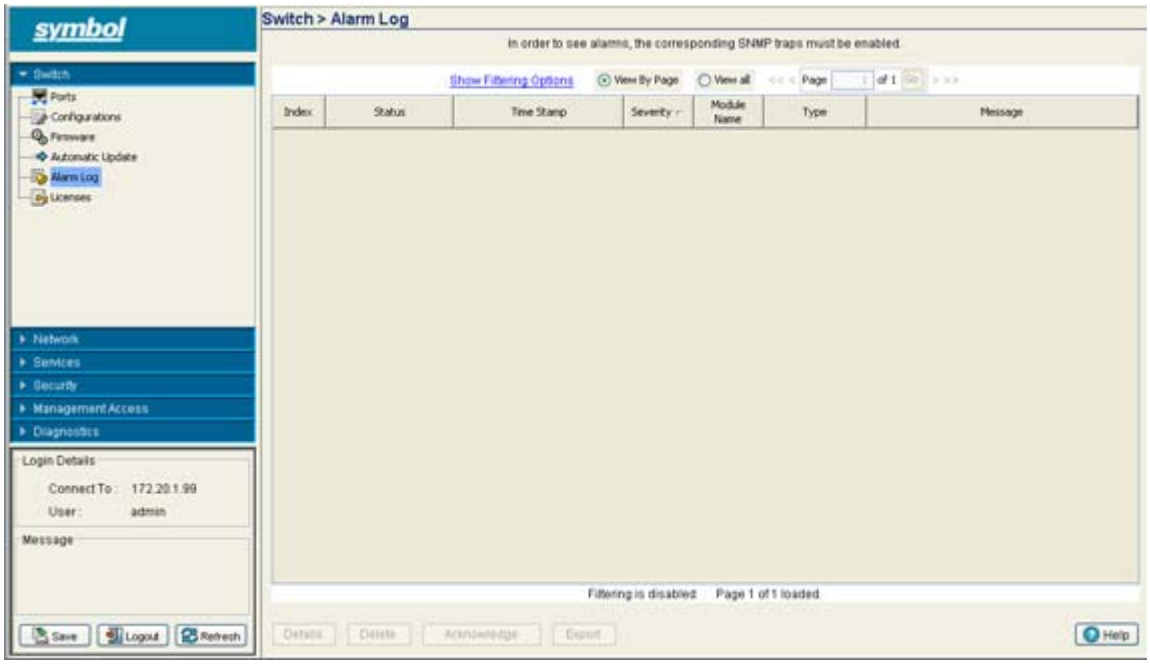
5. Click the **Apply** button to save the changes to the configuration.
6. Click the **Revert** button to revert back to the last saved configuration.

3.6 Viewing the Switch Alarm Log

Use the **Alarm Log** screen as an initial snapshot for alarm log information. Use this screen to expand alarms for greater detail, delete alarms, acknowledge alarms or export alarm data to a user-specified location.

To view switch Alarm Log information:

1. Select **Switch** > **Alarm Log** from the main menu tree.



2. Select either of the two available options to view alarm log information:

View By Page	Select the **View By Page** radio button to view alarm log information on a per page basis. Use the View By Page option to display alarm logs in pages. If there are a large number of alarms, the user can navigate to the page that has been completely loaded. All operations can be performed on the currently loaded data. Enter a page number next to "Page" and click the **Go** button to move to the specific page.
View All	Select the **View All** radio button to display the complete alarm log with in the table. If there are a large number of alarms, the View All option will take several minutes to load.

3. Refer to the table within the **Alarm Log** screen for the following information:

Index	Displays the unique numerical identifier for trap events (alarms) generated in the system. Use the index to help differentiate the alarm from other alarms with similar attributes.
Status	Displays the current state of the requests made from the applet. Requests are any "SET/GET" operation from the applet. The Status displays error messages if something goes wrong in the transaction between the applet and the switch.

Time Stamp	Displays the date, year and time the alarm was raised (as well as the time zone of the system). The Time Stamp only states the time the alarm was generated, not the time it was acknowledged.
Severity	Displays the severity level of the event. Use this (non numerical and verbal) description to assess the criticality of the alarms. Severity levels include: • Critical • Major • Warning • Informational • Normal
Module Name	Displays the module name that triggered this alarm. Use this information to assess if this alarm is a recurring problem with or if it is an isolated incident.
Type	Displays the alarm type.
Message	Displays a detailed event message corresponding to the alarm event. It contains an event specific message for detailed information about the alarm. Use this value along with the Details description for optimal problem event identification.

4. Select an alarm and click the **Details** button to display an alarm description along with the solution and possible causes. For more information, see *Viewing Alarm Log Details on page 3-27*.
5. Select the alarm(s) from those listed and click the **Delete** button to remove them from the list of alarms.

   This is not recommended in instances where the problem is unacknowledged and the criticality has not yet been assessed.
6. Select the unacknowledged alarm(s) from those listed and click the **Acknowledge** button to acknowledge them.
7. Click the **Export** button to export the content of the table to a *Comma Separated Values* file (CSV).

3.6.1 Viewing Alarm Log Details

Use the **Details** option when additional information is required for a specific alarm to make an informed decision on whether to delete, acknowledge or export it.

To review switch alarm details:

1. Select **Switch** > **Alarm Log** from the main menu tree.
2. Select an alarm and click the **Details** button.
3. Refer to the fields within the Details screen for the following information:

Severity	Displays the severity of the event. Use these numeric identifiers to assess the criticality of this specific alarm. The Severity classes include: **Critical**, **Major**, **Warning**, **Informational** and **Normal**.
Description	Displays the details of the alarm log event. This information can be used in conjunction with the **Solution** and **Possible Causes** items to troubleshoot the event and determine how the event can be avoided in the future.

Solution	Displays a possible solution to the alarm event.
Possible Causes	Describes the probable causes that could have raised the specific alarm. Determine whether the causes listed can be remedied in order to avoid this alarm from being raised in the future.

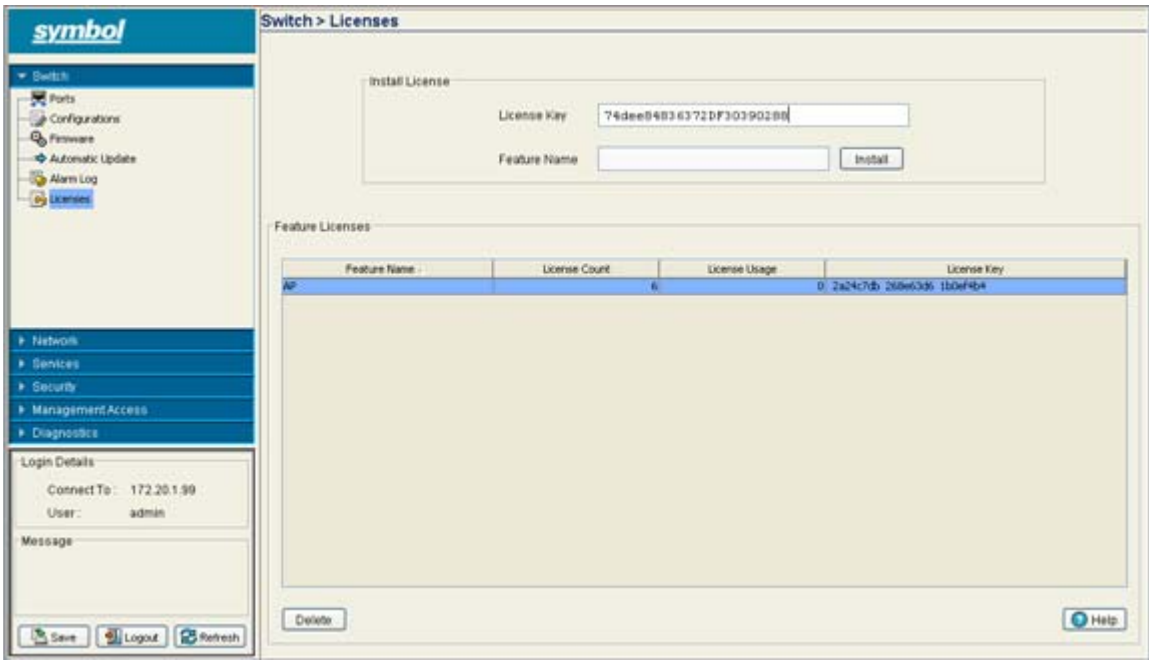
4. Click **OK** to use the changes to the running configuration and close the dialog.

3.7 Viewing Switch Licenses

Use the **Licenses** screen to install and add a new licenses on the switch.

To install a new license:

1. Select **Switch** > **Licenses** from the main menu tree.



2. Refer to the **Install License** field for the following information:

License Key	Enter the license key required to install a particular feature. The license key is provided when you supply the switch MAC address to Symbol customer care.
Feature Name	The name of the feature you wish to install/upgrade using the license.

3. Click the **Install** button to install the selected license.
4. Refer to the **Feature Licenses** table for the following license specific information:

Feature Name	Displays the name of the feature either installed or upgraded on the switch.
License Count	The number of licenses that you have applied while entering the license key.

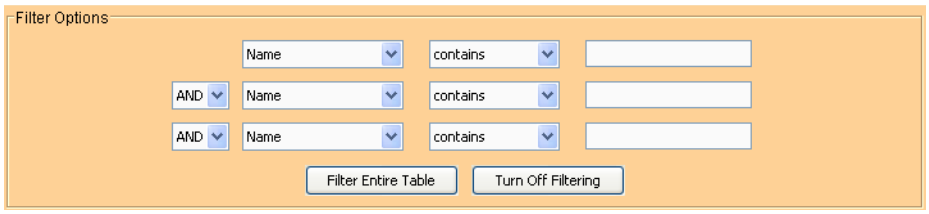
License Usage	The number of license currently in use. Determine whether this number adequately represents the number of switches you need to deploy.
License Key	The license key for the feature installed/upgraded.

5. Select a license from the table and click the **Delete** button to remove the license from the list available to the switch.

3.8 How to use the Filter Option

Use the Filter Option to sort the display details of any screen.

1. Click the **Show Filtering Option** to expand the Filter Option zone, whenever it appears in any screen.



2. Enter the filter criteria as per the options provided in the Filter Option zone.
3. The fields in the Filter Option zone are populated with the parameters of the screen in which it appears.

   Filtering is always conducted for the entire table.
4. Click the **Filter Entire Table** button to filter the entire table in which the filter zone appears.

   The result of the filtering operation displays at the bottom of the table
5. Click the **Turn Off Filtering** button to disable the filtering option for the screen where it appears.

   Filtering status (when filtering is turned off) displays at the bottom of the table.
6. Click the **Hide Filtering Option** button to hide the Filter Option zone.

4

Network Setup

This chapter describes the Network Setup menu information used to configure the switch. This chapter consists of the following sections:

NOTE HTTPS must be enabled to access the switch applet. Ensure that HTTPS access has been enabled before using the login screen to access the switch applet.

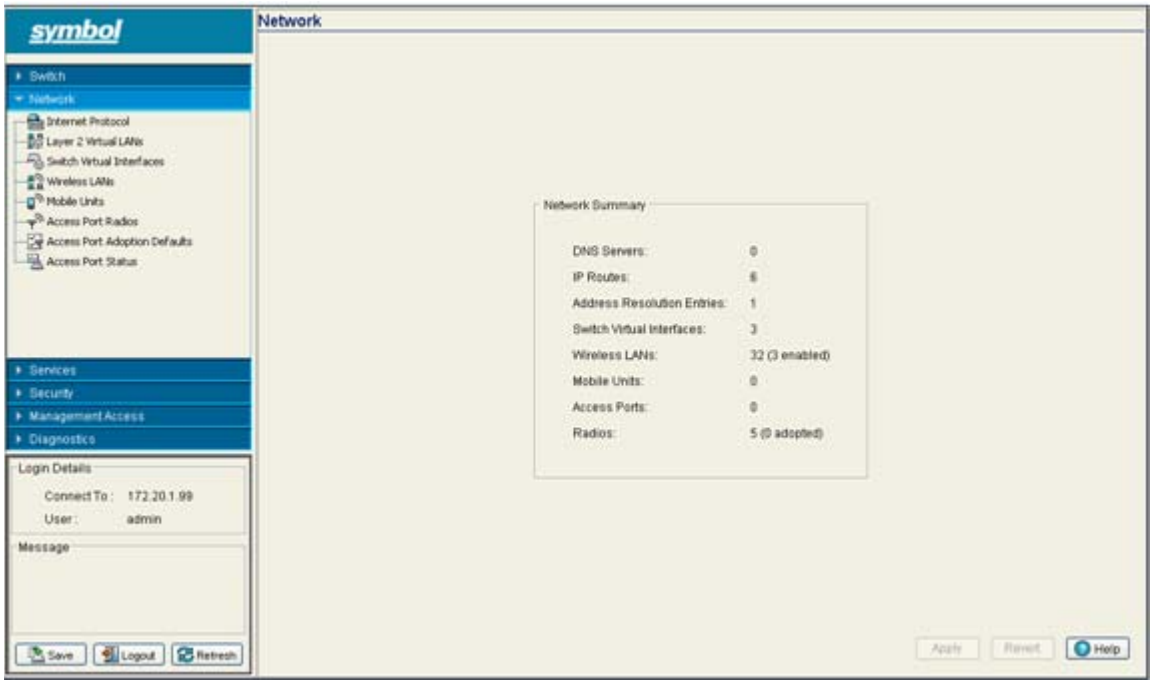
4.1 Displaying the Network Interface

The main **Network** interface displays a high-level overview of the configuration (default or otherwise) as defined within the Network main menu. Use the information to determine what items require additional configuration using the sub-menu items under the main Network menu item.

NOTE When the switch's configuration is successfully updated (using the Web UI), the effected screen is closed without informing the user their change was successful. However, if an error were to occur, the error displays within the effected screen's Status field and the screen remains displayed. In the case of file transfer operations, the transfer screen remains open during the transfer operation and remains open upon completion (with status displayed within the Status field).

To view the switch's Network configuration:

1. Select **Network** from the main menu tree.



2. Refer to the following information to discern if configuration changes are warranted:

DNS Servers	Displays the number of DNS Servers configured thus far for use with the switch. For more information, see *Viewing Network IP Information*.
IP Routes	Displays the number of IP routes for routing packets to a defined destination. For information on defining IP Routes, see *Configuring IP Forwarding*.
Additional Resolution Entries	Displays the number of mappings of layer three (IP) addresses to layer two (MAC) addresses. For more information, see *Viewing Address Resolution*.
Switch Virtual Interfaces	Displays the number of virtual interfaces (VLANs) defined thus far for the switch. New VLANs can be defined or existing VLANs can be modified as needed. For more information, see *Configuring Switch Virtual Interfaces*.
Wireless LANs	Displays the number of WLANs currently defined on the switch. The switch has 32 default WLANs. New WLANs can be added as needed, and their descriptions, VLAN assignments and security schemes modified. For more information, see *Viewing and Configuring Switch WLANs*.
Mobile Units	Displays the number of MUs currently associated to (and interacting with) the switch. The details of individual MUs can be displayed as needed. For more information, see *Viewing Associated MU Details*.
Access Ports	Displays the number of Access Ports (APs) active on the switch. Access ports can be added or existing APs can have their VLAN assignments changed, their descriptions modified and their current authentication and encryption schemes modified. For more information, see *Viewing Access Port Information*.
Radios	Displays the number of AP radios detected over the switch managed network. Displayed with this information is the number of radios detected that have been adopted by the switch. For more information, see *Viewing Access Port Status*.

The **Apply** and **Cancel** buttons are greyed out within this screen, as there is no data to be configured or saved.

4.2 Viewing Network IP Information

Use the **Internet Protocol** screen to view and configure network associated IP details. The Internet Protocol screen consists of the following tabs:

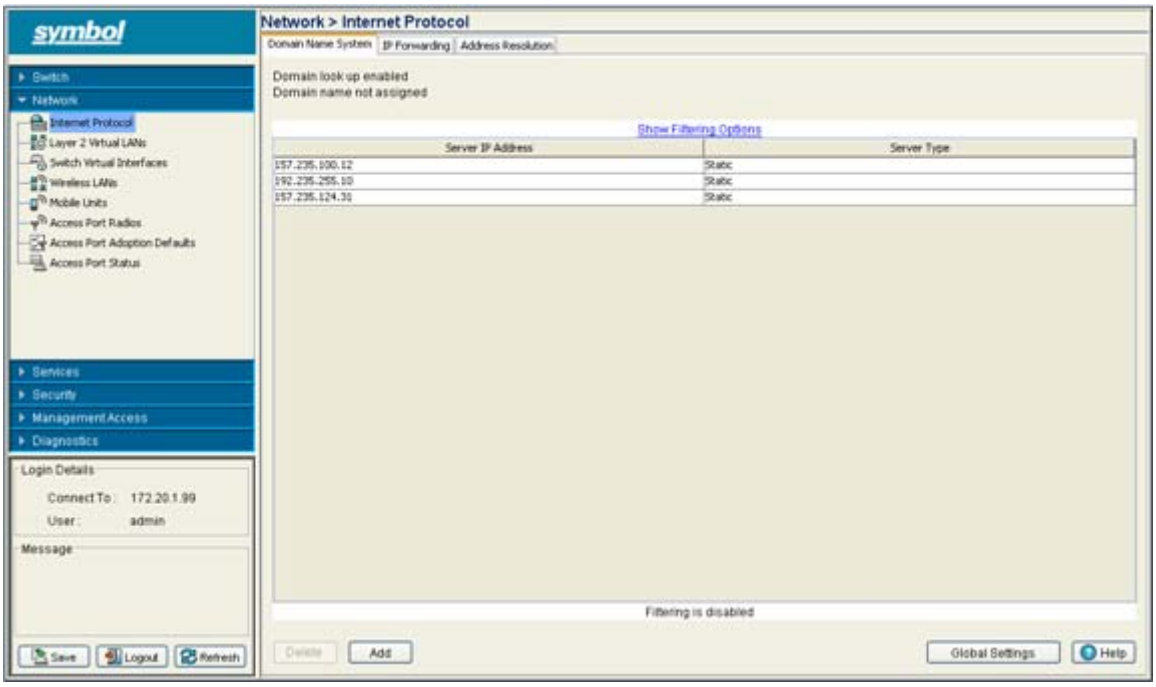
- *Configuring DNS*
- *Configuring IP Forwarding*
- *Viewing Address Resolution*

4.2.1 Configuring DNS

Use the **Domain Name System** tab to view Server address information and delete or add severs to the list of servers available. To configure DNS:

1. Select **Network > Internet Protocol** from the main tree menu.
2. Select the **Domain Network System** tab.

   Use the Filtering Option to view the details displayed in the table.



3. The **Domain Name System** tab displays DNS details in a tabular format.

Server IP Address	Displays the IP address of the domain name server(s) the system can use for resolving domain names to IP addresses. Domain look up order is determined by the order of the servers listed. The first server queried is the first server displayed. Therefore, ensure obsolete addresses are periodically removed.
Server Type	Displays whether the DNS IP address entry has been created statically (manually) or dynamically. The DHCP server provides the dynamic DNS IP address entry which will be displayed on the list. A static DNS IP address can be created by clicking the **Add** button.

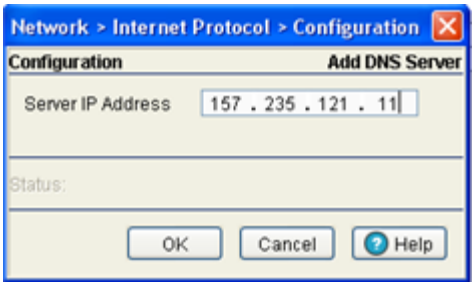
4. Select an IP Address from the table and click the **Delete** button to remove the selected entry from the list.
5. Click the **Add** button to display a screen used to add another domain name server. For more information, see *Adding an IP Address for a DNS Server on page 4-5*.
6. Click the **Global Settings** button to open a screen that allows the domain lookup to be enabled/disabled and the domain name to be specified. For more information, see *Configuring Global Settings on page 4-5*.

4.2.1.1 Adding an IP Address for a DNS Server

Add an IP address for a new domain server using the **Add** screen.

1. Click the **Add** button within the Domain Network System screen.

   The new **Configuration** screen displays enabling you to add IP address for the DNS Server.



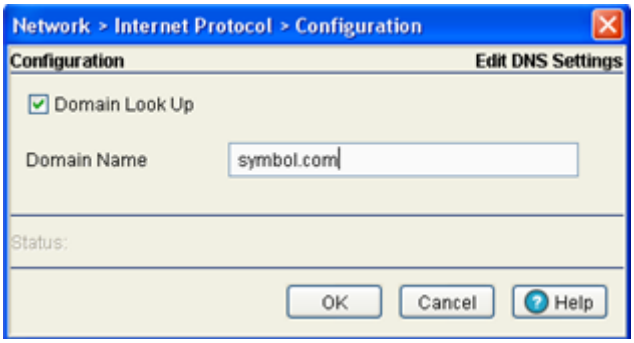
2. Enter the **Server IP Address** to define the IP address of the new static domain name server.
3. Refer to the **Status** field for the current state of the requests made from applet. This field displays error messages if something goes wrong in the transaction between the applet and the switch.
4. Click **OK** to use the changes to the running configuration and close the dialog.
5. Click **Cancel** to close the dialog without committing updates to the running configuration.

4.2.1.2 Configuring Global Settings

Use the **Global Settings** screen to query domain name servers to resolve domain names to IP addresses. Use this screen to enable/disable the **Domain look up**, which allows you to use commands like ping, traceroute etc. using hostnames rather than IP addresses.

1. Click the **Global Settings** button in the main Domain Network System screen.

   A **Configuration** screen displays allowing you to edit the DNS settings of the server



2. Select the **Domain Look Up** checkbox to enable the switch to query domain name servers to resolve domain names to IP addresses.

NOTE The order of look up is determined by the order of the servers within **Domain Name System** tab. The first server queried is the first server displayed.

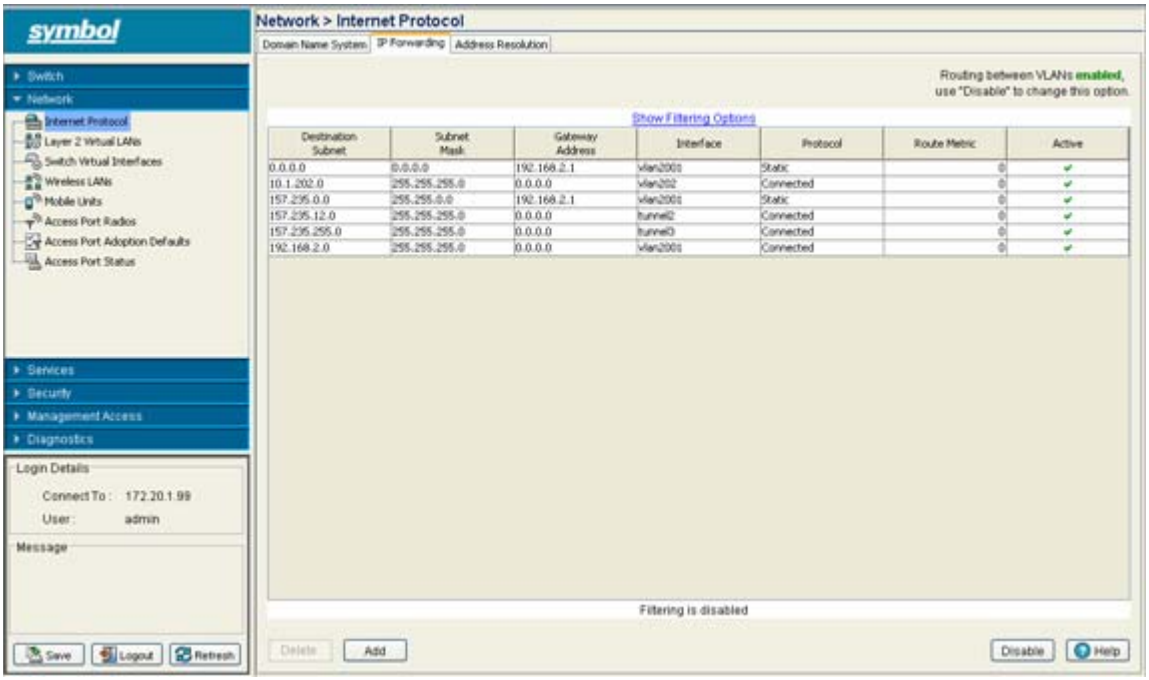
3. Enter a **Domain Name** in the text field. This is the domain the switch is installed in.
4. Refer to the **Status** field for the current state of the requests made from applet. This field displays error messages if something goes wrong in the transaction between the applet and the switch.
5. Click **OK** to use the changes to the running configuration and close the dialog.
6. Click **Cancel** to close the dialog without committing updates to the running configuration.

4.2.2 Configuring IP Forwarding

The IP Forwarding table lists all the routing entries to route the packets to a specific destination. To view the IP forwarding details:

1. Select **Network** > **Internet Protocol** from the main tree menu.
2. Select the **IP Forwarding** tab.

   Use the Filtering Option to view the details displayed in the table.



3. The read-only **IP Forwarding** tab displays the current status between VLANs. To toggle the status of routing between VLANs, use the **Enable/Disable** options located at the bottom of the screen.

   The following details display in the table:

   Destination Subnet — Displays the mask used for destination subnet entries. The Subnet Mask is the IP mask used to divide internet addresses into blocks (known as subnets). A value of 255.255.255.0 will support 256 IP addresses.

Subnet Mask	Displays the mask used for destination subnet entries. The Subnet Mask is the IP mask used to divide internet addresses into blocks (known as subnets). A value of 255.255.255.0 will support 256 IP addresses.
Gateway Address	Displays the IP address of the Gateway used to route the packets to the specified destination subnet. Do not set the gateway address to any VLAN interface used by the switch.
Interface	Displays the interface name with which the destination subnet entries are attached.
Protocol	Displays the name of the routing protocol with which this route was obtained. Possible values are: • Static — Routes are statically added by the operator. • DHCP — Routes that are obtained from the DHCP server. • Connected — Routes automatically installed by the switch for directly connected networks based on interface IP addresses. • Kernel/ ICMP — Routes added as a result of receiving an ICMP redirect from an intermediate router.
Route Metric	The **Route Metric** is used for selecting the best available path. If there are multiple routes for a particular destination address, the packets are forwarded on the basis of the route metric. Routes with lower metric value are given higher preference. A routing protocol uses the route metric to determine which routes to include in the routing table when it has two available routes to the same destination from a single routing protocol (static, RIP, OSPF etc). The router includes the route with the smallest metric because it considers this route to be the shortest (and therefore the best). Different routing protocols calculate their metric in different ways. RIP uses hops, OSPF uses bandwidth etc. Sample values: 0, 1, 10, 20… Currently all static and connected routes have a default metric of 0.
Active	When IP Forwarding is enabled for the selected subnet, a green check displays in the Active column.

4. Select an entry and click the **Delete** button to remove the selected entry from the IP forwarding table.
5. Click the **Add** button to create a new static route. For more information, see *Adding a New Static Route on page 4-7*.
6. Click **Enable** (to allow) or **Disable** (to deny) routing between VLANs.

4.2.2.1 Adding a New Static Route

Use the **Add** screen to add a new destination subnet, subnet mask and gateway for routing packets to a defined destination. Use the screen when an existing destination subnet does not meet the needs of the network. To add a new static route:

1. Click the **Add** button.

A new **Configuration** screen displays enabling you to add a new destination subnet, subnet mask and gateway for routing packets to a defined destination.

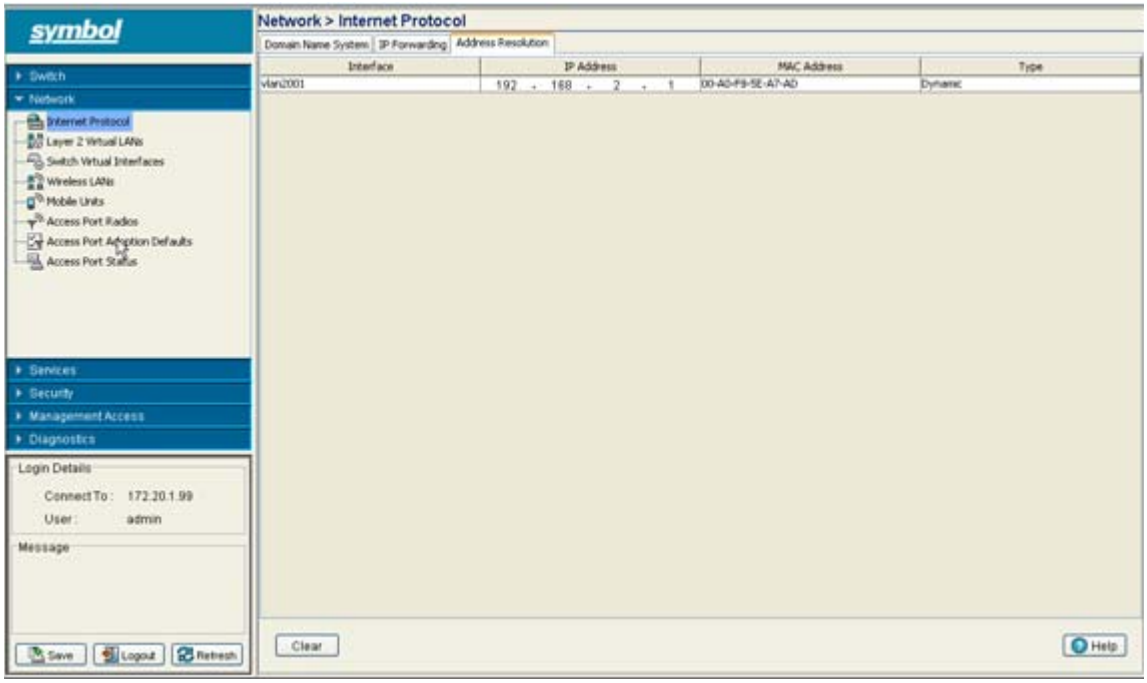
2. In the **Destination Subnet** field, enter an IP address to route packets to a specific destination address.
3. Enter a subnet mask for the destination subnet in the **Subnet Mask** field.

   The Subnet Mask is the IP mask used to divide internet addresses into blocks known as subnets. A value of 255.255.255.0 support 256 IP addresses.
4. In the **Gateway Address** field, enter the IP address of the gateway used to route the packets to the specified destination subnet. Do not set the gateway address to any VLAN interface used by the switch.
5. Refer to the **Status** field for the current state of the requests made from applet. This field displays error messages if something goes wrong in the transaction between the applet and the switch.
6. Click **OK** to use the changes to the running configuration and close the dialog.
7. Click **Cancel** to close the dialog without committing updates to the running configuration.

4.2.3 Viewing Address Resolution

The **Address Resolution** table displays the mapping of layer three (IP) addresses to layer two (MAC) addresses. To view the details of the tab:

1. Select **Network** > **Internet Protocol** from the main tree menu.
2. Select the **Address Resolution** tab.



3. Refer to the Address Resolution table for the following information:

Interface	Displays the name of the actual interface on which the IP address was found (typically a VLAN).
IP Address	Displays the IP address being resolved.
MAC Address	Displays the MAC address that correspond to the IP address being resolved.
Type	Defines whether the entry was added statically or created dynamically due to network traffic. Entries are typically static.

4. Click the **Clear** button to remove the selected AP entry.

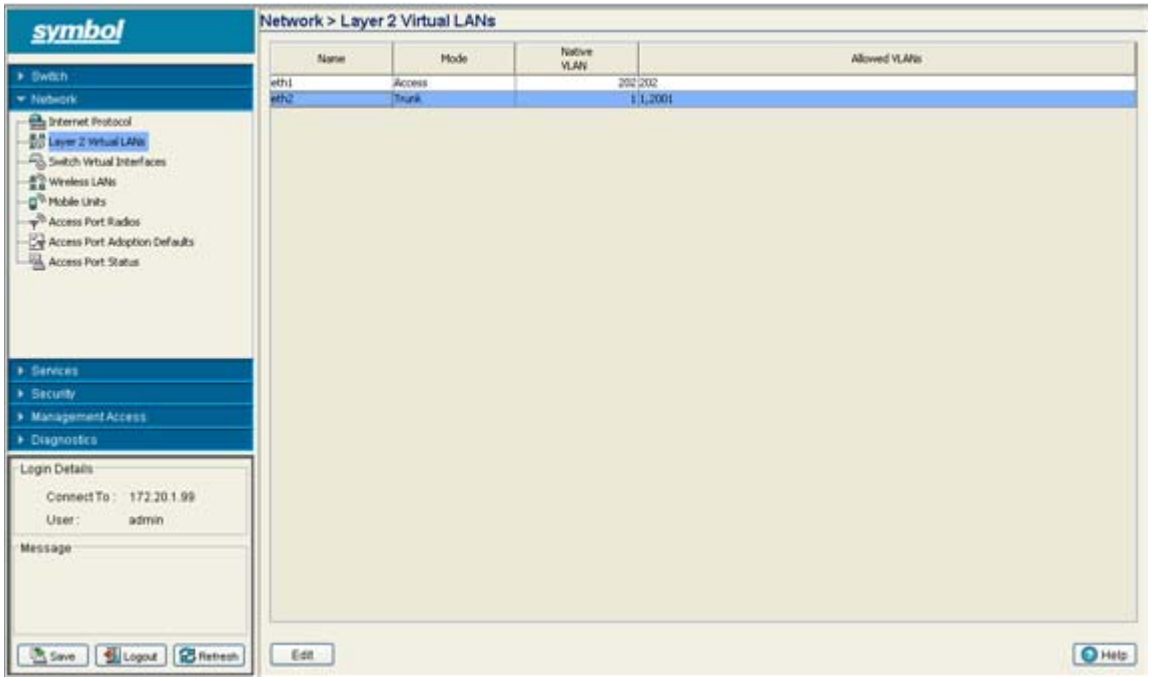
4.3 Viewing and Configuring Layer 2 Virtual LANs

A *virtual LAN* (VLAN) is similar to a *Local Area Network* (LAN), however devices do not need to be connected to the same segment physically. Devices perform as if they are connected to the same LAN, but they may be connected at various physical connections across the LAN segment. The VLAN can be connected at various physical points but react as if it were connected directly. Therefore, a VLAN is an independent network made up of several devices. One of the biggest advantages of VLANs is that when a computer is physically moved to another location, it can stay on the same VLAN without reconfiguration. The switch can support multiple VLANs.

Use the **Layer 2 Virtual LANs** screen to view and configure VLAN properties. To view Virtual LANs details:

1. Select **Network** > **Layer 2 Virtual LANs** from the main menu tree.

   VLAN details display within the Virtual LANs screen.



   The following details display in the table:

Name	Displays the name of the VLAN to which the switch is currently connected. It can be either ethernet 1 or ethernet 2.
Mode	It can be either Access or Trunk. • Access– This ethernet interface accepts packets only form the native VLANs. • Trunk–The Ethernet interface allows packets from the given list of VLANs that you add to the trunk.
Native VLAN	Displays the tag assigned to the native VLAN.
Allowed VLANs	Displays VLAN tags allowed on this interface

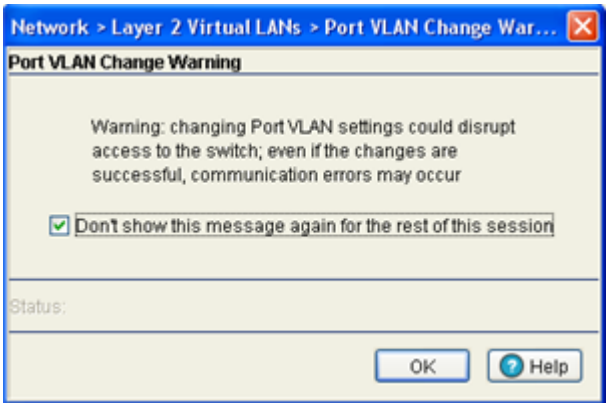
2. Select a record from the table and click the **Edit** button to modify the record. For more information, see *Editing the Details of an Existing VLAN on page 4-11*.

4.3.1 Editing the Details of an Existing VLAN

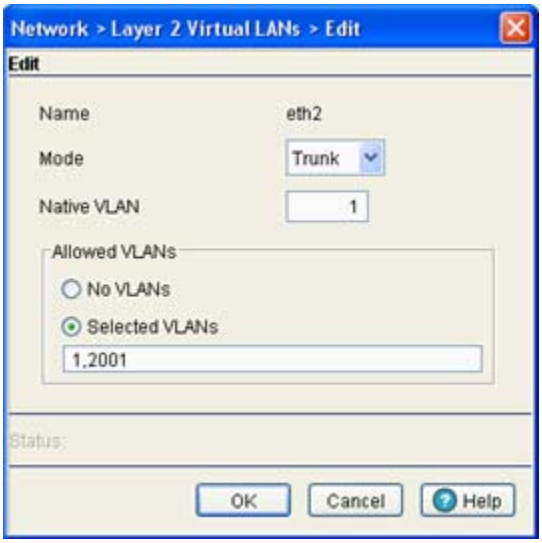
To revise the configuration of an existing VLAN:

1. Select **Network** > **Virtual LANs** from the main menu tree.
2. Select an Ethernet for which you want to configure the VLAN and click on the **Edit** button.

   The system prompts you with a **Port VLAN Change Warning** message stating communication disruptions could occur with the switch.
3. Click **OK** to continue.



4. The Virtual LANs edit dialog box for the selected ethernet allows you to configure/modify the VLANs.



5. Use the Edit screen to modify the following:

Name	Displays a read only field and with the name of the Ethernet to which the VLAN is associated.
Mode	Use the drop down menu to select the mode. It can be either: • Access– This ethernet interface accepts packets only form the native VLANs. • Trunk–The ethernet interface allows packets from the given list of VLANs that you add to the trunk.
Native VLAN	Use this field to change the tag assigned to native VLAN

Allowed VLANs This section has the following 2 options:

- No VLANs– Select this option if you do not wish to add any additional VLANs.
- Selected VLANs– Select this option if you wish to add additional VLANs.

6. Refer to the **Status** field for the current state of the requests made from applet. This field displays error messages if something goes wrong in the transaction between the applet and the switch.
7. Click **OK** to use the changes to the running configuration and close the dialog.
8. Click **Cancel** to close the dialog without committing updates to the running configuration.

4.4 Configuring Switch Virtual Interfaces

A *switch virtual interface* (SVI) is required for any layer 3 (IP) access to the switch or for the switch to provide any layer 3 service on that VLAN. The SVI defines which IP address is associated with each VLAN ID that the switch is connected. A SVI is created for the default VLAN (VLAN 1) to enable remote switch administration. An SVI is also used to map a VLANs to IP address ranges; this mapping determines the destination networks for any routing the switch performs.

Each IP address range (IP Address and Subnet Mask) can be mapped to one and only one VLAN ID. A VLAN ID does not require that an IP address be defined on the switch. Each VLAN ID must be mapped to a physical port using the Layer 2 Virtual LANs configuration to communicate properly with the rest of the network.

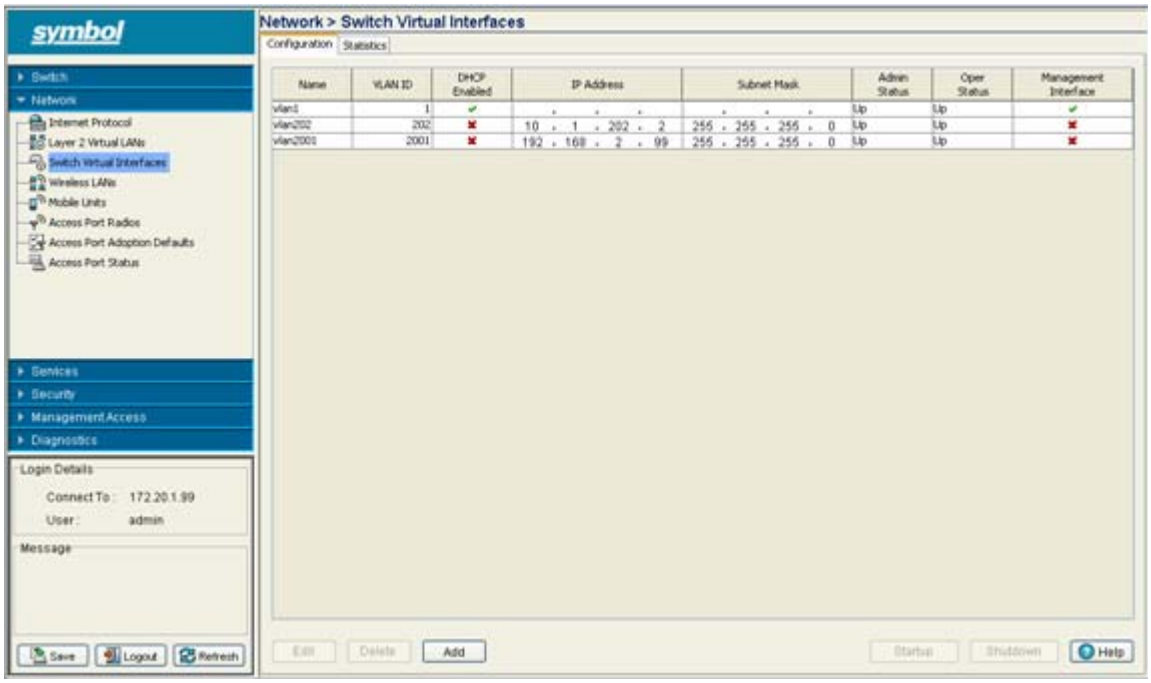
Use the **Switch Virtual Interfaces** screen to view and configure VLAN interfaces. This screen consists of the following tabs:

- *Configuring the Virtual Interface*
- *Viewing Virtual Interface Statistics*

4.4.1 Configuring the Virtual Interface

Use the **Configuration** screen to view and configure the virtual interface details.

1. Select **Network** > **Switch Virtual Interface** from the main tree menu.
2. Select the **Configuration** tab.



The following configuration details display in the table:

Name	Displays the name of the virtual interface.
VLAN ID	Displays the VLAN ID associated with the interface.
DHCP	Displays whether the DHCP client is enabled or not.
IP Address	Displays the IP address for the virtual interface.

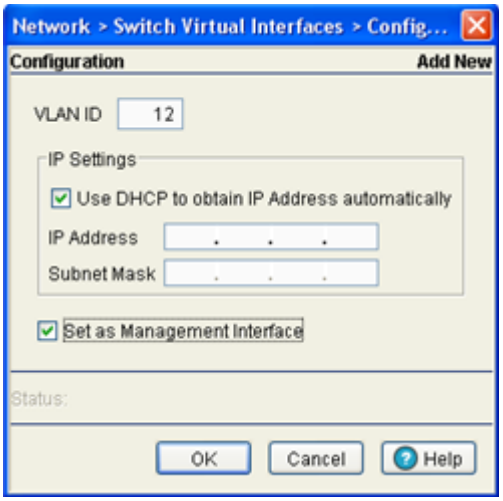
Subnet Mask	Displays the subnet mask assigned for this interface.
Oper Status	Displays whether the Switch Virtual Interface has been created successfully.
Management Interface	A green checkmark within this column defines this VLAN as the one currently used by the switch management interface. This designates the interface settings used for global switch settings in case of any conflicts. For example, if multiple SVIs are configured with DHCP enabled on each the switch could have multiple domain names assigned from the different DHCP servers; the one assigned over the selected Management Interface would be the only one used by the switch. This setting does not affect any of the Management Access Interfaces configured in *Configuring Access Control on page 7-3*.

3. Click the **Add** button to add a new configuration to the switch virtual interface. For more information, see *Adding a Virtual Interface on page 4-14*.
4. Select a record from the table and click the **Edit** button to modify the record. For more information, see *Modifying a Virtual Interface on page 4-15*.
5. Select a record from the table and click the **Delete** button to remove the configuration from the list of switch virtual interfaces.

4.4.1.1 Adding a Virtual Interface

To add a new virtual interface for the switch:

1. Select **Network** > **Switch Virtual Interface from** the main tree menu.
2. Select the **Configuration** tab
3. Click on the **Add** button.



4. Enter the **VLAN ID** for the switch virtual interface.
5. The IP Setting field consists of the following:
   a. Select **Use DHCP to obtain IP Address automatically to** enable DHCP to provide the IP address for the switch's virtual interface. Selecting this disables the IP address field.
   b. Enter the **IP Address** for the VLAN associated virtual interface.
   c. Enter the **Subnet Mask** for the IP address.

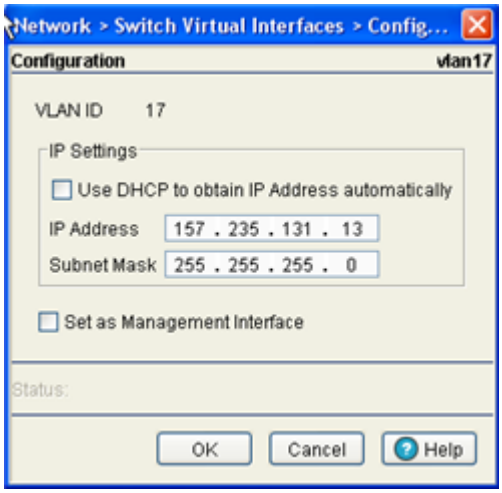
6. Select the **Set as Management Interface** checkbox to enable any host displayed in this VLAN to configure the switch.
7. Refer to the **Status** field for the current state of the requests made from applet. This field displays error messages if something goes wrong in the transaction between the applet and the switch.
8. Click **OK** to use the changes to the running configuration and close the dialog.
9. Click **Cancel** to close the dialog without committing updates to the running configuration.

4.4.1.2 Modifying a Virtual Interface

To modify an existing virtual interface.

CAUTION When changing from a default DHCP address to a fixed IP address, set a static route first. This is critical when the switch is being accessed from a subnet not directly connected to the switch and the default route was set from DHCP.

1. Select **Network** > **Switch Virtual Interface from** the main tree menu.
2. Select the **Configuration** tab and click the **Edit** button.



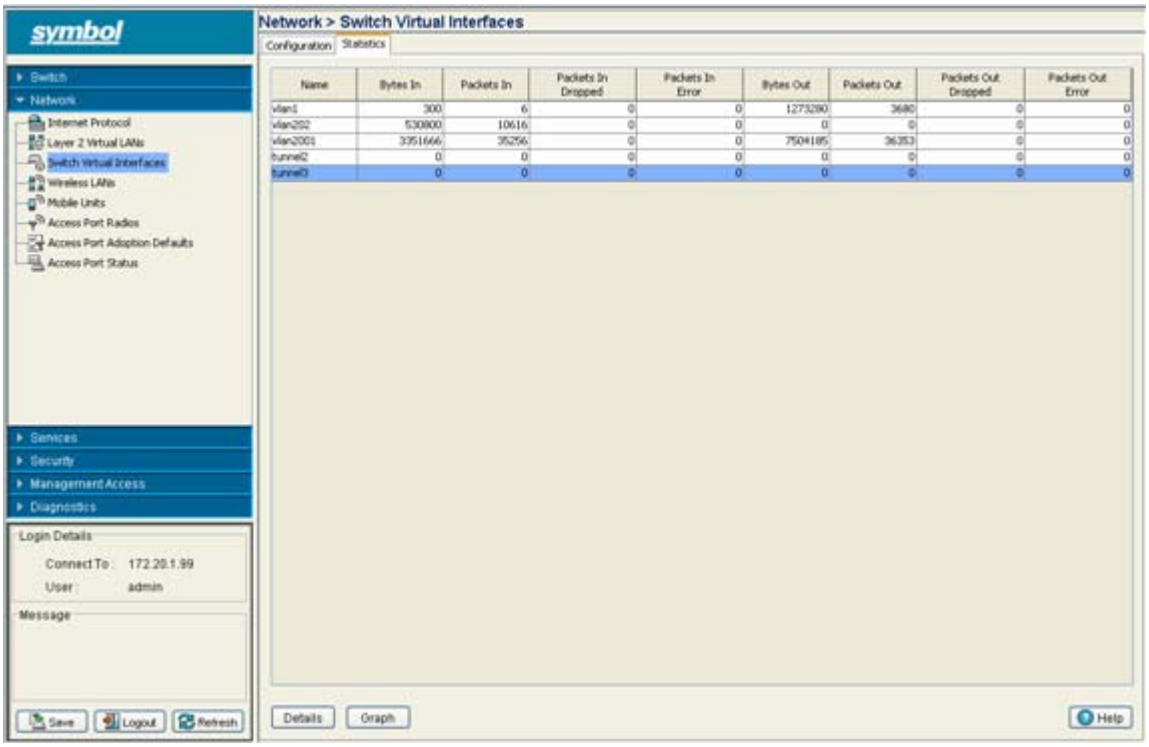
3. Unselect the **Use DHCP to obtain IP Address automatically** checkbox to assign IP addresses manually and do not want DHCP to provide them.
4. Use the **IP Address** field to manually enter the IP address for the virtual interface.
5. Enter the **Subnet Mask** for the IP address.
6. Select the **Set as Management Interface** checkbox to convert the selected VLAN ID as management interface.
7. Refer to the **Status** field for the current state of the requests made from applet. This field displays error messages if something goes wrong in the transaction between the applet and the switch.
8. Click **OK** to use the changes to the running configuration and close the dialog.
9. Click **Cancel** to close the dialog without committing updates to the running configuration.

4.4.2 Viewing Virtual Interface Statistics

The **Statistics** screen displays information from the switch software and hardware modules about the packet level statistics and errors at the interface defined.

To view virtual interface statistics:

1. Select **Network** > **Switch Virtual Interface** from the main tree menu.
2. Select the **Statistics** tab.



3. Refer to the following details as displayed within the Statistics tab:

Name	Displays the user defined interface name. The corresponding statistics are displayed along the row. The statistics are the total traffic to the interface since its creation.
Bytes In	Displays the number of bytes coming into the interface. The status is not self-updated periodically. To view the current status, click on the Details button.
Packets In	Displays the number of packets coming into the interface (including packets dropped, error packets, etc.)
Packets In Dropped	Displays the number of dropped packets coming into the interface. Packets are dropped in the following situations: 1. If the input queue for the hardware device/software module handling the interface definition is saturated/full 2. Overruns – occurs when the interface receives packets faster than it can transfer them to any buffer.

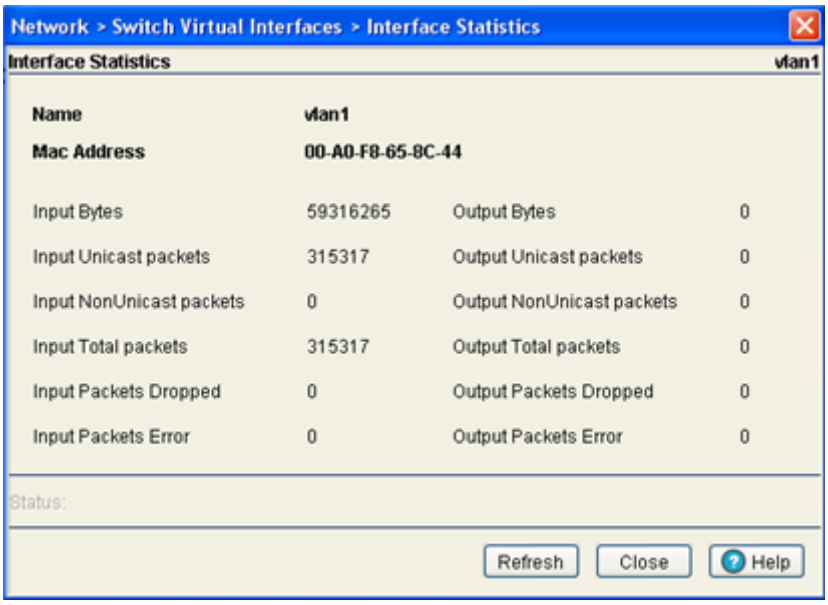
Packets In Error	Displays the number of error packets coming into the interface.It includes: • Runt frames — Packets shorter than the minimum Ethernet frame length (64 bytes). • CRC errors — The *Cyclical Redundancy Check* (CRC) is the 4 byte field at the end of every frame the receiving station uses to interpret if the frame is valid. If CRC value computed by the interface does not match with the value at the end of frame it is considered as a CRC error. • Late collisions — A late collision is any collision that occurs after the first 64 octets of data have been sent by the sending station. Late collisions are not normal and are usually the result of out of spec. cabling or a malfunctioning device. • Misaligned frames — A misaligned frame is a frame that somehow gets out of sync with the receiving station's receive clock recovery circuit. Misalignment is reported if the frame ends with a CRC error and extra bits are also detected.
Bytes Out	Displays the number of bytes going out on the interface.
Packets Out	Displays the number of packets going out of the interface.
Packets Out Dropped	Displays the number of dropped packets going out of the interface, due to the saturated output queues assigned to the interface processor or the physical device/software module. Packets can be dropped due to collisions as well.
Packets Out Error	Displays the number of error packets going out of the interface, including frame forming errors or malformed packets transmitted over the interface.

3. Click the **Details** button to view packet level statistics of any user defined interface. For more information, see *Viewing Virtual Interface Statistics on page 4-18*.
4. Click the **Graph** button to view a graphical representation of the switch virtual interface statistics. For more information, see *Viewing the Virtual Interface Statistics Graph on page 4-19*.

4.4.2.1 Viewing Virtual Interface Statistics

To view detailed virtual interface statistics:

1. Select a record from the table displayed in the Statistics screen.
2. Click the **Details** button.



3. The **Interface Statistics** screen displays with the following content:

Name	Displays the title of the logical interface selected.
MAC Address	Displays physical address information associated with the interface. This address is read-only (hard-coded at the factory) and cannot be modified.
Input Bytes	Displays the number of bytes received by the interface.
Input Unicast Packets	Displays the number of unicast packets (packets directed towards the interface) received in the interface.
Input NonUnicast Packets	Displays the number of NonUnicast Packets (Multicast and Broadcast Packets) received at the interface.
Input Total Packets	Displays the total number of packets received at the interface.
Input Packets Dropped	Displays the number of received packets dropped at the interface by the input Queue of the hardware unit /software module associated with the VLAN interface. Packets are dropped when the input Queue of the interface is full or unable to handle incoming traffic.
Input Packets Error	Displays the number of received packets with errors at the interface. Input Packet Errors are input errors occurring due to; no buffer space/ignored packets due to broadcast storms, packets larger than maximum packet size, framing errors, input rate exceeding the receiver's date handling rate or cyclic redundancy check errors. In all these cases, an error is reported.
Output Bytes	Displays the number of bytes transmitted from the interface.

Output Unicast Packets	Displays the number of unicast packets (packets directed towards a single destination address) transmitted from the interface.
Output NonUnicast Packets	Displays the number of unicast packets transmitted from the interface.
Output Total Packets	Displays the total number of packets transmitted from the interface.
Output Packets Dropped	Displays the number of transmitted packets dropped at the interface. Output Packets Dropped are the packets dropped when the output queue of the physical device associated with interface is saturated.
Output Packets Error	Displays the number of transmitted packets with errors at the interface. Output Packet Errors are the sum of all the output packet errors, malformed packets and misaligned packets received on an interface.

4. The **Status** is the current state of requests made from the applet. Requests are any "SET/GET" operation from the applet. The Status field displays error messages if something goes wrong in the transaction between the applet and the switch.
5. Click the **Refresh** button to refresh the virtual interface statistics. Status information is not polled to the applet. Hence you have to refresh the switch to retrieve the data.
6. Click the **Close** button to exit the screen. Clicking Close does not lose any data, as there are no values configured within this screen (it is read-only).

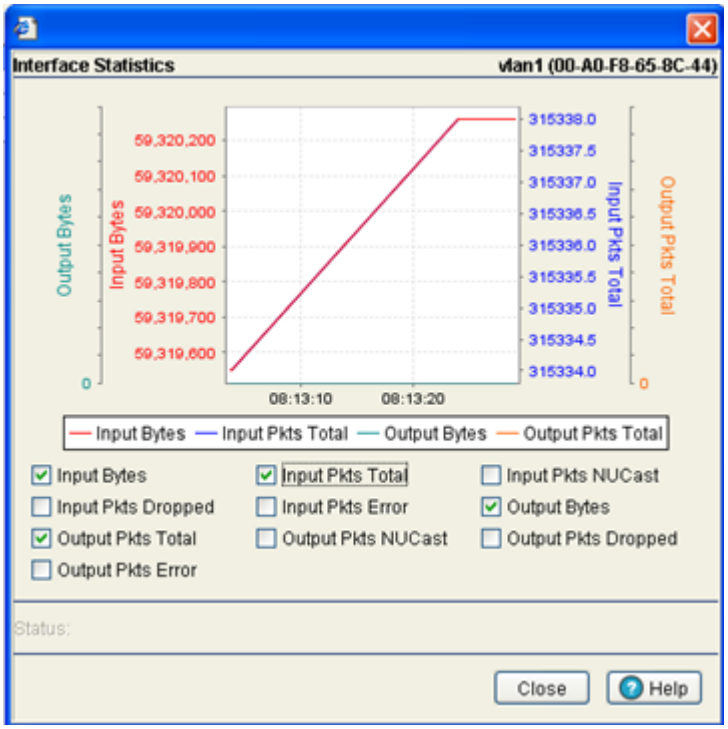
4.4.2.2 Viewing the Virtual Interface Statistics Graph

The switch Web UI continuously updates its virtual interface statistics, even when the graph is closed. Periodically display the virtual statistics graph for the latest information.

To view detailed graphical statistics for a selected interface:

1. Select a record from the table displayed in the **Statistics** screen.
2. Click the **Graph** button.
3. The Interface Statistics screen displays. The Interface Statistics screen provides the option of viewing graphical statistics for the following parameters:
   - Input Bytes
   - Input Pkts Dropped
   - Output Pkts Total
   - Output Pkts Error
   - Input Pkts Total
   - Input Pkts Error
   - Output Pkts NUCast
   - Input Pkts NUCast
   - Output Bytes
   - Output Pkts Dropped

   Select any of the above parameters by clicking on the checkbox associated with it.



NOTE Do not select more than four parameters at any given time.

4. Refer to the **Status** field for the current state of the requests made from applet. This field displays error messages if something goes wrong in the transaction between the applet and the switch.
5. Click **Close** to close the dialog.

4.5 Viewing and Configuring Switch WLANs

A *wireless LAN* (WLAN) is a local area network (LAN) without wires (see LAN, left). WLANs transfer data through the air using radio frequencies instead of cables. The WLAN screen displays a high-level overview of the WLANs created for the switch managed network. Use this data as necessary to check the WLANs that are active, their VLAN assignments, updates to a WLANs description and their current authentication and encryption schemes.The Wireless LANs screen consists of the following tabs:

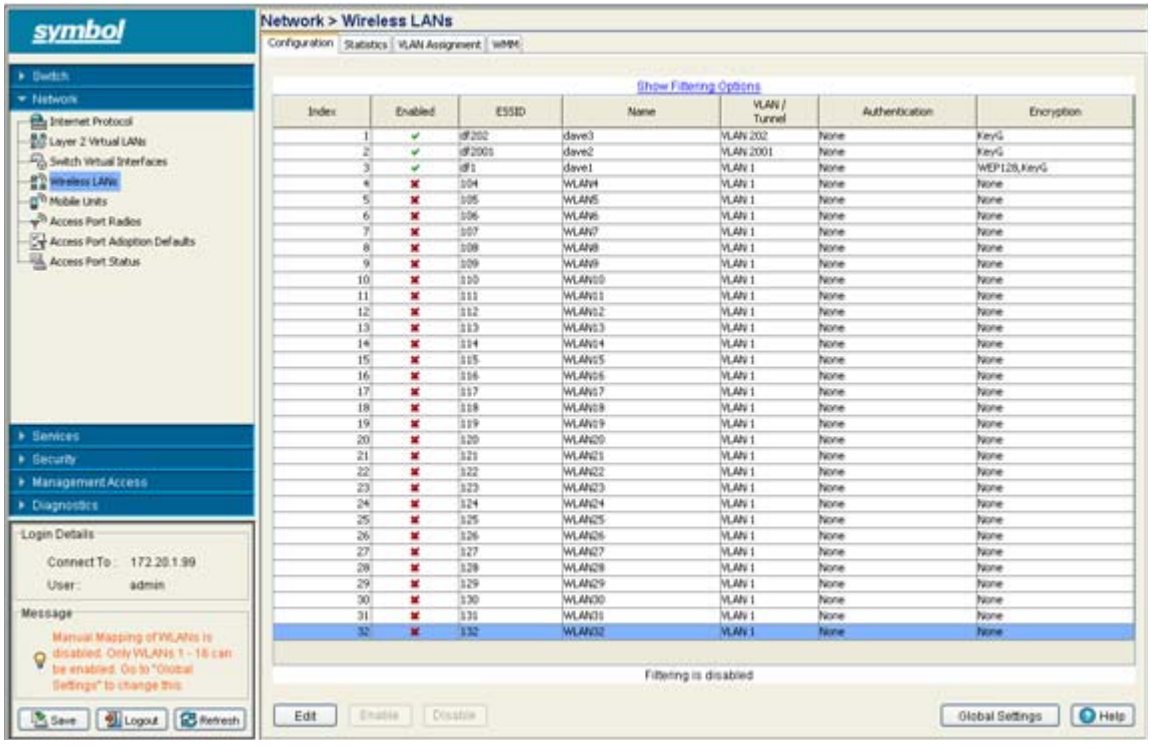
- *Configuring WLANs*
- *Viewing WLAN Statistics*
- *Viewing VLAN Assignment*
- *Configuring WMM*

4.5.1 Configuring WLANs

Refer to the **Configuration** screen for a high-level overview of the WLANs created for use within the switch-managed network. Use this data as necessary to keep current of active WLANs, their VLAN assignments, updates to a WLAN's description and their current authentication and encryption schemes. Be careful to properly map BSS WLANs and security schemes.

To configure a WLAN:

1. Select **Network** > **Wireless LANs** from the main menu tree.
2. Click the **Configuration** tab.



The Configuration tab displays the following details:

Index — Displays the WLAN's numerical identifier. The WLAN index range is from 1 to 32. An index can be helpful to differentiate a WLAN from other WLANs with similar configurations.

Enabled	Refer to the Enabled parameter to discern whether the specified WLAN is enabled or disabled. When enabled, a green check mark displays. When disabled, a red "X" displays. To enable or disable a WLAN, select it from the table and click the Enable or Disable button.
ESSID	Displays the Service Set ID associated with each WLAN. Click the Edit button to modify the value to a new unique SSID.
Name	Displays a short description of the associated WLAN. Click the Edit button to modify the value the WLAN description.
VLAN	Displays the name of the VLAN the WLAN is associated with. The VLAN ID is an integer assigned for the corresponding user defined name. The VLAN ID can be between 1 and 4094. The default VLAN ID is 1.
Authentication	Displays the type of authentication in use with the specified WLAN. Click the Edit button to modify the WLAN's current authentication scheme.
Encryption	Displays the type of wireless encryption in use on the specified WLAN. When no encryption is used, the field displays "none". Click the Edit button to modify the WLAN's current encryption scheme.

3. Click the **Edit** button to display a screen where WLAN information, encryption and authentication settings can be viewed or changed. For more information, see *Editing the WLAN Configuration on page 4-23*.
4. Click the **Enable** button to enable the selected WLAN. When enabled, a green check mark displays. When disabled, a red "X" displays. To enable or disable a WLAN, select it from the table and click the Enable or Disable button. The Enable button is only available when the selected WLAN is disabled.
5. Click the **Disable** button to disable the selected WLAN. When enabled, a green check mark displays. When disabled, a red "X" displays. To enable or disable a WLAN, select it from the table and click the Enable or Disable button. The Disable button is only available when the selected WLAN is enabled.
6. Click the **Global Settings** button to display a screen with WLAN settings applying to the all the WLANs on the system. Checkbox options within the Global Settings screen include:
    - MU Proxy ARP handling - Selected by default.
    - WLAN Prioritization - Selected by default.
    - Shared Key Authentication
    - Manual mapping of WLANs

4.5.1.1 Editing the WLAN Configuration

Security measures for the switch and its WLANs are critical. Use the available switch security options to protect each WLAN from wireless vulnerabilities, and safeguard the transmission of RF packets between WLANs and the MU traffic each supports.

The user has the capability of configuring separate security policies for each WLAN. Each security policy can be configured based on the authentication (Kerberos, 802.1x EAP, Hotspot) or encryption (WEP, KeyGuard, WPA/TKIP or WPA2/CCMP) scheme best suited to the coverage area the policy supports.

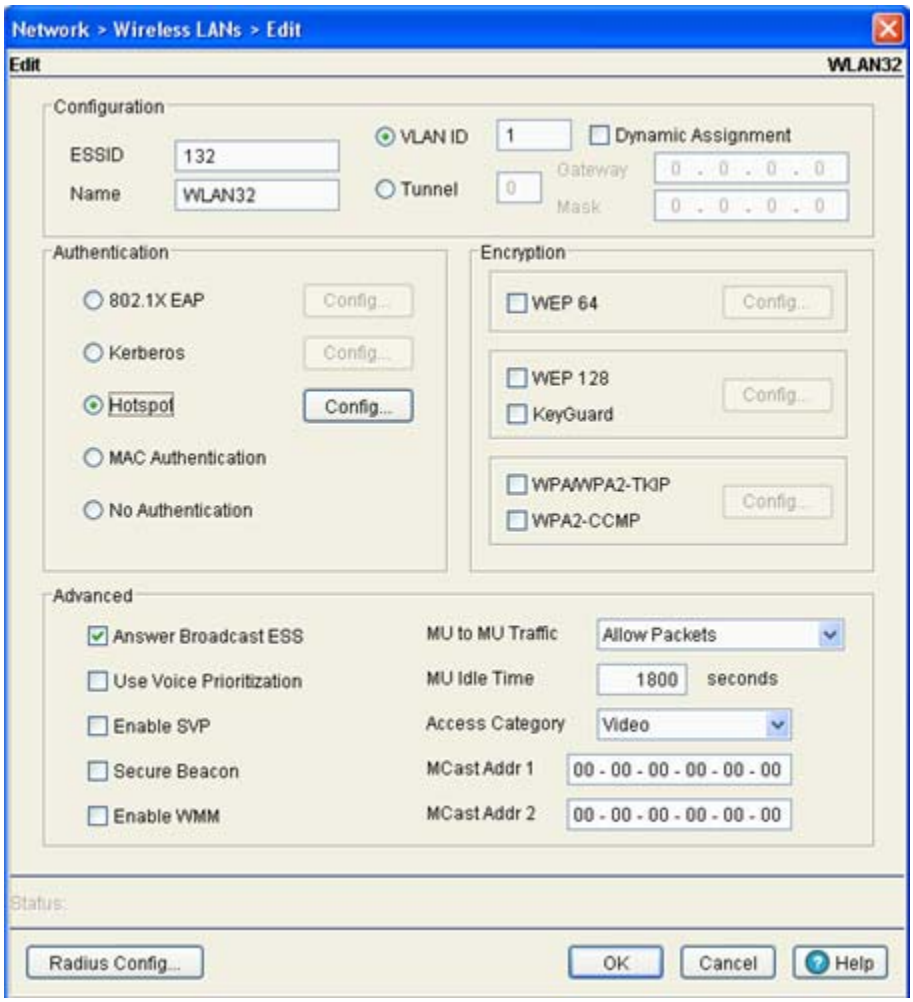
All of the default WLANs are available for modification when the user accesses the Wireless LANs screen. However, the WLAN requires an authentication or encryption scheme be applied before it can begin protecting the data proliferating the switch-managed wireless network.

The Edit screen provides a mean of modifying the existing WLANs SSID, description, VLAN ID assignment, inter-WLAN communication definition and encryption and authentication scheme.

To edit WLAN configuration settings:

1. Select **Network** > **Wireless LANs** from the main menu tree.
2. Click the **Configuration** tab.
3. Select a WLAN to edit from the table.

4. Click the **Edit** button.



The Wireless LANs Edit screen is divided into the following fields:

- Configuration
- Authentication
- Encryption
- Advanced

5. Refer to the **Configuration** field for the following information:

ESSID	Displays the Service Set ID associated with each WLAN. If changing the SSID, ensure the value used is unique.
Name	If editing an existing WLAN, ensure its description is updates accordingly to best describe the intended function of the WLAN.
VLAN ID	Select the **VLAN ID** checkbox to change the VLAN designation for this WLAN. By default, all WLANs created are assigned to VLAN 1. Select the **Dynamic Assignment** checkbox for an automatic VLAN assignment for this WLAN. The WS5100 Series Switch cannot route traffic between different VLANs on ETH1 and ETH2. Be cognizant of this limitation when planning to route traffic between different VLANs.

Tunnel	Select the **Tunnel** checkbox to enable a field for entering the tunnel number to be used with this WLAN. The available range is from 1-32. Enter the **Gateway** and **Mask** addresses used with the tunnel. When selected, the **VLAN ID** field is not available. Do not set the gateway address to any VLAN interface used by the switch.

6. Refer to the **Authentication** field to select amongst the following options:

802.1X EAP	A RADIUS server is used to authenticate users.
Kerberos	A Kerberos server is used to authenticate users.
Hotspot	A Hotspot is used to authenticate users.
Dynamic MAC ACL	The switch uses a Radius server to see if a target MAC address is allowed on the network.
No Authentication	When selected, no Authentication is used and transmissions are made (in the open) without security unless an encryption scheme is used. This setting is not recommended when data protection is important.

Of the above authentication types, 802.1x EAP, Kerboros and Hotspot have a **Config** button associated with it. *Configuring Authentication Types on page 4-27* provides more information on configuring the different authentication types available to the switch.

7. Refer to the **Encryption** field to select amongst the following options:

WEP 64	Use the WEP 64 radio button to enable the *Wired Equivalent Privacy* (WEP) protocol with a 40-bit key. WEP is available in two encryption modes: 40 bit (also called WEP 64) and 104 bit (also called WEP 128). The 104-bit encryption mode provides a longer algorithm that takes longer to decode than that of the 40-bit encryption mode.
WEP 128	Use the WEP 128 radio button to enable the *Wired Equivalent Privacy* (WEP) protocol with a 104-bit key. WEP is available in two encryption modes: WEP 64 (using a 40-bit key) and WEP 128 (using a 104-bit key). WEP 128 encryption mode provides a longer algorithm that takes longer to decode than that of the WEP 64 encryption mode.
KeyGuard	Uses a Symbol MU proprietary encryption mechanism to protect data.
WPA-WPA2-TKIP	Use the WPA-TKIP radio button to enable *Wi-Fi Protected Access* (WPA) with *Temporal Key Integrity Protocol* (TKIP).
WPA2-CCMP	WPA2 is a newer 802.11i standard that provides even stronger wireless security than Wi-Fi Protected Access (WPA) and WEP. CCMP is the security standard used by the *Advanced Encryption Standard* (AES). AES serves the same function TKIP does for WPA-TKIP. CCMP computes a *Message Integrity Check* (MIC) using the proven *Cipher Block Chaining* (CBC) technique. Changing just one bit in a message produces a totally different result.

802.11i Mixed Mode (WPA2/AES-TKIP)	802.11i Mixed Mode enables WPA2-AES and WPA-TKIP clients to operate simultaneously on the network. Enabling this option allows backwards compatibility for clients that support WPA-TKIP but do not support WPA2-AES.
No Encryption	When selected, no Encryption is used and transmissions are made (in the open) without security unless an authentication scheme is used. This setting is not recommended when data protection is important.

Each of the above listed encryption types has a **Config** button associated with it. *Configuring Different Encryption Types on page 4-37* provides more information on configuring the different encryption types available to the switch.

8. Refer to the **Advanced** field for the following information:

Answer Broadcast ESS	Enabling Broadcast ESS allows you to broadcast the WLANs SSID with outgoing data traffic.
Use Voice Prioritization	Select the Use Voice Prioritization option if Voice is used on the WLAN. This gives priority to voice packets and voice management packets.
Enable SVP	Enabling SVP (Spectralink Voice Prioritization) sends packets allowing the switch to identify MU's as voice MU's. Thereafter, any UDP packet sent by these MU's is prioritized ahead of data.
Secure Beacon	Closed system is the secure beacon feature for not answering broadcast SSID. This option still allows MU to MU communication within the WLAN.
Enable WMM	Enable the WMM (Wireless Multimedia extensions) option if multi media applications (such as video) are used on WLAN. Enabling WMM allows for prioritizing voice and video packets on the network.
MU to MU Traffic	Allows frames from one MU, where the destination MAC is of another MU, are switch to that second MU. Use the drop-down menu to select one of the following options: • Drop Packets – This restricts MU to MU communication based on the WLAN's configuration • Allow Packets – This allows MU to MU communication based on the WLAN's configuration • Forward through switch – The frames from the MU are switched out to the wired network (out of the switch). Another upstream device decides whether the frame should be sent back to the second MU, and if so, it sends the frame back to the switch and is switched out just like any other frame on the wire.
MU Idle Time out	Set the MUs idle time limit in seconds.

Access Category	Displays the Access Category for the intended AP traffic. The Access Categories are the different WLAN-WMM options available to the radio. The Access Category types are: • Automatic/WMM– Optimized for WMM • Background– Optimized for background traffic • Best-effort– Optimized for best effort traffic • Video– Optimized for video traffic • Voice– Optimized for voice traffic
MCast Addr 1	Define the Multicast Mask address to broadcast packets to all the hosts in the WLAN.
MCast Addr 2	Define the Multicast mask MAC address to broadcast packet to all the hosts in the WLAN.

NOTE If the WLAN is supporting multimedia applications (video or voice), ensure a valid multicast address is provided. If using a 802.11bg radio, ensure "24" is also selected as an additional Basic data rate. In addition, ensure the "multicast-packet-limit 128 vlan-id" CLI command is properly configured under the "wireless" context.

9. Refer to the **Status** field for the current state of the requests made from applet. This field displays error messages if something goes wrong in the transaction between the applet and the switch.
10. Click **OK** to use the changes to the running configuration and close the dialog.
11. Click **Cancel** to close the dialog without committing updates to the running configuration.

4.5.1.2 Configuring Authentication Types

Refer to the following to configure the WLAN authentication options available on the WS5100. Refer to the following

- *Configuring 802.1x EAP*
- *Configuring Kerboros*
- *Configuring Hotspots*
  - *Configuring an Internal Hotspot*
  - *Configuring External Hotspot*
  - *Configuring Advanced Hotspot*
- *Configuring Dynamic MAC ACL*

Configuring 802.1x EAP

The IEEE 802.1x standard ties the 802.1x EAP authentication protocol to both wired and wireless LAN applications.

The EAP process begins when an unauthenticated supplicant (MU) tries to connect with an authenticator (in this case, the authentication server). The switch passes EAP packets from the client to an authentication server

on the wired side of the switch. All other packet types are blocked until the authentication server (typically, a RADIUS server) verifies the MU's identity.

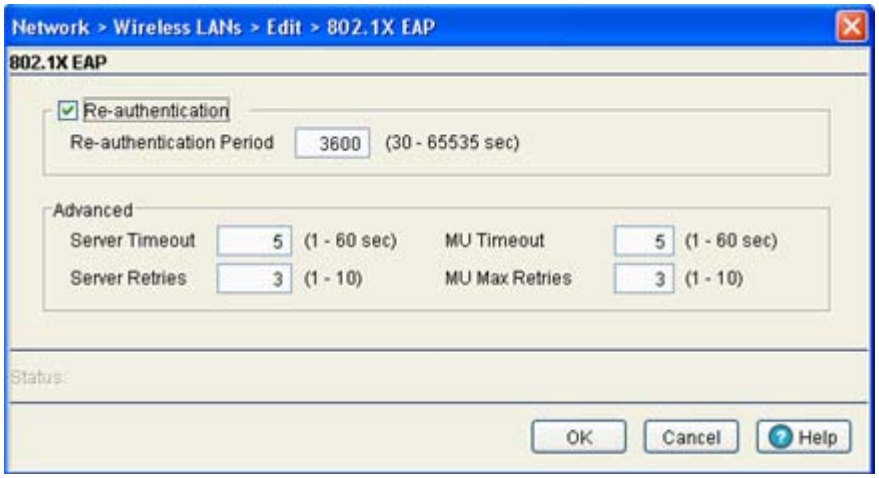
NOTE As part of the EAP configuration process, ensure a primary and optional secondary Radius server have been properly configured to authenticate the users requesting access to the EAP protected WLAN.

To configure a Kerberos authentication scheme:

1. Select **Network** > **Wireless LANs** from the main menu tree.
2. Select an existing WLAN from those displayed within the **Configuration** tab and click the **Edit** button.

   A WLAN screen displays with the WLAN's existing configuration. Refer to the **Authentication** and **Encryption** columns to assess the WLAN's existing security configuration.
3. Select the **802.1X EAP** button from within the Authentication field.
4. Click the **Config** button to the right of the 802.1X EAP checkbox.

   The **802.1x EAP** screen displays.



5. Select the **Re-authentication** checkbox so MUs are forced to reauthenticate periodically. Periodic repetition of the EAP process provides ongoing security for current authorized connections.

   Set the EAP re-authentication period to a shorter time interval (at least 30 seconds) for tighter security on the WLAN's connections. Set the EAP reauthentication period to a longer time interval (at most, 9999 seconds) to relax security on wireless connections. The reauthentication period does not affect wireless connection throughput. The default is 30 seconds
6. Configure the **Advanced** field as required to define timeout and retry information for the authentication server.

Server Timeout	Specify an interval (between 1 - 60 seconds) for the switch's retransmission of EAP-Request packets to the server. The default is 10 seconds. If this time is exceeded, the authentication session is terminated.
Server Retries	Specify the maximum number of times for the switch can retransmit an EAP-Request frame to the server before it times out of the authentication session. The default is 10 retries.

MU Timeout	Define the time (between 1- 60 seconds) for the switch's retransmission of EAP-Request packets. The default is 10 seconds.
MU Max Retries	Specify the maximum number of times the switch retransmits an EAP-Request frame to the client before it times out the authentication session. The default is 10 retries.

7. Refer to the **Status** field for the current state of the requests made from applet. This field displays error messages if something goes wrong in the transaction between the applet and the switch.
8. Click **OK** to use the changes to the running configuration and close the dialog.
9. Click **Cancel** to close the dialog without committing updates to the running configuration.

Configuring Kerboros

Kerberos (designed and developed by MIT) provides strong authentication for client/server applications using secret-key cryptography. Using Kerberos, a MU must prove its identity to a server (and vice versa) across an insecure network connection. Once a MU and server prove their identity, they can encrypt all communications to assure privacy and data integrity. Kerberos can only be used on the with Symbol clients.

CAUTION Kerberos makes no provisions for host security. Kerberos assumes it is running on a trusted host with an untrusted network. If host security is compromised, Kerberos is compromised as well

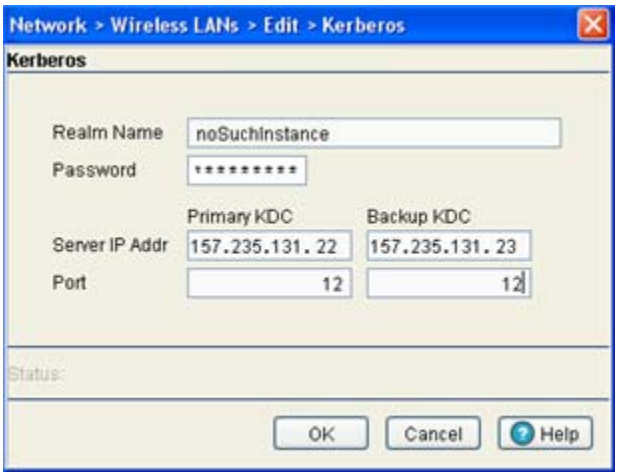
To configure a Kerberos authentication scheme for a WLAN:

1. Select **Network** > **Wireless LANs** from the main menu tree.
2. Select an existing WLAN from those displayed within the **Configuration** tab.
3. Click the **Edit** button.

   A WLAN screen displays with the WLAN's existing configuration. Refer to the **Authentication** and **Encryption** columns to assess the WLAN's existing security configuration.
4. Select the **Kerberos** button from within the Authentication field.

NOTE Kerberos requires at least one encryption scheme be enabled (WEP 128 or other). If neither WEP 128 or KeyGuard is enabled, WEP 128 will automatically be enabled for use with Kerberos.

5. Click the **Config** button to the right of the Kerberos checkbox. The **Kerberos** screen displays.



6. Specify a case-sensitive **Realm Name** (for example, SYMBOL.COM).

   The realm name is the name domain/realm name of the KDC Server. A realm name functions similarly to a DNS domain name. In theory, the realm name is arbitrary. However, in practice a Kerberos realm is named by uppercasing the DNS domain name associated with hosts in the realm.

7. Enter a **Server IP Addr** (IP address) for the Primary and (if necessary) Backup KDC.

   Specify a numerical (non-DNS) IP address for the Primary *Key Distribution Center* (KDC). The KDC implements an Authentication Service and a Ticket Granting Service, whereby an authorized user is granted a ticket encrypted with the user's password. The KDC has a copy of every user password provided. Optionally, specify a numerical (non-DNS) IP address for a backup KDC. Backup KDCs are often referred to as slave servers.

8. Specify the **Ports** on which the Primary and Backup KDCs reside.

   The default port number for Kerberos Key Distribution Centers is port 88.

9. Refer to the **Status** field for the current state of the requests made from applet. This field displays error messages if something goes wrong in the transaction between the applet and the switch.
10. Click **OK** to use the changes to the running configuration and close the dialog.
11. Click **Cancel** to close the dialog without committing updates to the running configuration.

Configuring Hotspots

The switch enables hotspot operators to provide user authentication and accounting without a special client application. The switch uses a traditional Internet browser as a secure authentication device. Rather than rely on built-in 802.11security features to control association privileges, configure a WLAN with no WEP (an open network). The switch issues an IP address to the user using a DHCP server, authenticates the user and grants the user access the Internet.

When a user visits a public hotspot and wants to browse to a Web page, they boot up their laptop and associate with the local Wi-Fi network by entering the correct SSID. They then start a browser. The hotspot access controller forces this un-authenticated user to a Welcome page from the hotspot Operator that allows the user to login with a username and password.

NOTE For hotspot deployment, Symbol recommends using the switch's onboard Radius server and built-in user database. This is the easiest setup option and offers a high degree of security and accountability. For information on configuring the Radius server, see *Configuring the Radius Server on page 6-64*.

To configure hotspot support for the switch:

1. Select **Network** > **Wireless LANs** from the main menu tree.
2. Select an existing WLAN from those displayed within the **Configuration** tab and click the **Edit** button.

   A WLAN screen displays with the WLAN's existing configuration. Refer to the **Authentication** and **Encryption** columns to assess the WLAN's existing security configuration.

3. Select the **Hotspot** button from within the Authentication field.
4. Click the **Config** button to the right of the Hotspot checkbox.

   A **Hotspot** screen displays.

5. Use the drop-down menu at the top of the screen to define whether this WLAN's Web Pages are:
   - Internal - three HTML pages with basic functionality are made available on the switch's onboard HTTP server. The HTML pages are pre-created to collect login credentials through Login.htm, send

them to a Radius server and display a Welcome.htm or a Faliure.htm depending on the result of the authentication attempt. For more information, see
Configuring an Internal Hotspot on page 4-32.

- External - a customer may wish to host their own external Web server using advanced Web content (using XML, Flash). Use the External option to point the switch to an external hotspot. For more information, see *Configuring External Hotspot on page 4-34*.
- Advanced - a customer may wish to use advanced Web content (XML, Flash) but might not have (or would not want to use) an external Web server, choosing instead to host the Web pages on the switch's HTTP Web server. Selecting the Advanced option allows for the importing the Web pages from an external source (like an FTP server) and hosting them on the switch. For more information, see *Configuring Advanced Hotspot on page 4-36*.

NOTE The appearance and user defined values for the Hotspot screen differ depending on which option is selected from the drop-down menu. You may want to research the options available before deciding which hotspot option to select.

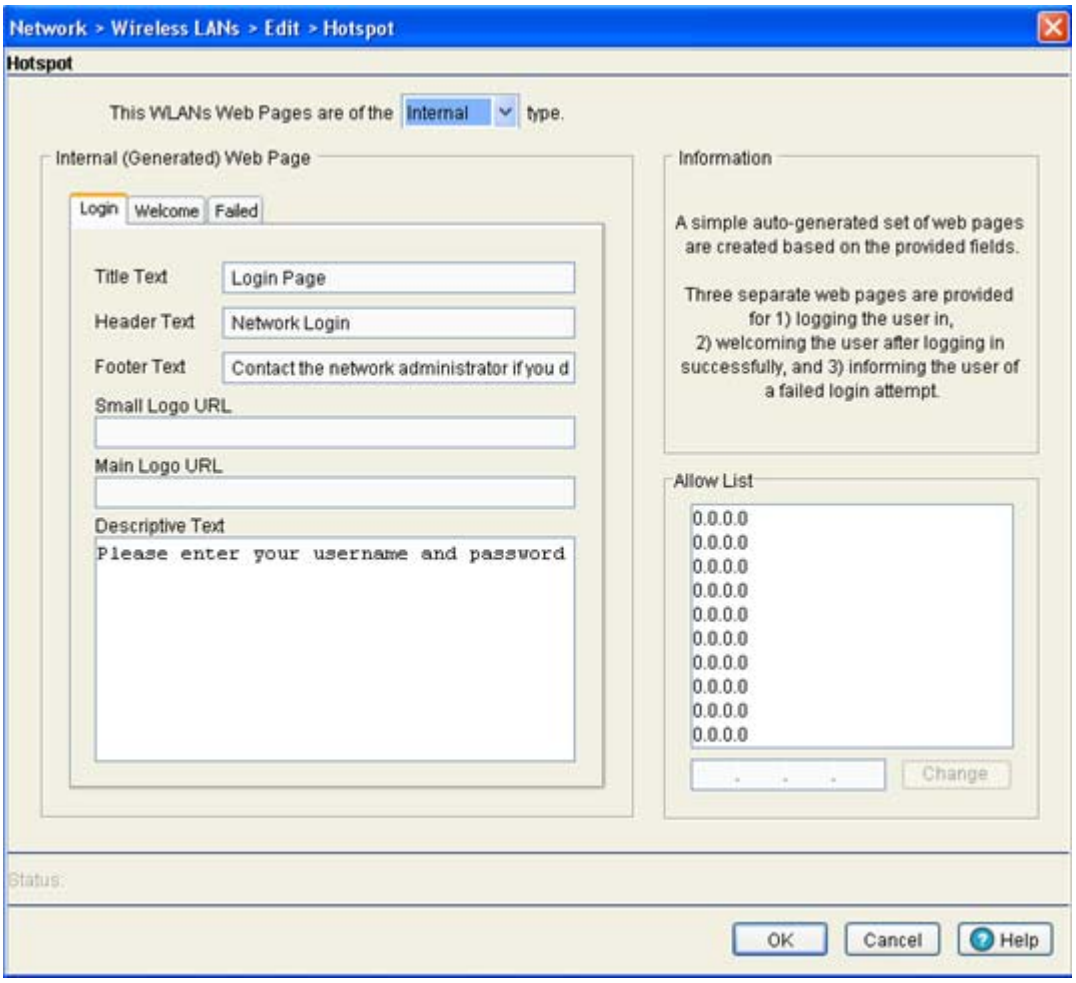
Configuring an Internal Hotspot

Using the Internal option means the user develops the hotspot using the three HTML pages made available on the switch's onboard HTTP server. The HTML pages are pre-created to collect login credentials through Login.htm, send them to a Radius server and display a Welcome.htm or a Faliure.htm depending on the result of the authentication attempt.

To create a hotspot maintained by the switch's own internal resources:

1. Select **Network** > **Wireless LANs** from the main menu tree. Select an existing WLAN from those displayed within the **Configuration** tab and click the **Edit** button.

2. Select the **Hotspot** button from within the Authentication field. Ensure **Internal** is selected from within the **This WLAN's Web Pages are of the** drop-down menu.



3. Click the **Login** tab and enter the title, header, footer Small Logo URL, Main Logo URL and Descriptive Text you would like to display when users login to the switch maintained hotspot.

Title Text	Displays the HTML text displayed on the Welcome page when using the switch's internal Web server. This option is only available if Internal is chosen from the drop-down menu.
Header Text	Displays the HTML header displayed on the Failed page when using the switch's internal Web server. This option is only available if Internal is chosen from the drop-down menu.
Footer Text	Displays the HTML footer text displayed on the Failed page when using the switch's internal Web server. This option is only available if Internal is chosen from the drop-down menu.
Small Logo URL	Displays the URL for a small logo image displayed on the Failed page when using the switch's internal Web server. This option is only available if Internal is chosen from the drop-down menu.

Main Logo URL	Displays the URL for the main logo image displayed on the Failed page when using the switch's internal Web server. This option is only available if Internal is chosen from the drop-down menu above.
Descriptive Text	Specify any additional text containing instructions or information for the users who access the Failed page. This option is only available if Internal is chosen from the drop-down menu above. The default text is: "Either the username and password are invalid, or service is unavailable at this time."

4. Refer to the **Allow List** field, and enter any IP address (for internal or external Web sites) that may be accessed by the Hotspot user without authentication.
5. Refer to the **Status** field for the current state of the requests made from applet. This field displays error messages if something goes wrong in the transaction between the applet and the switch.
6. Click **OK** to use the changes to the running configuration and close the dialog.
7. Click **Cancel** to close the dialog without committing updates to the running configuration.

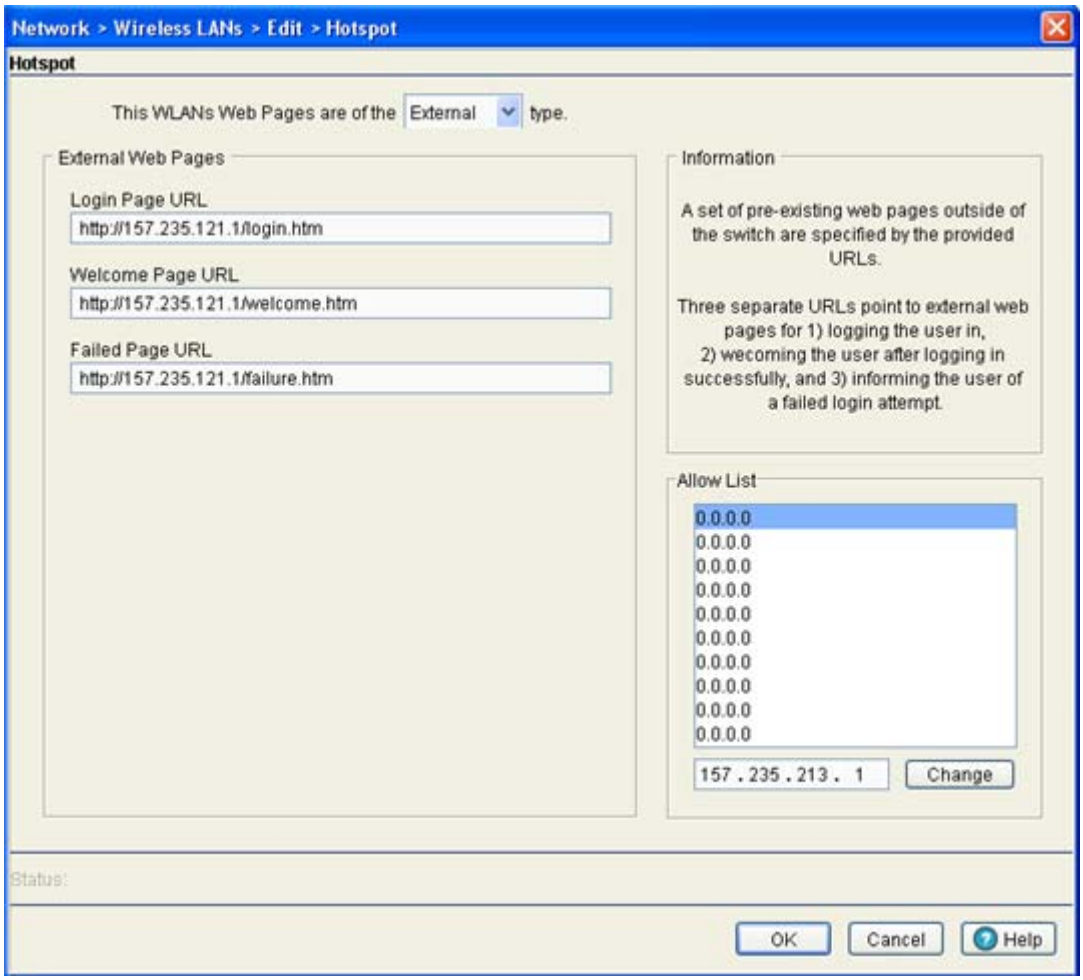
Configuring External Hotspot

Selecting the external option entails hosting your own external Web server using advanced Web content (using XML, Flash).

To create a hotspot maintained by an external server:

1. Select **Network** > **Wireless LANs** from the main menu tree. Select an existing WLAN from those displayed within the **Configuration** tab and click the **Edit** button.

2. Select the **Hotspot** button from within the Authentication field. Ensure **External** is selected from within the **This WLAN's Web Pages are of the** drop-down menu.



3. Refer to the **External Web Pages** field and provide the Login, Welcome and Failed Page URLs used by the external Web server to support the hotspot.

Login Page URL	Define the complete URL for the location of the Login page. The Login screen will prompt the hotspot user for a username and password to access the Welcome page.
Welcome Page URL	Define the complete URL for the location of the Welcome page. The Welcome page assumes the hotspot user has logged in successfully and can access the Internet.
Failed Page URL	Define the complete URL for the location of the Failed page. The Failed screen assumes the hotspot authentication attempt has failed, you are not allowed to access the Internet and you need to provide correct login information to access the Web.

4. Refer to the **Allow List** field, and enter any IP address (for internal or external Web sites) that may be accessed by the Hotspot user without authentication.
5. Refer to the **Status** field for the current state of the requests made from applet. This field displays error messages if something goes wrong in the transaction between the applet and the switch.
6. Click **OK** to use the changes to the running configuration and close the dialog.

7. Click **Cancel** to close the dialog without committing updates to the running configuration.

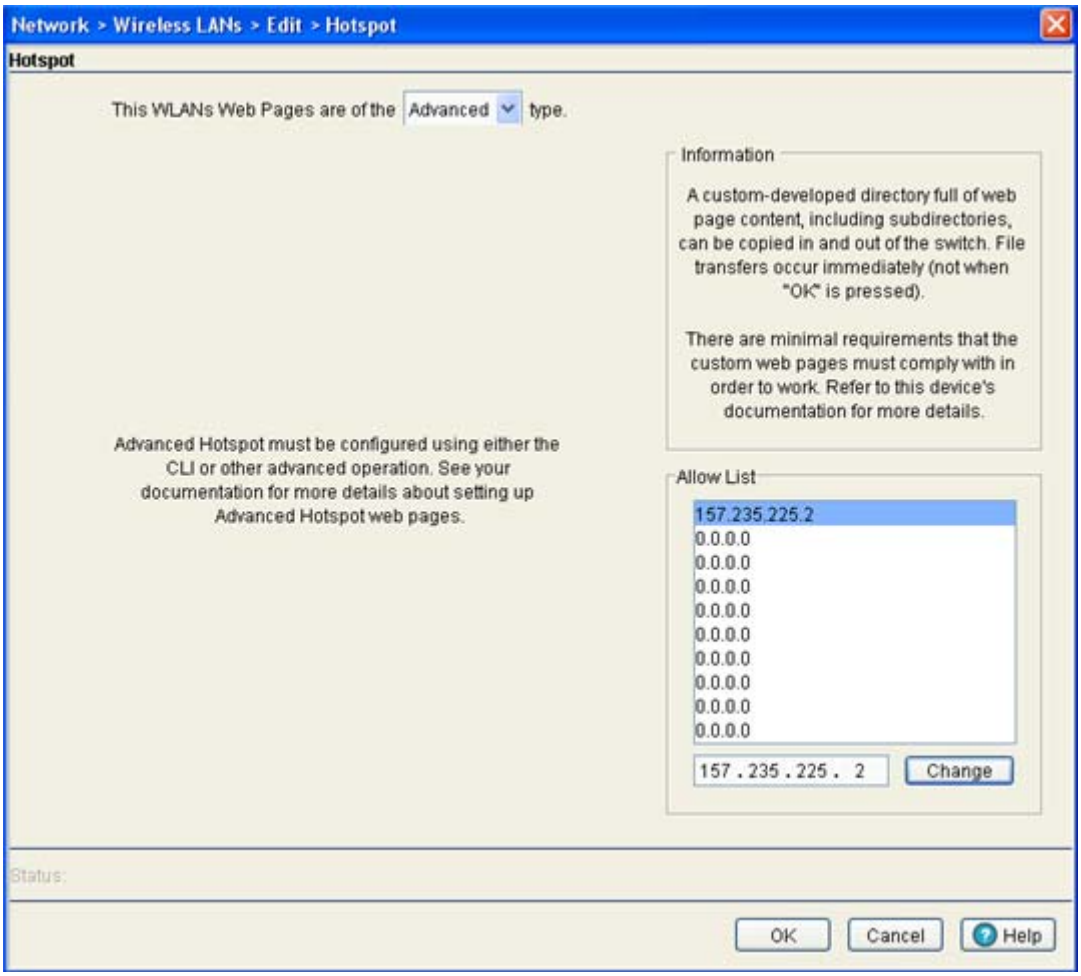
Configuring Advanced Hotspot

A customer may wish to use advanced Web content (XML, Flash) but might not have (or would not want to use) an external Web server, choosing instead to host the Web pages on the switch's HTTP Web server. Selecting the Advanced option allows for the importing the Web pages from an external source (like an FTP server) and hosting them on the switch.

To use the Advanced option to define the hotspot:

1. Select **Network** > **Wireless LANs** from the main menu tree.
2. Select an existing WLAN from those displayed within the **Configuration** tab.
3. Click the **Edit** button.
4. Select the **Hotspot** button from within the Authentication field.

   Ensure **Advanced** is selected from within the **This WLAN's Web Pages are of the** drop-down menu.



NOTE Advanced hotspot configuration is not permissible using the switch Web UI. Refer to the switch CLI or other advanced configuration options to define a hotspot with advanced properties. However, the switch can still maintain directories containing Web page content.

5. Refer to the **Allow List** field, and enter any IP address (for internal or external Web sites) that may be accessed by the Hotspot user without authentication.
6. Refer to the **Status** field for the current state of the requests made from applet. This field displays error messages if something goes wrong in the transaction between the applet and the switch.
7. Click **OK** to use the changes to the running configuration and close the dialog.
8. Click **Cancel** to close the dialog without committing updates to the running configuration.

Configuring Dynamic MAC ACL

The Dynamic MAC ACL option allows the user to configure a Radius server for user authentication with the range of MAC addressees defined as allowed or denied access to the switch managed network.

NOTE As part of the Dynamic MAC ACL configuration process, ensure a primary and optional secondary Radius server have been properly configured to authenticate the users requesting access to the ACL protected WLAN. For information on configuring the Radius server, see *Configuring the Radius Server on page 6-64*.

4.5.1.3 Configuring Different Encryption Types

To configure the WLAN data encryption options available on the WS5100, refer to the following:

- *Configuring WEP 64*
- *Configuring WEP 128 / KeyGuard*
- *Configuring WPA/WPA2 using TKIP and CCMP*

Configuring WEP 64

Wired Equivalent Privacy (WEP) is a security protocol specified in the *IEEE Wireless Fidelity (Wi-Fi)* standard. WEP is designed to provide a WLAN with a level of security and privacy comparable to that of a wired LAN.

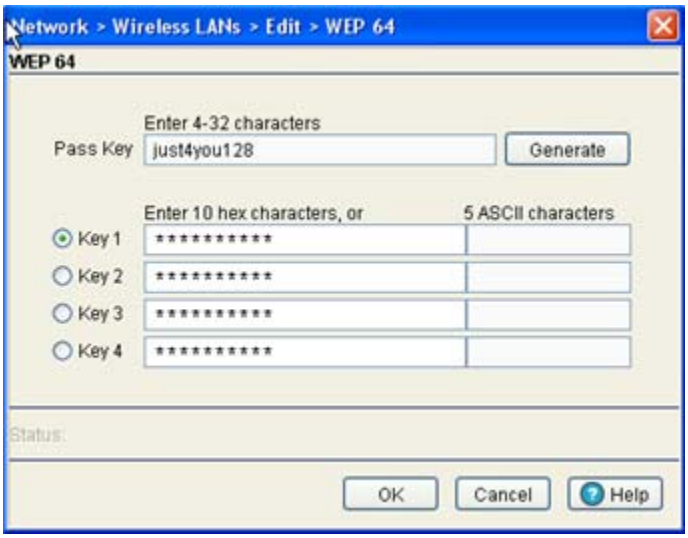
WEP 64 is a less robust encryption scheme than WEP 128 (shorter WEP algorithm for a hacker to duplicate), but WEP 64 may be all that a small-business user needs for the simple encryption of wireless data. However, networks that require more security are at risk from a WEP flaw. The existing 802.11 standard alone offers administrators no effective method to update keys.

To configure WEP 64:

1. Select **Network** > **Wireless LANs** from the main menu tree.
2. Select an existing WLAN from those displayed within the **Configuration** tab and click the **Edit** button.

   A WLAN screen displays with the WLAN's existing configuration. Refer to the **Authentication** and **Encryption** columns to assess the WLAN's existing security configuration.
3. Select the **WEP 64** button from within the Encryption field.
4. Click the **Config** button to the right of the WEP 64 checkbox.

The **WEP 64** screen displays.



5. Specify a 4 to 32 character **Pass Key** and click the **Generate** button.

   The pass key can be any alphanumeric string. The switch, other proprietary routers and Symbol MUs use the algorithm to convert an ASCII string to the same hexadecimal number. MUs without Symbol adapters need to use WEP keys manually configured as hexadecimal numbers.

6. Use the **Key #1-4** areas to specify key numbers.

   The key can be either a hexadecimal or ASCII. For WEP 64 (40-bit key), the keys are 10 hexadecimal characters in length or 5 ASCII characters. Select one of these keys for activation by clicking its radio button.

   Default (hexadecimal) keys for WEP 64 include:

Key 1	1011121314
Key 2	2021222324
Key 3	3031323334
Key 4	4041424344

7. Refer to the **Status** field for the current state of the requests made from applet. This field displays error messages if something goes wrong in the transaction between the applet and the switch.
8. Click **OK** to use the changes to the running configuration and close the dialog.
9. Click **Cancel** to close the dialog without committing updates to the running configuration.

Configuring WEP 128 / KeyGuard

WEP 128 provides a more robust encryption algorithm that WEP 64 by requiring a longer key length and pass key. Thus, making it harder to hack through the replication of WEP keys. WEP 128 may be all that a small-business user needs for the simple encryption of wireless data.

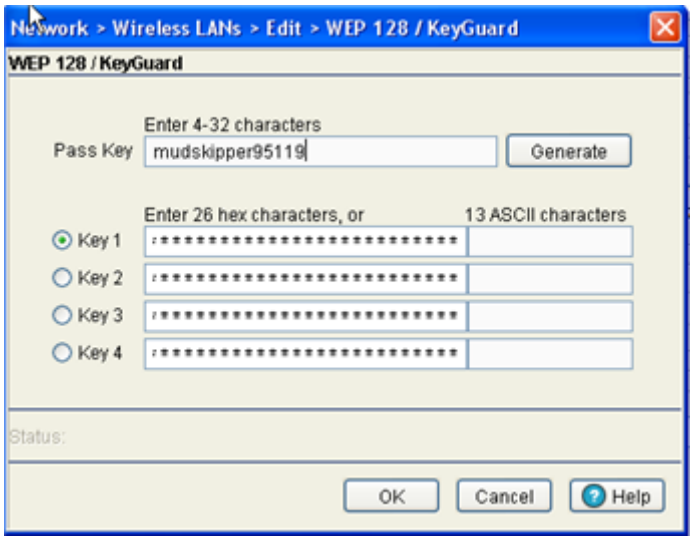
KeyGuard is a proprietary encryption method developed by Symbol Technologies. KeyGuard is Symbol's enhancement to WEP encryption, and was developed before the finalization of WPA-TKIP. This encryption implementation is based on the IEEE Wireless Fidelity (Wi-Fi) standard, 802.11i.

To configure WEP 128 or KeyGuard:

1. Select **Network** > **Wireless LANs** from the main menu tree.
2. Select an existing WLAN from those displayed within the **Configuration** tab and click the **Edit** button.

   A WLAN screen displays with the WLAN's existing configuration. Refer to the **Authentication** and **Encryption** columns to assess the WLAN's existing security configuration.
3. Select either the **WEP 128** or **KeyGuard** button from within the Encryption field.
4. Click the **Config** button to the right of the WEP 128 and KeyGuard checkboxes.

   The **WEP 128 / KeyGuard** screen displays.



5. Specify a 4 to 32 character **Pass Key** and click the **Generate** button.

   The pass key can be any alphanumeric string. The switch and Symbol MUs use the algorithm to convert an ASCII string to the same hexadecimal number. MUs without Symbol adapters need to use WEP keys manually configured as hexadecimal numbers.
6. Use the **Key #1-4** areas to specify key numbers.

   The key can be either a hexadecimal or ASCII. The keys are 26 hexadecimal characters in length or 13 ASCII characters. Select one of these keys for activation by clicking its radio button.

   Default (hexadecimal) keys for WEP 128 and KeyGuard include:

Key 1	101112131415161718191A1B1C
Key 2	202122232425262728292A2B2C
Key 3	303132333435363738393A3B3C
Key 4	404142434445464748494A4B4C

7. Refer to the **Status** field for the current state of the requests made from applet. This field displays error messages if something goes wrong in the transaction between the applet and the switch.
8. Click **OK** to use the changes to the running configuration and close the dialog.
9. Click **Cancel** to close the dialog without committing updates to the running configuration.

Configuring WPA/WPA2 using TKIP and CCMP

Wi-Fi Protected Access (WPA) is a robust encryption scheme specified in the *IEEE Wireless Fidelity* (Wi-Fi) standard, 802.11i. WPA provides more sophisticated data encryption than WEP. WPA is designed for corporate networks and small-business environments where more wireless traffic allows quicker discovery of encryption keys by an unauthorized person.

WPA's encryption method is *Temporal Key Integrity Protocol (TKIP).* TKIP addresses WEP's weaknesses with a re-keying mechanism, a per-packet mixing function, a message integrity check, and an extended initialization vector. WPA also provides strong user authentication based on 802.1x EAP.

WPA2 is a newer 802.11i standard that provides even stronger wireless security than WPA and WEP. CCMP is the security standard used by the *Advanced Encryption Standard* (AES). AES serves the same function TKIP does for WPA-TKIP. CCMP computes a *Message Integrity Check* (MIC) using the proven *Cipher Block Chaining* (CBC) technique. Changing just one bit in a message produces a totally different result.

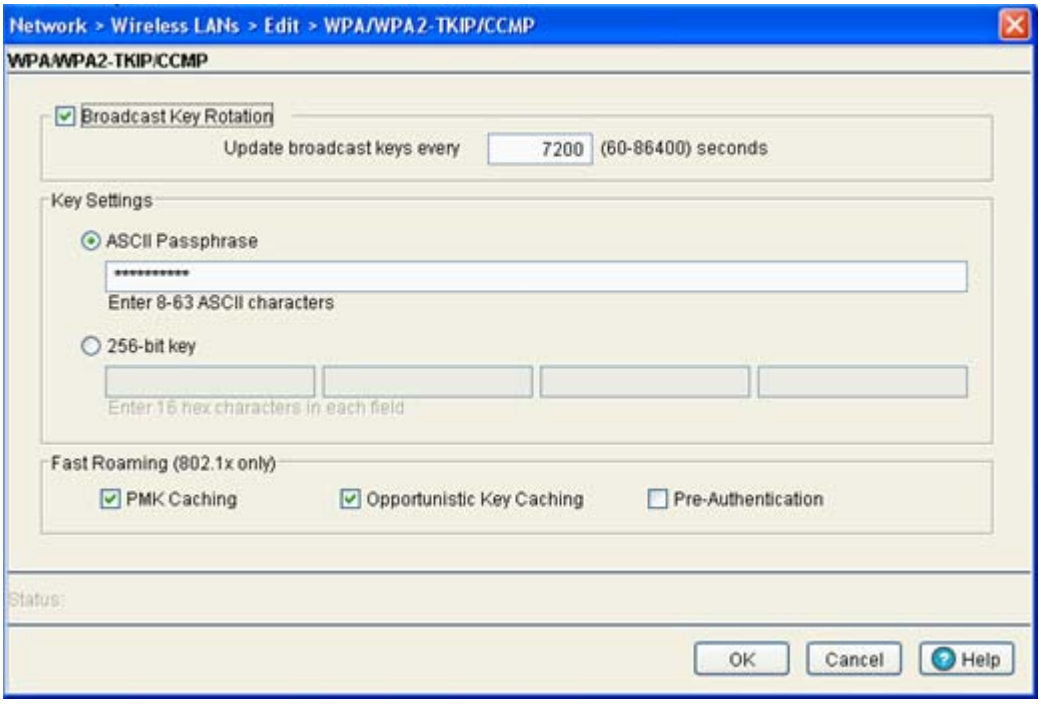
WPA2-CCMP is based on the concept of a *Robust Security Network* (RSN), which defines a hierarchy of keys with a limited lifetime (similar to TKIP). Like TKIP, the keys the administrator provides are used to derive other keys. Messages are encrypted using a 128-bit secret key and a 128-bit block of data. The end result is an encryption scheme as secure as any the switch provides.

To configure WPA/WPA2-TKIP/CCMP encryption:

1. Select **Network** > **Wireless LANs** from the main menu tree.
2. Select an existing WLAN from those displayed within the **Configuration** tab and click the **Edit** button.

   A WLAN screen displays with the WLAN's existing configuration. Refer to the **Authentication** and **Encryption** columns to assess the WLAN's existing security configuration.
3. Select either the **WPA/WPA2-TKIP** or **WPA2-CCMP** button from within the Encryption field.
4. Click the **Config** button to the right of the WPA/WPA2-TKIP and WPA2-CCMP checkboxes.

   The **WPA/WPA2-TKIP/CCMP** screen displays. This single screen can be used to configure either WPA/WPA2-TKIP or WPA-CCMP.



5. Select the **Broadcast Key Rotation** checkbox to enable the broadcasting of encryption-key changes to MUs.

   Only broadcast key changes when required by associated MUs to reduce the transmissions of sensitive key information. This value is enabled by default.

6. Refer to the **Update broadcast keys every** field to specify a time period (in seconds) for broadcasting encryption-key changes to MUs.

   Set key broadcasts to a shorter time interval (at least 60 seconds) for tighter security on the WLAN's wireless connections. Set key broadcasts to a longer time interval (at most, 86400 seconds) to extend the key times for wireless connections. Default is 7200 seconds.

7. Configure the **Key Settings** field as needed to set an ASCII Passphrase and key values.

ASCII Passphrase	To use an ASCII passphrase (and not a hexadecimal value), select the checkbox and enter an alphanumeric string of 8 to 63 characters. The alphanumeric string allows character spaces. The switch converts the string to a numeric value. This passphrase saves the administrator from entering the 256-bit key each time keys are generated.
256-bit Key	To use a hexadecimal value (and not an ASCII passphrase), select the checkbox and enter 16 hexadecimal characters into each of the four fields displayed.

   Default (hexadecimal) 256-bit keys for WPA/TKIP include:

   - 1011121314151617
   - 18191A1B1C1D1E1F
   - 2021222324252627
   - 28292A2B2C2D2E2F

8. Optionally select one of the following from within the **Fast Roaming (8021x only)** field.

PMK Caching	Select *Pairwise Master Key* (PMK) caching to create a shared key between a client device and its authenticator. When a client roams between devices, the clients credentials no longer must be completely reauthenticated (a process that can take up to 100 milliseconds). In the instance of a voice session, the connection would likely be terminated if not using a PMK. PMK cache entries are stored for a finite amount of time, as configured on the wireless client.
Opportunistic Key Caching	**Opportunistic Key Caching** allows the switch to use a PMK derived with a client on one access port with the same client when it roams over to another access port. Upon roaming the client does not have to do 802.1x authentication and can start sending/ receiving data sooner.
Pre-Authentication	Selecting the **Pre-Authentication** option enables an associated MU to carry out an 802.1x authentication with another switch (or device) before it roams to it. The switch caches the keying information of the client until it roams to the other switch. This enables the roaming client to send and receive data sooner by not having to conduct an802.1x authentication after roaming. This is only supported when 802.1x EAP authentication is enabled.

9. Refer to the **Status** field for the current state of the requests made from applet. This field displays error messages if something goes wrong in the transaction between the applet and the switch.
10. Click **OK** to use the changes to the running configuration and close the dialog.
11. Click **Cancel** to close the dialog without committing updates to the running configuration.

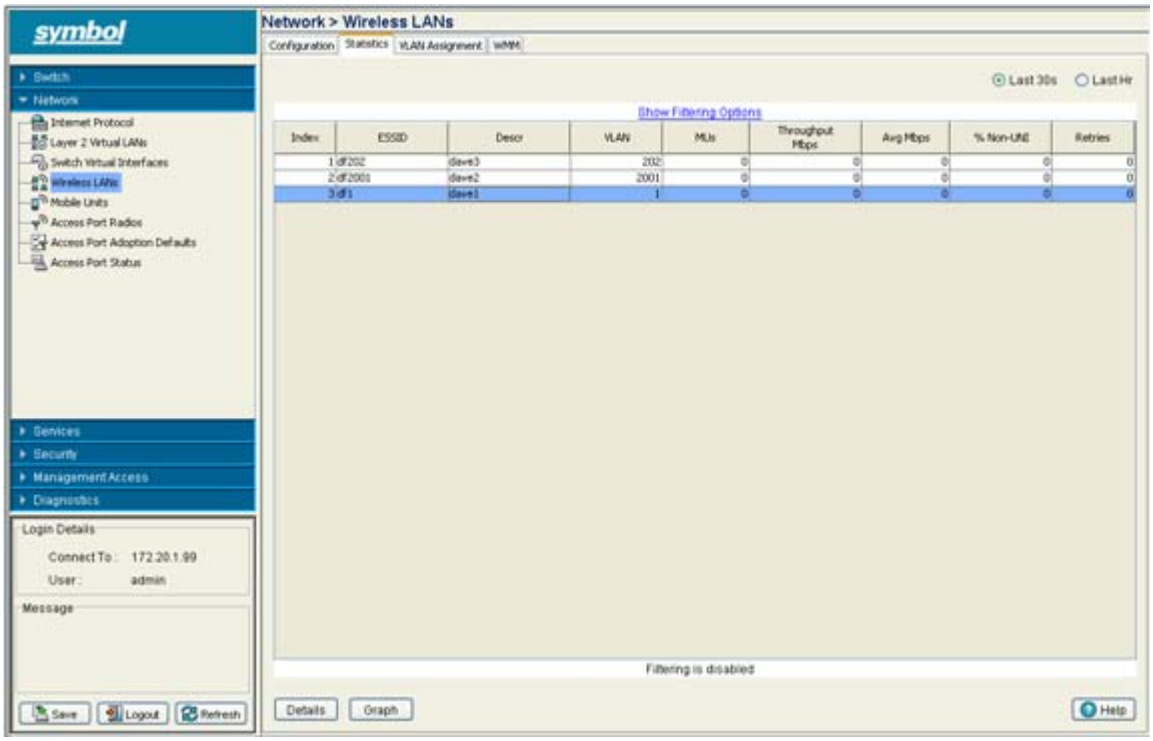
4.5.2 Viewing WLAN Statistics

The **Statistics** screen displays read-only statistics for each WLAN. Use this information to assess if configuration changes are required to improve network performance. If a more detailed set of WLAN statistics is required, select a WLAN from the table and click the **Details** button.

To view WLAN configuration details:

1. Select **Network** > **Wireless LANs** from the main menu tree.

2. Click the **Statistics** tab.



3. Refer to the following details displayed within the table:

Last 30s	Click the Last 30s radio button to display statistics for the WLAN over the last 30 seconds.
Last Hr	Click the Last Hr radio button to displays statistics for the WLAN over the last 1 hour.
Index	The Idx (or index) is a numerical identifier used to differentiate the WLAN from other WLANs that may have similar characteristics.
ESSID	The SSID is the *Service Set ID* (SSID) for the selected WLAN.
Descr	The Descr item contains a brief description of the WLAN. Use the description (along with the index) to differentiate the WLAN from others with similar attributes.
VLAN	The VLAN parameter displays the name of the VLAN that the WLAN is associated with.
MUs	Lists the number of MUs associated with the WLAN.
Throughput Mbps	Throughput Mbps is the average throughput in Mbps on the selected WLAN. The Rx value is the average throughput in Mbps for packets received on the selected WLAN. The Tx value is the average throughput for packets sent on the selected WLAN.
Avg BPS	Displays the average bit speed in Mbps for the selected WLAN. This includes all packets sent and received.
% Non-UNI	Displays the percentage of the total packets for the selected WLAN that are non-unicast packets. Non-unicast packets include broadcast and multicast packets.

Retries	Displays the average number of retries for all MUs associated with the selected WLAN.

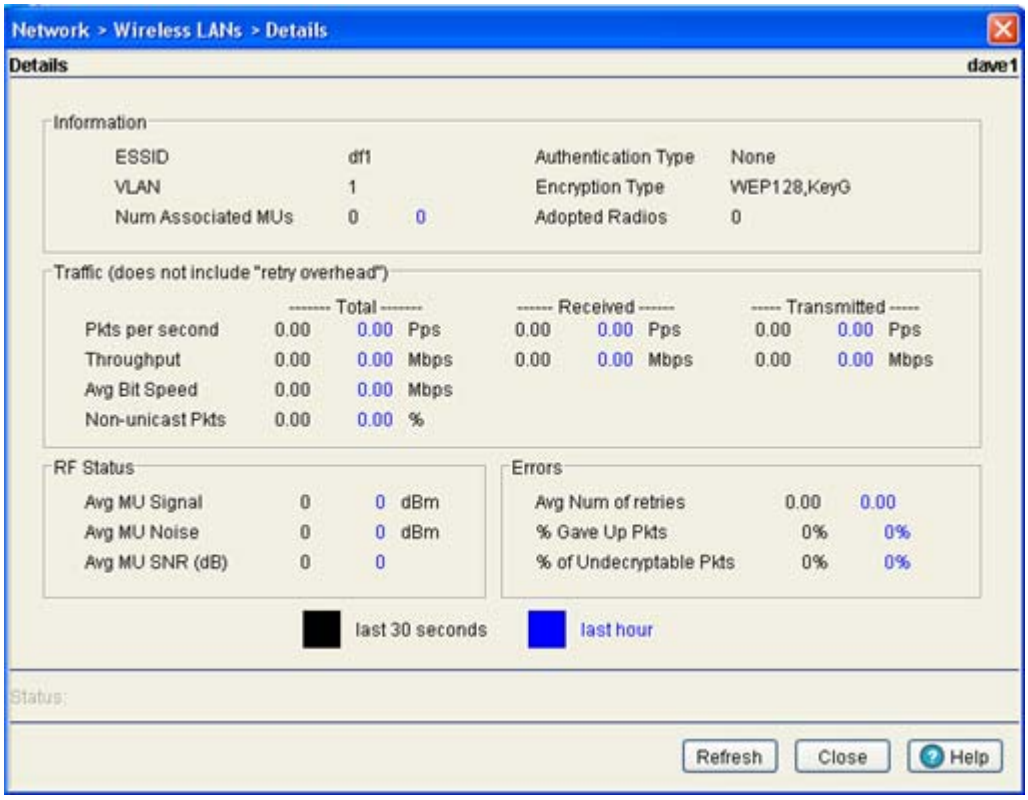
4. To view WLAN statistics in greater detail, select a WLAN and click the **Statistics** button. For more information, see *Viewing WLAN Statistics Details on page 4-44*.
5. To view WLAN statistics in a graphical format, select a WLAN and click the Graph button. For more information, see *Viewing WLAN Statistics in a Graphical Format on page 4-46*.

4.5.2.1 Viewing WLAN Statistics Details

When the WLAN Statistics screen does not supply adequate information for an individual WLAN, the **Details** screen is recommended for displaying individual WLAN information, WLAN traffic throughout information and RF Status and Error information. Use this information to discern if WLAN's require modification to meet network expectations.

To view detailed statistics for a WLAN:

1. Select a **Network** > **Wireless LANs** from the main menu tree.
2. Click the **Statistics** tab.
3. Select a WLAN from the table displayed in the Statistics screen. and click the **Details** button. v



4. The Details screen displays the WLAN statistics of the selected WLAN. The Details screen contains the following fields:
    - Information
    - Traffic
    - RF Status
    - Errors

Information in **black** represents the statistics from the last 30 seconds and information in **blue** represents statistics from the last hour.

5. Refer to the The **Information** field for the following information:

ESSID	Displays the Service Set ID (SSID) for the selected WLAN.
VLAN	Displays the name of the VLAN the WLAN is associated with.
Num Associated Stations	Displays the total number of MUs currently associated with the selected WLAN.
Authentication Type	Displays the authentication method active on the selected WLAN.
Encryption Type	Displays the method of encryption type active on the selected WLAN.
Adopted Radios	Displays the radios adopted by the selected WLAN.

6. Refer to the **Traffic** field for the following information (both received and transmitted):

Pkts per second	Displays the average total packets per second that cross the selected WLAN. The Rx column displays the average total packets per second received on the selected WLAN. The Tx column displays the average total packets per second sent on the selected WLAN. The number in black represents this statistic for the last 30 seconds and the number in blue represents this statistic for the last hour.
Throughput	Displays the average throughput in Mbps on the selected WLAN. The Rx column displays the average throughput in Mbps for packets received on the selected WLAN. The Tx column displays the average throughput for packets sent on the selected WLAN. The number in black represents this statistic for the last 30 seconds and the number in blue represents this statistic for the last hour.
Avg Bit Speed	Displays the average bit speed in Mbps on the selected WLAN. This includes all packets sent and received. The number in black represents this statistic for the last 30 seconds and the number in blue represents this statistic for the last hour.
Non-unicast Pkts	Displays the percentage of the total packets for the selected WLAN that are non-unicast packets. Non-unicast packets include broadcast and multicast packets. The number in black represents this statistic for the last 30 seconds and the number in blue represents this statistic for the last hour.

7. Refer to the **RF Status** field for the following information:

Avg MU Signal	Displays the average RF signal strength in dBm for all MUs associated with the selected WLAN. The number in black represents this statistic for the last 30 seconds and the number in blue represents this statistic for the last hour.
Avg MU Noise	Displays the average RF noise for all MUs associated with the selected WLAN. The number in black represents this statistic for the last 30 seconds and the number in blue represents this statistic for the last hour.
Avg MU SNR	Displays the average *Signal to Noise Ratio* (SNR) for all MUs associated with the selected WLAN. The Signal to Noise Ratio is an indication of overall RF performance on your wireless network.

8. Refer to the **Errors** field for the following information:

Average Number of Retries	Displays the average number of retries for all MUs associated with the selected WLAN. The number in black represents this statistic for the last 30 seconds and the number in blue represents this statistic for the last hour.
% Gave Up Pkts	Displays the percentage of packets the switch gave up on for all MUs associated with the selected WLAN. The number in black represents this statistic for the last 30 seconds and the number in blue represents this statistic for the last hour.
% Non-decryptable Pkts	Displays the percentage of undecryptable packets for all MUs associated with the selected WLAN. The number in black represents this statistic for the last 30 seconds and the number in blue represents this statistic for the last hour.

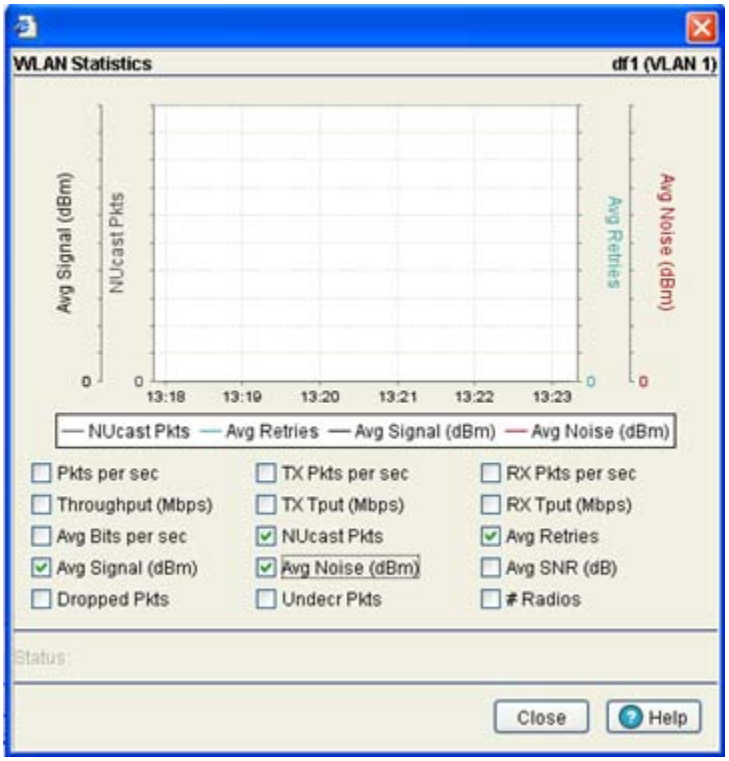
9. Refer to the **Status** field for the current state of the requests made from applet. This field displays error messages if something goes wrong in the transaction between the applet and the switch.
10. Click **OK** to use the changes to the running configuration and close the dialog.
11. Click **Cancel** to close the dialog without committing updates to the running configuration.

4.5.2.2 Viewing WLAN Statistics in a Graphical Format

The switch Web UI continuously collects WLAN statistics even when the graph is not displayed. Periodically display the WLAN statistics graph for the latest WLAN throughput and performance information.

To view detailed graphical statistics for a WLAN:

1. Select a WLAN from the table displayed in the **Statistics** screen.
2. Click the **Graph** button.



The WLAN Statistics screen displays for the select port. The WLAN Statistics screen provides the option of viewing the graphical statistics of the following parameters:

- Pkts per sec
- Throughput (Mbps)
- Avg Bits per sec
- Avg Signal (dBm)
- Dropped Pkts
- TX Pkts per sec
- TX Tput (Mbps)
- NUcast Pkts
- Avg Noise (dBm)
- Undecr Pkts
- RXPkts per sec
- RX Tput (Mbps)
- Avg Retries
- Avg SNR (dB)
- # Radios

NOTE You cannot select more than four parameters at any given time.

3. Select any of the above listed parameters by clicking on the checkbox associated with it.
4. Click the **Close** button to exit the screen.

4.5.3 Viewing VLAN Assignment

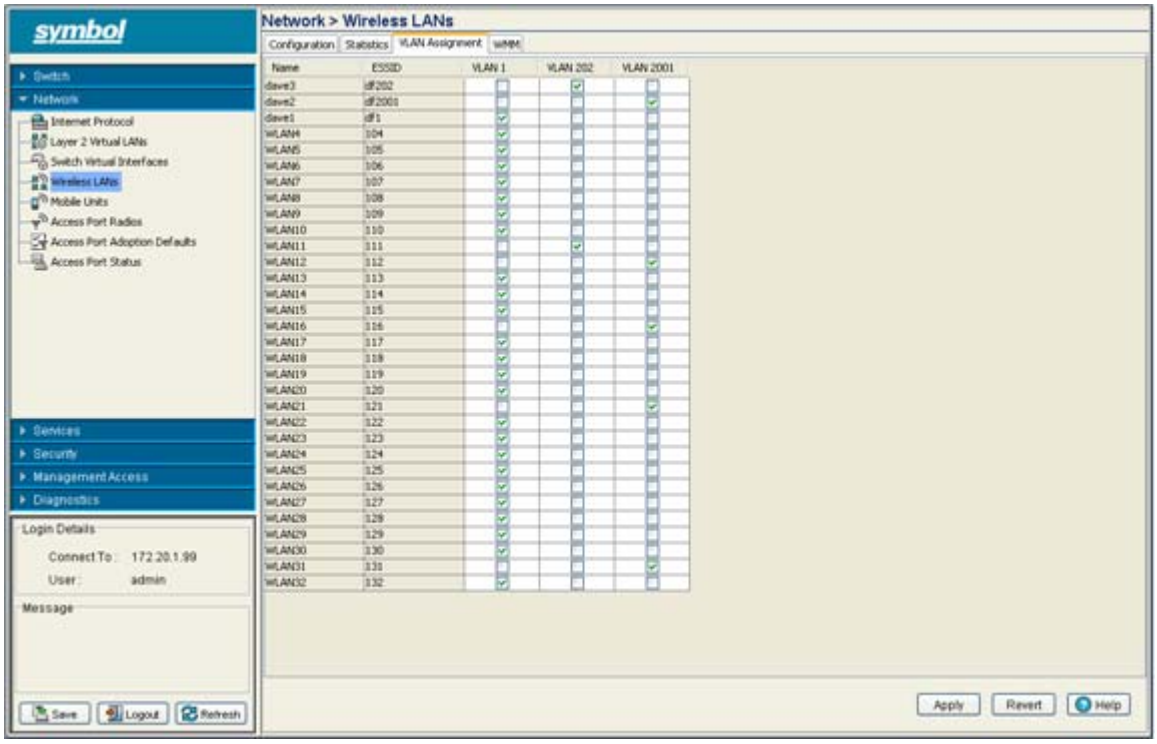
The VLAN Assignment screen displays the current SSID to VLAN assignments.If necessary, use the checkboxes within the screen to associate (or un-associate) existing SSIDs with the VLANs listed.

NOTE Mapping multiple WLANs, on the same VLAN, with different security settings to a single BSS poses a security risk to the system.

To view existing VLAN Assignments:

1. Select **Network > Wireless LANs** from the main menu tree.
2. Click the **VLAN Assignment** tab.

3. Select a **SSID** from the table to view its VLAN assignment information.



The **VLAN Assignment** tab displays the following information:

Name	Displays a short description of the WLAN. This description can be added or edited using the Edit button on the Configuration tab within the WLANs page.
ESSID	Displays the Service Set ID (SSID) associated with each WLAN.
VLAN (Number)	List all available VLANs, and contains a checkbox that (when selected) will associate the SSID with a particular VLAN ID.

4. Click the **Apply** button to save all changes to the VLAN assignments.
5. Click the **Revert** button to undo any changes and revert back to the last saved configuration.

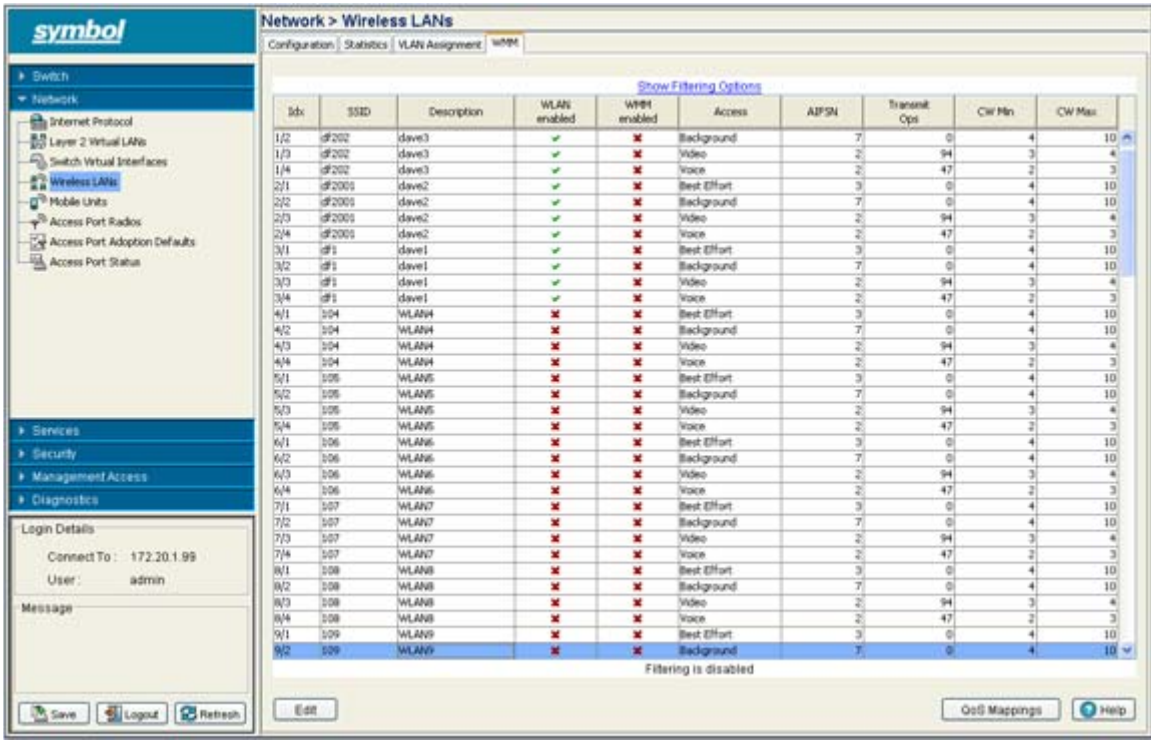
4.5.4 Configuring WMM

Use the **WMM screen** to review a WLAN's current index (numerical identifier), SSID, description, current enabled/disabled designation, and Access Category. WMM is for downstream and WLAN WMM is for upstream.

To view existing WMM Settings:

1. Select **Network** > **Wireless LANs** from the main menu tree.

2. Click the **WMM** tab.



The **WMM** tab displays the following information:

Idx	Displays the WLANs numerical identifier. The WLAN index range is from 1 to 32. Click the Edit button to modify this property.
SSID	Displays the Service Set ID (SSID) associated with each WLAN.
Description	Displays a brief description of the WLAN.
WLAN Enabled	Displays the status of the WLAN. A Green check defines the WLAN as enabled and a Red "X" means it is disabled. The enable/disable setting can be defined using the WLAN Configuration screen.
WMM Enabled	Displays WLAN-WMM status. It can be enabled (for a WLAN) from the WLAN Configurations Edit screen by selecting the Enable WMM checkbox.
Access	Displays the Access Category for the intended radio traffic. The Access Categories are the different WLAN-WMM options available to the radio. The four Access Category types are: • Background — Optimized for background traffic • Best-effort — Optimized for best effort traffic • Video — Optimized for video traffic • Voice — Optimized for voice traffic
AIFSN	Displays the current Arbitrary Inter-frame Space Number. Higher-priority traffic categories should have lower AIFSNs than lower-priority traffic categories. This will causes lower-priority traffic to wait longer before trying to access the medium.

Transmit Ops	Displays the maximum duration a device can transmit after obtaining a transmit opportunity. For Higher-priority traffic categories, this value should be set higher.
CW Min	The CW Min is combined with the CW Max to make the Contention screen. From this range, a random number is selected for the back off mechanism. Lower values are used for higher priority traffic.
CW Max	The CW Max is combined with the CW Min to make the Contention screen. From this range, a random number is selected for the back off mechanism. Lower values are used for higher priority traffic.

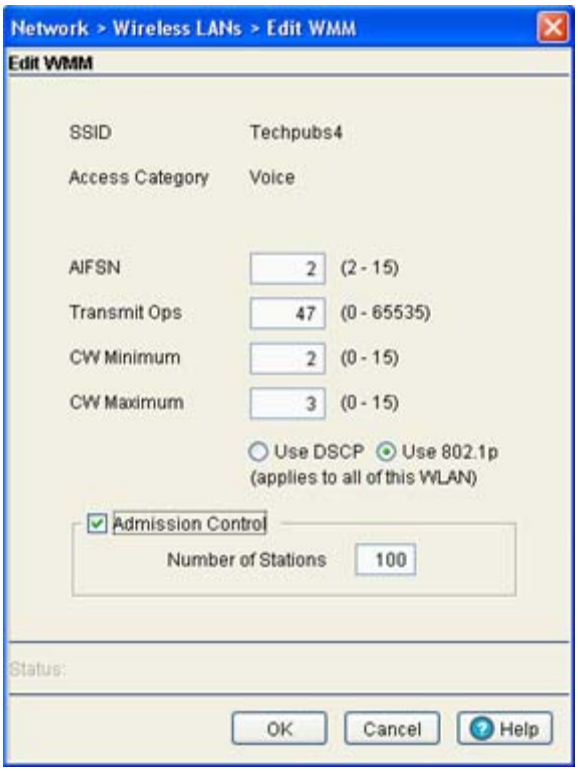
3. Click the **Edit** button to display a screen used to modify the WMM parameters. For more information, see *Editing WMM Setting on page 4-50*.

4.5.4.1 Editing WMM Setting

Use the WMM Edit screen to modify the existing Access Category settings for the WLAN selected within the WMM screen. This could be necessary in instances when the data traffic has changed and high-priority traffic (video and voice) must be accounted for by modifying the AIFSN Transmit Ops and CW values accordingly. WMM is for downstream and WLAN WMM is for upstream.

To edit existing WMM Settings:

1. Select **Network Setup > WLAN Setup** from the main menu tree.
2. Click the **WMM** tab.
3. Select a Access Category from the table and click the **Edit** button to launch a dialog with WMM configuration for that radio.



4. Refer to the **Edit WMM** screen for the following information:

SSID	Displays the Service Set ID (SSID) associated with the selected WMM index. This SSID is read-only and cannot be modified within this screen.
Access Category	Displays the Access Category for the intended radio traffic. The Access Categories are the different WLAN-WMM options available to the radio. The four Access Category types are: • Background: Optimized for background traffic • Best-effort: Optimized for best effort traffic • Video: Optimized for video traffic • Voice: Optimized for voice traffic
AIFSN	Define the current *Arbitrary Inter-frame Space Number* (AIFSN). Higher-priority traffic categories should have lower AIFSNs than lower-priority traffic categories. This will causes lower-priority traffic to wait longer before trying to access the medium.
Transmit Ops	Define the maximum duration a device can transmit after obtaining a transmit opportunity. For Higher-priority traffic categories, this value should be set higher.
CW Minimum	The CW Minimum is combined with the CW Maximum to make the Contention screen. From this range, a random number is selected for the back off mechanism. Select a lower value for high priority traffic.
CW Maximum	The CW Maximum is combined with the CW Minimum to make the Contention screen. From this range, a random number is selected for the back off mechanism. Lower values are used for higher priority traffic
Use DSCP or 802.1p	Select the DSCP or 802.1p radio buttons to choose between DSCP and 802.1p.

5. Select the **Admission Control** checkbox (enabled for only voice and video access categories) to define (limit) the number of MUs permitted to interoperate within this multimedia supported WLAN.

   Once selected, the maximum number of MUs allowed is 250. Limiting MU traffic in a multimedia (voice or video) supported WLAN is a good idea to maintain data rates and throughput.
6. Refer to the **Status** field for the current state of the requests made from applet. This field displays error messages if something goes wrong in the transaction between the applet and the switch.
7. Click **OK** to use the changes to the running configuration and close the dialog.
8. Click **Cancel** to close the dialog without committing updates to the running configuration.

4.6 Viewing Associated MU Details

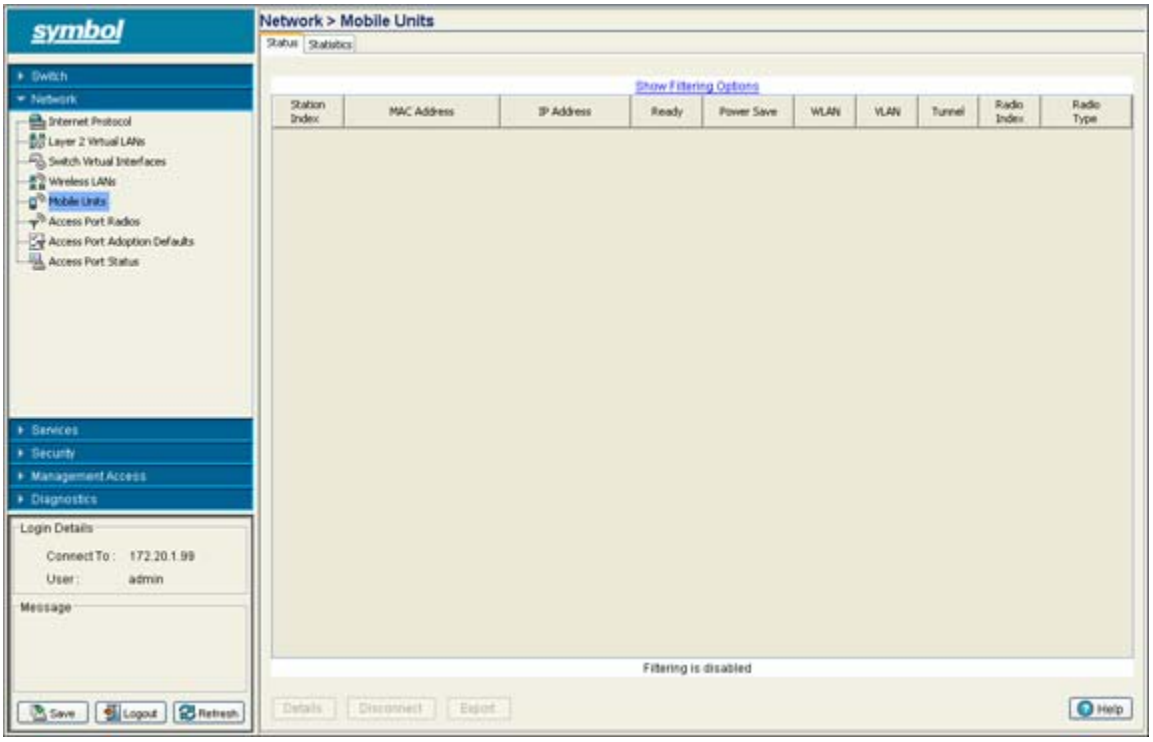
The **Mobile Units** screen displays read-only device information for MUs interoperating with the switch managed network. The Mobile Units screen consists of the following tabs:

- *Viewing MU Status*
- *Viewing MU Statistics*

4.6.1 Viewing MU Status

To view MU Status is detail:

1. Select **Network > Mobile Units** from the main menu tree.
2. Click the **Status** tab.



The Status screen displays the following read-only device information for MUs interoperating within the switch managed network.

Station Index	Displays a numerical device recognition identifier for a specific MU.
MAC Address	Each MU has a unique Media Access Control (MAC) address through which it is identified. This address is burned into the ROM of the MU.
IP Address	Displays the unique IP address for the MU. Use this address as necessary throughout the applet for filtering and device intrusion recognition and approval.
Ready	Displays whether the MU is ready for switch interoperation. Values are Yes and No.

Power Save	Displays the current (read-only) Power-Save-Poll (PSP) state of the MU. The Power Save field has two potential settings. PSP indicates the MU is operating in Power Save Protocol mode. In PSP, the MU runs enough power to check for beacons and is otherwise inactive. CAM indicates the MU is continuously aware of all radio traffic. CAM is recommended for MUs transmitting with the switch's access ports frequently and for periods of two hours or greater.
WLAN	Displays the name of the WLAN the MU is currently associated with.
VLAN	Displays the specific VLAN the target MU is mapped to.
Radio Index	The Radio Index is a numerical device recognition identifier for MU radios. The index is helpful to differentiate device radios when a particular MU has more than one radio.
Radio Type	The radio type defines the radio used by the adopted MU. The switch supports 802.11b MUs and 802.11 a/b and 802.11 a/g dual-radio MUs. The radio also supports 802.11a only and 802.11g MUs.

3. Click the **Details** button to launch a screen with additional information about the selected MU. For more information, see *Viewing MU Details on page 4-53*
4. Highlight a MU from those listed and click the **Disconnect** button to remove the MU from the list of currently associated devices.

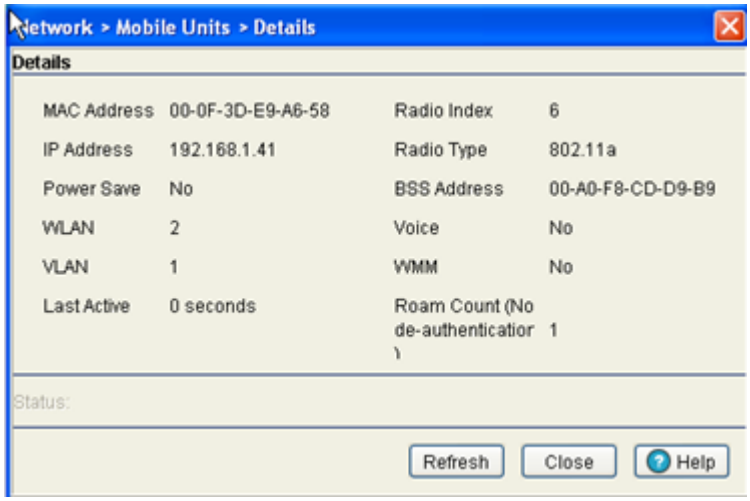
   Be aware that disconnected MUs will often become immediatly re-connected to the switch. Ensure disconnected MUs are perminantly removed from switch association.
5. Click the **Export** button to export the content of the table to a Comma Separated Values file (CSV).

4.6.1.1 Viewing MU Details

The **MUs Details** screen displays read-only MU transmit and receive statistics.

To view MU Details:

1. Select a **Network** > **Mobile Units** from the main menu tree.
2. Click the **Status** tab.
3. Select a MU from the table in the Status screen and click the **Details** button.



4. Refer to the following read-only MU's transmit and receive statistics:.

MAC Address	Displays the Hardware or Media Access Control (MAC) address for the MU.
IP Address	Displays the unique IP address for the MU. Use this address as necessary throughout the applet for filtering and device intrusion recognition and approval.
Power Save	Displays the current PSP state of the MU. This field has two potential settings. PSP indicates if the MU is operating in Power Save Protocol mode. In PSP, the MU runs enough power to check for beacons, and is otherwise inactive. CAM indicates the MU is continuously aware of all radio traffic. CAM is recommended for those MUs transmitting frequently.
WLAN	Displays of the WLAN the MU is currently associated with.
VLAN	Displays the VLAN parameter for the name of the VLAN the MU is currently mapped to.
Last Active	Displays the time the MU last interoperated with the switch.
Radio Index	Displays is a numerical identifier used to associate a particular Radio with a set of statistics. The Index is helpful for distinguishing the a particular radio from other MU radios with similar configurations.
Radio Type	Displays the radio type used by the adopted MU. The Switch supports 802.11b MUs and 802.11 a/b and 802.11 a/g dual-radio MUs. The radio also supports 802.11a only and 802.11g MUs.
Base Radio MAC	Displays the SSID of the access port when it is initially adopted by the switch.
BSS Address	Displays the MU's BSSID.
Voice	Displays whether or not the MU is a voice capable device. Traffic from a voice enabled MU is handled differently than traffic from MUs without this capability. MUs grouped to particular WLANs can be prioritized to transmit and receive voice traffic over data traffic.
WMM	Displays WMM usage status for the MU, including the Access Category currently in use. Use this information to assess whether the MU is using the correct WMM settings in relation to the operation of the switch.
Roam Count	Refer to the Roam Count value to assess the number of times the MU has roamed from the switch.

5. Click the **Refresh** button to update the MU Statistics to their latest values.
6. Refer to the **Status** field for the current state of the requests made from applet. This field displays error messages if something goes wrong in the transaction between the applet and the switch.

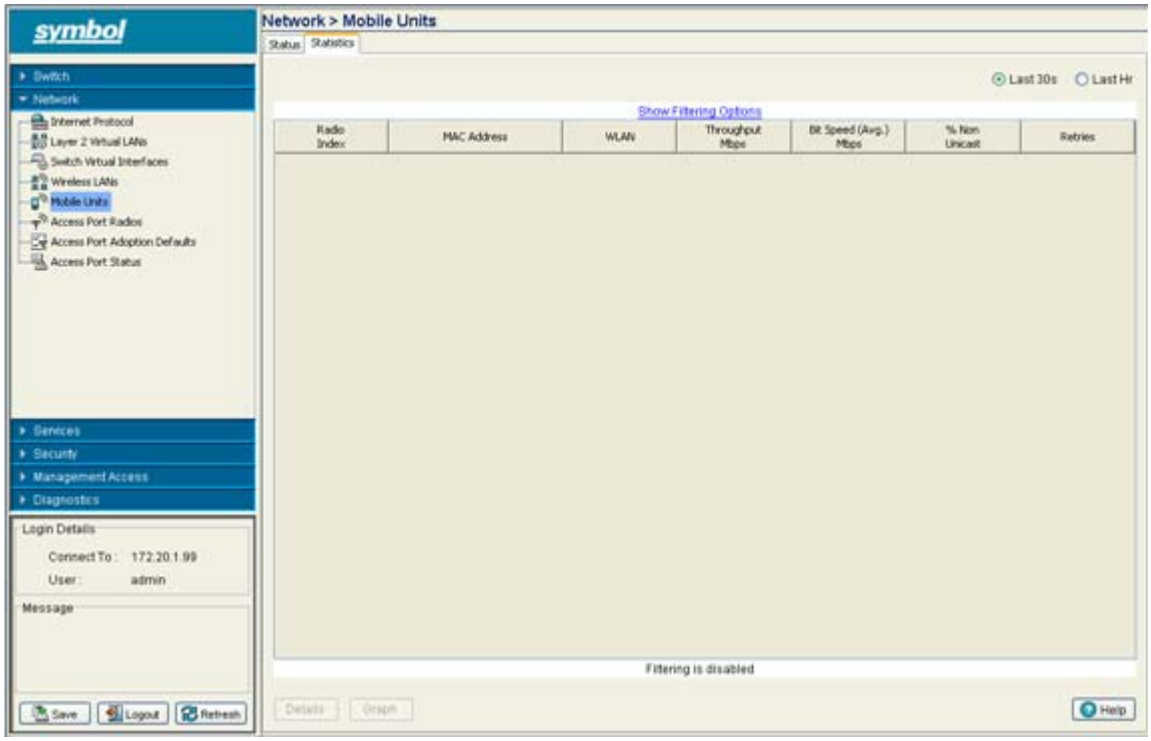
4.6.2 Viewing MU Statistics

The **Statistics** screen displays read-only statistics for each MU. Use this information to assess if configuration changes are required to improve network performance. If a more detailed set of MU statistics is required, select a MU from the table and click the **Details** button.

NOTE Each switch can support a maximum of 4096 MUs.

To view MU statistics details:

1. Select **Network** > **Mobile Units** from the main menu tree.
2. Click the **Statistics** tab.



3. Select the **Last 30s** checkbox to display MU statistics as gathered over the last 30 seconds.
4. Select the **Last HR** checkbox to display MU statistics as gathered over the last hour.
5. Refer to following details as displayed within the MU Statistics table:

Radio Index	Displays a numerical identifier used to associate a particular Radio with a set of statistics. The Index is helpful for distinguishing the radio from other radios with a similar configuration.
MAC Address	Displays the Hardware or Media Access Control (MAC) address for the MU. The MAC address is hard coded at the factory and cannot be modified.
WLAN	Displays the name of the WLAN the MU is currently associated with. Use this information to determine if the MU/WLAN placement best suits the intended operation and coverage area of the MU.

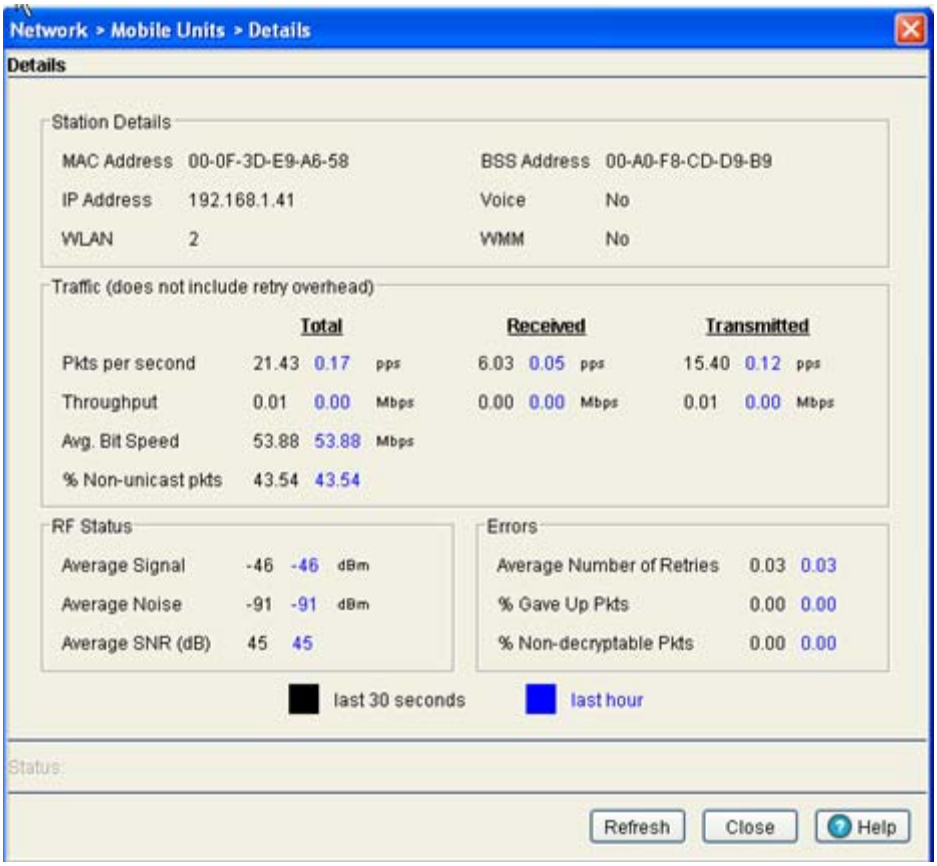
Throughput Mbps	Displays the average throughput in Mbps between the selected MU and the access port. The Rx column displays the average throughput in Mbps for packets received on the selected MU from the access port. The Tx column displays the average throughput for packets sent on the selected MU from the access port.
Bit Speed (Avg.) Mpbs	Displays the average bit speed in Mbps for the selected MU. This includes all packets sent and received.
% Non Unicast	Displays the percentage of the total packets for the selected MU that are non-unicast packets. Non-unicast packets include broadcast and multicast packets.
Retries	Displays the average number of retries per packet. A high number in this field could indicate possible network or hardware problems.

6. Click the **Details** button to launch a screen with additional information about the selected MU. For more information, see *Viewing MU Statistics Details on page 4-57*.
7. Click the **Graph** button to launch a graph with pictorial information about the selected MU in a graphical format. For more information, see *View a MU Statistics Graph on page 4-59*.

4.6.2.1 Viewing MU Statistics Details

The MU Statistics **Details** screen displays additional device address and performance information for the selected MU. Use the WMM information to assess if poor MU performance can be attributed to an inaccurate WMM setting for the type of data transmitted. To view the MU Statistics details:

1. Select a **Network** > **Mobile Units** from the main menu tree.
2. Click the **Statistics** tab.
3. Select a MU from the table displayed in the Statistics screen and click the **Details** button.



The Details screen displays WLAN statistics for the selected WLAN, including:

- Information
- Traffic
- RF Status
- Errors

Information in **black** represents the statistics from the last 30 seconds and information in **blue** represents statistics from the last hour.

4. Refer to the **Information** field for the following information:

MAC Address	Displays the Hardware or Media Access Control (MAC) address for the MU. This address is hard-coded at the factory and cannot be modified.
BSS Address	Displays the MU's BSSID.

IP Address	Displays the current IP address for the MU.
Voice	Displays whether the MU is a voice capable device. Traffic from voice enabled MUs is handled differently than traffic from MUs without this capability.
WLAN	Displays the name of the WLAN the MU is currently associated with.
WMM	Displays WMM usage status for the MU, including the Access Category currently in use. Use this information to assess whether the MU is using the correct WMM settings in relation to the operation of the switch.

5. Refer to the **Traffic** field for the following information:

Pkts per second	Displays the average total packets per second received by the selected MU. The Rx column displays the average total packets per second received on the selected MU. The Tx column displays the average total packets per second sent on the selected MU.
Throughput	Displays the average throughput in Mbps between the selected MU and the access port. The Rx column displays the average throughput in Mbps for packets received on the selected MU from the access port. The Tx column displays the average throughput for packets sent on the selected MU from the access port.
Avg. Bit Speed	Displays the average bit speed in Mbps on the selected MU. This includes all packets sent and received.
% Non-unicast pkts	Displays the percentage of the total packets for the selected MU that are non-unicast packets. Non-unicast packets include broadcast and multicast packets.

6. Refer to the **RF Status** field for the following information:

Avg MU Signal	Displays the RF signal strength in dBm for the selected MU.
Avg MU Noise	Displays the RF noise for the selected MU.
Avg MU SNR	Displays the Signal to Noise Ratio (SNR) for the selected MU. The Signal to Noise Ratio is an indication of overall RF performance on your wireless network.

7. Refer to the **Errors** field for the following information:

Avg Num of Retries	Displays the average number of retries for the selected MU. Use this information to assess potential performance issues.
% Gave Up Pkts	Displays the percentage of packets the switch gave up on for the selected MU.
% of Undecryptable Pkts	Displays the percentage of undecryptable packets (packets that could not be processed) for the selected MU.

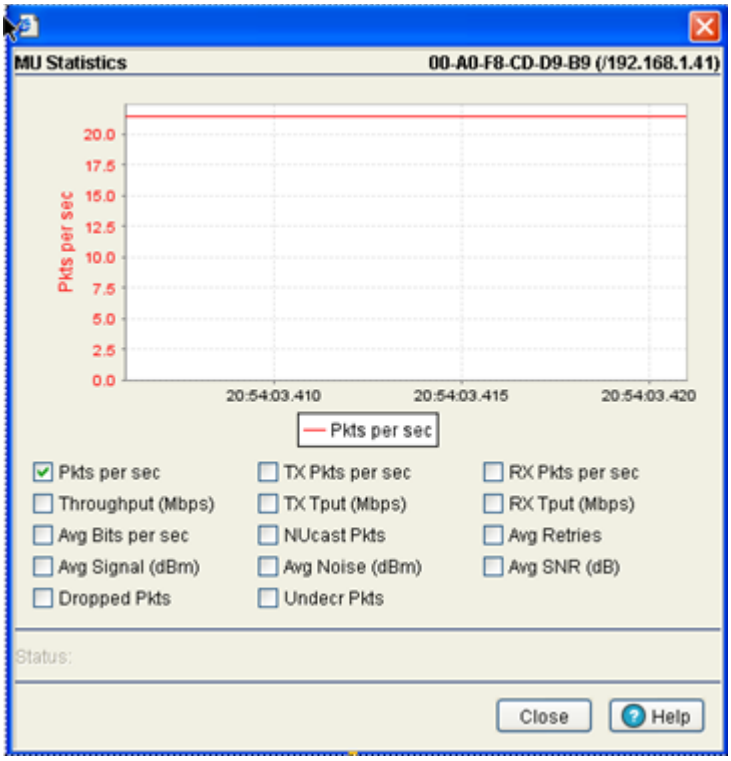
8. Refer to the **Status** field for the current state of the requests made from applet. This field displays error messages if something goes wrong in the transaction between the applet and the switch.
9. Click **Cancel** to close the dialog without committing updates to the running configuration.

4.6.2.2 View a MU Statistics Graph

The MU Statistics tab has an option for displaying detailed MU statistics for individual MUs in a graphical format. This information can be used for comparison purposes to chart MU performance and overall switch performance.

To view the MU Statistics in a graphical format:

1. Select a **Network** > **Mobile Units** from the main menu tree.
2. Click the **Statistics** tab.
3. Select a MU from the table displayed in the Statistics screen and click the **Graph** button.



4. Select a checkbox to display that metric charted within the graph. Choose as many of the values displayed to chart that behavior graphically within the graph. However, do not select more than four checkboxes at any one time.
5. Refer to the **Status** field for the current state of the requests made from applet. This field displays error messages if something goes wrong in the transaction between the applet and the switch.
6. Click **Cancel** to close the dialog without committing updates to the running configuration.
7. Click the **Details** button to launch a screen with additional information about the selected MU.
8. Click the **Graph** button to launch a screen with additional information about the selected MU.

4.7 Viewing Access Port Information

The **Access Ports** screen displays a high-level overview of the APs created for use within the switch managed network. Use this data as necessary to check all the APs that are active, their VLAN assignments, updates to a APs description as well as their current authentication and encryption schemes.

NOTE Each switch can support a maximum of 48 access ports. However, port adoption per switch is determined by the number of licenses acquired.

The Access Ports screen consists of the following tabs:

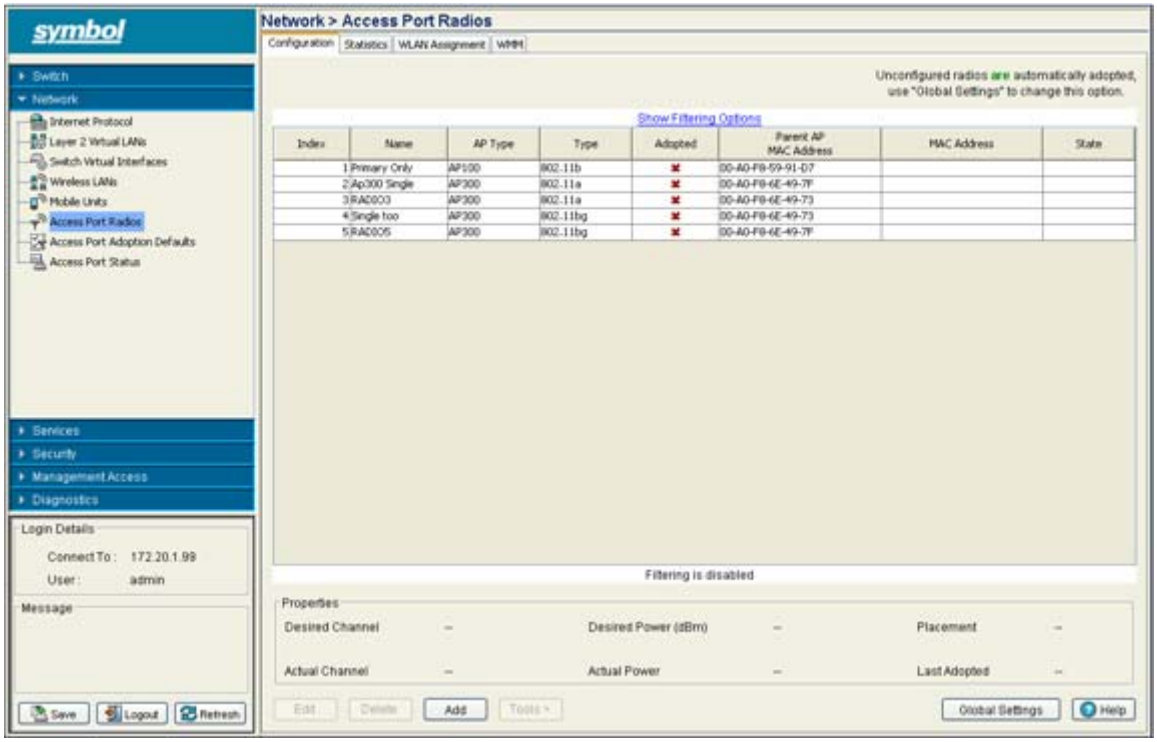
- *Configuring Access Port Radios*
- *Viewing AP Statistics*
- *Configuring WLAN Assignment*
- *Configuring WMM*

4.7.1 Configuring Access Port Radios

Refer to the **Configuration** tab to view current radio configurations. After reviewing the radios listed, you have the option of editing the properties of an existing radio, deleting a radio, adding a new radio, resetting a radio, scan available channels or exporting a radio.

To view WLAN configuration details:

1. Select **Network** > **Access Port Radios** from the main menu tree.
2. Click the **Configuration** tab.



3. Refer to the table for the following information:

Index	Displays the numerical index (device identifier) used with the device radio. Use this index (along with the radio name) to differentiate the radio from other device radios.
Name	Displays a user assigned name for the radio.
AP Type	Displays whether the AP is an AP100 or AP300 model Symbol access port.
Type	Use the Type to identify whether the radio is 802.11a radio or an 802.11bg radio.
Adopted	Displays the radio's adoption status. If the radio is adopted, a green check is displayed. If the radio is not adopted, a red X is displayed.
Parent AP MAC Address	Displays the access port's Ethernet MAC (the device MAC address that is printed on the casing of the unit). Please do not confuse this BSSID MAC with the access port's Ethernet MAC address.
MAC Address	The Base Radio MAC is the radio's first MAC address when it is adopted by the Switch.
State	Display the current operational mode that the Radio is set for. If the radio is set as a Detector AP the state will display "Detector", otherwise the state will read "Normal".

4. Refer to the **Properties** field for the following

Desired Channel	When the radio's channel is configured statically, the Actual Channel and Desired Channel are the same. If using ACS (Automatic Channel Selection), the switch selects a channel for the radio. The Desired Channel displays "ACS" and the Actual channel displays the channel selected for the radio. When set to Random, the applet makes the channel designation.
Actual Channel	When the radio's channel is configured statically, the Actual Channel and Desired Channel are the same. If using ACS (Automatic Channel Selection), the switch selects a channel for the radio. The Desired channel displays "ACS" and the Actual Channel displays the channel selected for the radio.
Desired Power	Displays the configured power setting in dBm for the selected radio. In most cases, the Desired Power and Actual Power are the same unless the desired power level would put the radio's output power outside the accepted regulatory compliance range.
Actual Power	Displays the current power level in dBm for the selected radio. In most cases, the Desired Power and Actual Power are the same unless the desired power level would put the radio's output power outside the accepted regulatory compliance range.
Placement	When the radio is adopted using the default configuration, the power for the radio can be defined as "Indoor" or "Outdoor." However, some countries have restrictions for the use of outdoor radios. If using a value of "Outdoor" verify it is in compliance with the country of operation.
Last Adopted	Displays the time this radio was last adopted by the switch.

5. Click the **Edit** button to launch a screen used to configure radio specific parameters.
6. Click the **Delete** button to remove a radio. However, before a radio can be removed, the radio's BSS mapping must be removed.
7. Click the **Add** button to add a radio. The radio must be added before the radio can be adopted.
8. Click the **Reset** button to reset an individual radio.
9. Click the **Tools >** button to displays a submneu with **Reset**, **Run ACS** and **Export** options.

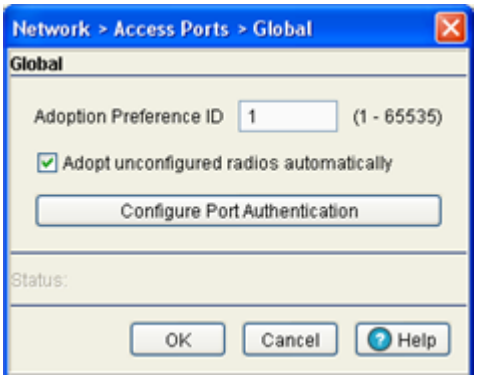
   Select the Reset option to reset the access port radio. Select the **Run ACS Now** option to scan all channels and discover which radios are adopted and on what channel. ACS then analyzes the radios' channels and moves the radio to the channel where it is least likely to have interference from the other radios. Use the **Export** option to move the contents of the table to a *Comma Separated Values* file (CSV).
10. Click the **Global Settings** button to display a screen with settings applying to all radios on the system. For more information, see *Configuring an AP's Global Settings on page 4-62*.

4.7.1.1 Configuring an AP's Global Settings

Use the **Global Settings** screen to define an adoption preference ID for the switch and enable an option to adopt non-configured radios. This can be helpful when you do not want to change an access port's configuration but require the access port to be adopted.

To edit Global Radio configuration settings:

1. Select **Network** > **Access Port Radios** from the main menu tree.
2. Click the **Configuration** tab.
3. Click the **Global Settings** button to display a screen containing global settings which apply to all radios on the switch.



4. Set an **Adoption Preference ID** value between 1 and 65535.

   To define a radio as preferred, the access port preference ID should be same as adoption preference ID. The adoption preference ID is used for AP load-balancing. A switch will preferentially adopt access ports having the same adoption-preference-id as the switch itself.

   The Adoption Preference ID defines the preference ID of the switch. The value can be set between 1 and 65535. To make the radios preferred, the access port preference ID should be same as adoption preference ID.

   Setting the preference ID to a 0 value essentially means you "do not care" what the value is and the switch will automatically assign a preference ID.

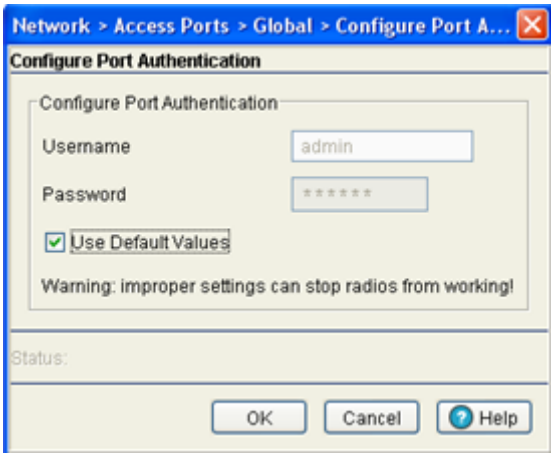
The adoption preference ID is used for AP load-balancing. A switch preferentially adopt APs which have the same adoption-preference-id as the switch itself.

5. To enable automatic adoption of non-configured radios on the network, check the box marked **Adopt unconfigured radios automatically**. Default radio settings are applied to access ports when they are automatically adopted. Enable this option to allow the adoption of access ports even when they are not configured. Default radio settings are applied to access ports adopted automatically.
6. Click the **Configure Port Authentication** button to open a new dialogue with port authentication configuration information.
7. Click **OK** to save the changes and return to the previous screen.

Port Authentication

To configure the port authentication settings on an access port:

1. Select **Network** > **Access Port Radios** from the main menu tree.
2. Click the **Configuration** tab.
3. Click the **Global Settings** button.
4. Click the **Configure Port Authentication** button.
5. Enter the 802.1x **Username** assigned to the access port.



6. Enter the 802.1x **Password** (for the corresponding username) providing authorization for access port authorization adoption.
7. Check the **Use Default Values** option checkbox to set the Username and Password to factory default values. The access port can get disconnected if the 802.1x authenticator is not configured accordingly.
8. Refer to the **Status** field for the current state of the requests made from applet. This field displays error messages if something goes wrong in the transaction between the applet and the switch.
9. Click **OK** to use the changes to the running configuration and close the dialog.
10. Click **Cancel** to close the dialog without committing updates to the running configuration.

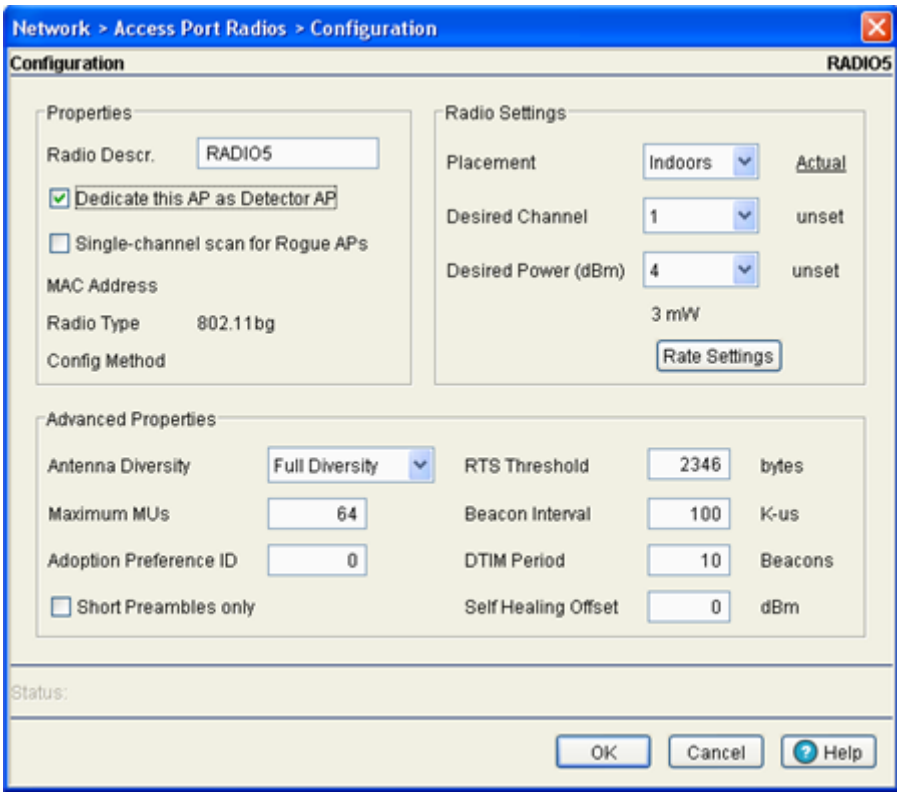
4.7.1.2 Editing AP Settings

The **Edit** screen provides a means of modifying the properties of an existing radio. This is often necessary when the radio's intended function has changed and its name needs modification or if the radio now needs to be defined as a detector radio. The Edit screen also enables you to modify placement, channel and power

settings as well as a set of advanced properties in case its transmit and receive capabilities need to be adjusted.

To edit a radio's configuration:

1. Select **Network** > **Access Port Radios** from the main menu tree.
2. Click the **Configuration** tab.
3. Select a radio to edit from the table.
4. Click the **Edit** button to display a screen containing settings for the selected radio.



5. In the **Radio Descr.** field, enter a brief description to identify the radio.
   The Radio Description is used to differentiate multiple radios of the same type and can be used to more easily locate a radio if there are any problems.
6. Check the box titled **Dedicate this Radio as Detector** to use this radio as a detector port to identify rogue APs on the network

   Setting this radio as a detector dedicates the radio to detect rogue APs on the network. Dedicated detectors are not connected to by clients.
7. Select the **Single-channel scan for Rogue APs** checkbox to enable the switch to scan for rogue devices using the switch's current channel of operation.
8. Configure the **Placement** of the access port as either **Indoors** or **Outdoors**.

   An access port can be set for Indoors or Outdoors use depending on the model and the placement location. Power settings and channel selection options differ based on each country's regulatory rules and whether or not the unit is placed indoors or outdoors.
9. Select a channel for communications between the access port and its associated MUs within the **Desired Channel** field.

The selection of a channel determines the available power levels. The range of legally approved communication channels varies depending on the installation location and country. The selected channel can be a specific channel, "Random," or "ACS." Random assigns each radio a random channel. ACS (Automatic Channel Selection) allows the switch to systematically assign channels. Default is Random.

10. After first selecting a channel, select a power level in dBm for RF signal strength in the **Desired Power (dBm)** field.

    The optimal power level for the specified channel is best determined by a site survey prior to installation. Available settings are determined according to the selected channel. Set a higher power level to ensure RF coverage in WLAN environments that have more electromagnetic interference or greater distances between the access port and MUs. Decrease the power level according to the proximity of other access ports. Overlapping RF coverage may cause lost packets and difficulty for roaming devices trying to engage a access port. After setting a power level, channel and placement the RF output power for the access port is displayed in mW. Default is 20 dBm (802.11bg), 17 dBm (802.11a).

NOTE After setting a power level, channel and placement, the RF output power for the access port is displays in mW.

11. To configure optional rate settings, click the **Rate Settings** button to display a new dialogue containing rate setting information. Instructions on configuring rate settings is described in *Configuring Rate Settings on page 4-67*.
12. In most cases, the default settings for the **Advanced Properties** are sufficient. If needed, additional radio settings can be modified for the following:

Antenna Mode	Use the drop-down menu to configure the Antenna Diversity settings for access ports using external antennas. Options include: • Full Diversity: Utilizes both antennas to provide antenna diversity. • Primary Only: Enables only the primary antenna. • Secondary Only: Enables only the secondary antenna. Antenna Diversity should only be enabled if the access port has two matching external antennas. Default value is **Full Diversity**
Maximum Stations	Sets the maximum number of MUs that can associate to a radio. The maximum number of MUs that can associate to a radio is 64.
Adoption Preference ID	Displays the preference ID of the switch.The value can be set between 1 and 65535. To make the radios preferred, the access port preference ID should be same as adoption preference ID. The adoption preference id is used for AP load-balancing. A switch will preferentially adopt APs which have the same adoption-preference-ID as the switch itself.
Short Preambles only	Select this checkbox for the access port radio to transmit using a short preamble. Short preambles improve throughput. However, some devices (SpectraLink phones) require long preambles.

RTS Threshold

Specify a Request To Send (RTS) threshold (in bytes) for use by the WLAN's adopted access ports.

RTS is a transmitting station's signal that requests a Clear To Send (CTS) response from a receiving station. This RTS/CTS procedure clears the air where many MUs are contending for transmission time. Benefits include fewer data collisions and better communication with nodes that are hard to find (or hidden) because of other active nodes in the transmission path.

Control RTS/CTS by setting an RTS threshold. This setting initiates an RTS/CTS exchange for data frames larger than the threshold, and simply sends (without RTS/CTS) any data frames that are smaller than the threshold.

Consider the trade-offs when setting an appropriate RTS threshold for the WLAN's access ports. A lower RTS threshold causes more frequent RTS/CTS exchanges. This consumes more bandwidth because of the additional latency (RTS/CTS exchanges) before transmissions can commence. A disadvantage is the reduction in data-frame throughput. An advantage is quicker system recovery from electromagnetic interference and data collisions. Environments with more wireless traffic and contention for transmission make the best use of a lower RTS threshold.

A higher RTS threshold minimizes RTS/CTS exchanges, consuming less bandwidth for data transmissions. A disadvantage is less help to nodes that encounter interference and collisions. An advantage is faster data-frame throughput. Environments with less wireless traffic and contention for transmission make the best use of a higher RTS threshold. Default is 2346

Beacon Interval

Specify a beacon interval in units of 1,000 microseconds (K-us). This is a multiple of the DTIM value, for example, 100: 10. (See "DTIM Period," below). A beacon is a packet broadcast by the adopted access ports to keep the network synchronized. Included in a beacon is information such as the WLAN service area, the radio-port address, the broadcast destination addresses, a time stamp, and indicators about traffic and delivery such as a DTIM. Increase the DTIM/beacon settings (lengthening the time) to let nodes sleep longer and preserve battery life. Decrease these settings (shortening the time) to support streaming-multicast audio and video applications that are jitter-sensitive. Default is 100 K-us

DTIM Period	Specify a period for the *Delivery Traffic Indication Message* (DTIM). This is a divisor of the beacon interval (in milliseconds), for example, 10 : 100. (See "Beacon Interval," above). A DTIM is periodically included in the beacon frame transmitted from adopted access ports. The DTIM period determines how often the beacon contains a DTIM, for example, 1 DTIM for every 10 beacons. The DTIM indicates that broadcast and multicast frames (buffered at the access port) are soon to arrive. These are simple data frames that require no acknowledgement, so nodes sometimes miss them. Increase the DTIM/beacon settings (lengthening the time) to let nodes sleep longer and preserve their battery life. Decrease these settings (shortening the time) to support streaming-multicast audio and video applications that are jitter-sensitive. The default DTIM period is 2 beacons.
Self Healing Offset	When an RP increases its power to compensate for a failed RP, power is increased to the country's regulatory maximum. Set the Self Healing Offset to reduce the country's regulatory maximum power if RPs are situated close to each other or if RPs use external antennas. For additional information on determining the offset value, see the documentation shipped with the RP**.**

13. Refer to the **Status** field for the current state of the requests made from applet. This field displays error messages if something goes wrong in the transaction between the applet and the switch.
14. Click **OK** to use the changes to the running configuration and close the dialog.
15. Click **Cancel** to close the dialog without committing updates to the running configuration.

Configuring Rate Settings

Use the **Rate Settings** screen to define a set of basic and supported rates for the target radio. This allows the radio to sync with networks using varying data rates and allows the radio to default to a predefined set of data rates when higher data rates cannot be maintained.

To configure Rate Settings for a radio:

1. Click the **Rate Settings** button within the radio edit screen to launch a new screen with rate setting information.
2. Check the boxes next to all the **Basic Rates** you want supported.

   Basic Rates are used for management frames, broadcast traffic and multicast frames. If a rate is selected as a basic rate it is automatically selected as a supported rate.
3. Check the boxes next to all the **Supported Rates** you want supported.

Supported Rates allow an 802.11 network to specify the data rate it supports. When a MU attempts to join the network, it checks the data rate used on the network. If a rate is selected as a basic rate it is automatically selected as a supported rate.

4. Click the **Clear all rates** button to uncheck all of the Basic and Supported rates.
5. Refer to the **Status** field for the current state of the requests made from applet. This field displays error messages if something goes wrong in the transaction between the applet and the switch.
6. Click **OK** to use the changes to the running configuration and close the dialog.
7. Click **Cancel** to close the dialog without committing updates to the running configuration.

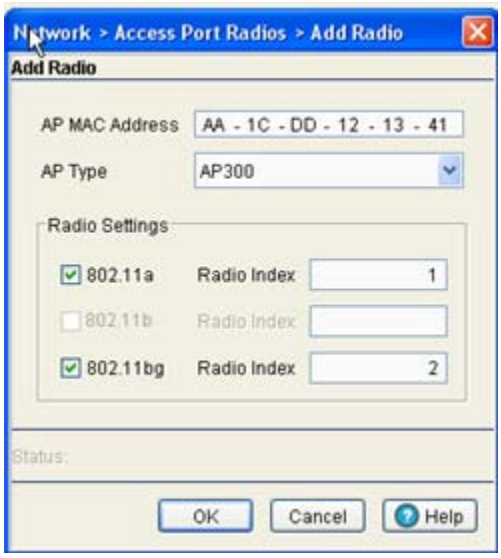
4.7.1.3 Adding APs

The **Add Radio** screen provides a facility for creating a new (unique) radio index for inclusion within the Configuration screen. Use the Add screen to add the new radio's MAC address and define its radio type.

To add a Radio to the switch:

1. Select **Network** > **Access Port Radios** from the main menu tree.
2. Click the **Configuration** tab.

3. Click the **Add** button to display at screen containing settings for adding a radio



4. Enter the device **MAC Address** (the physical MAC address of the radio). Ensure this address is the actual hard-coded MAC address of the device.
5. Use the **AP Type** drop-down menu to define the radio type you would like to add.
6. Select the radio type checkboxes corresponding to the type of AP radio used.
7. Enter a numerical value in the **Radio Index** field for each selected radio.

   The Radio Index is a numerical value assigned to the radio as a unique identifier. For example; 1, 2, or 3. The index is helpful for differentiating radios of similar type and configuration.
8. Refer to the **Status** field for the current state of the requests made from applet. This field displays error messages if something goes wrong in the transaction between the applet and the switch.
9. Click **OK** to use the changes to the running configuration and close the dialog.
10. Click **Cancel** to close the dialog without committing updates to the running configuration.

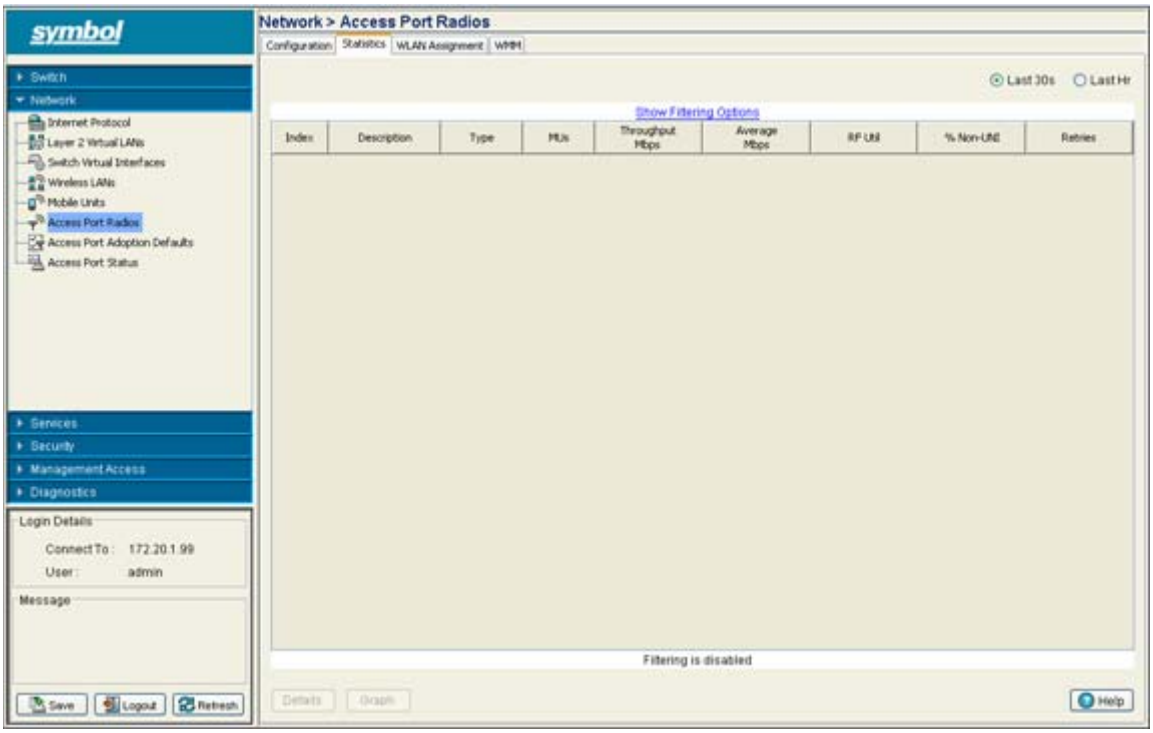
4.7.2 Viewing AP Statistics

Refer to the **Statistics** tab for information and high-level performance data for individual radios. Performance information can be reviewed for either a 30 second or one hour interval. Use the Details button to display additional information for an individual radio.

To view Radio Statistics:

1. Select **Network** > **Access Port Radios** from the main menu tree.

2. Click the **Statistics** tab.



3. To select the time frame for the radio statistics, select either **Last 30s** or **Last Hr** above the statistics table.
   - Select the Last 30s radio button to display statistics for the last 30 seconds for the radio.
   - Select the Last Hr radio button to display statistics from the last hour for the radio.
4. Refer to the table for the following information:

Index	Displays the numerical index (device identifier) used with the radio. Use this index (along with the radio name) to differentiate the radio from other device radios.
Description	Displays the name used with the radio. Use this name (along with the radio index) to differentiate the radio from other device radios.
Type	The Type value identifies whether the radio is an 802.11a radio or an 802.11 bg radio.
MU	Displays the number of MUs currently associated with the access port.
Throughput Mbps	Displays the average throughput in Mbps for the selected radio. The Rx column displays the average throughput in Mbps for packets received on the selected radio. The Tx column displays the average throughput for packets sent on the selected radio.
Avg Mbps	Displays the average bit speed in Mbps on the selected access port. This value includes all packets that are sent and received.
RF Util	Displays the percentage of the total packets for the selected radio that are non-unicast packets. Non-unicast packets include broadcast and multicast packets.

% Non-UNI	Displays the percentage of the total packets for the selected radio that are non-unicast packets. Non-unicast packets include broadcast and multicast packets.
Retries	Displays the average number of retries for all MUs associated with the selected radio.

5. Select a radio from those displayed and click the Details button for additional radio information. For more information, see *Viewing APs Details on page 4-71*.

4.7.2.1 Viewing APs Details

The **Details** screen provides additional (and more specific) traffic, performance and error information for the selected radio.

To view Radio Statistics Details:

1. Select **Network** > **Access Port Radios** from the main menu tree.
2. Click the **Statistics** tab.
3. Select a radio from the table and click the **Details** button to display a screen with detailed statistics for that radio.

   Radio statistics details are split into four sections: **Information**, **Traffic**, **RF Status** and **Errors**. Information in black represents the statistics from the last 30 seconds and information in blue represents statistics from the last hour.
4. Refer to the **Information** field for the following information:

Description	Displays a brief description of the radio to help differentiate the radio from similar models.
MAC Address	Displays the Hardware or Media Access Control (MAC) address for the access port. access ports with dual radios will have a unique hardware address for each radio.
Num Associated Stations	Displays the number of MUs currently associated with the radio.
AP Type	Displays the access port model.
Current Channel	The Current Channel displays the channel the access port is currently passing traffic on. If the channel is displayed in red, it means the configured channel does not match the current channel. The configured channel in this case, is the value in parentheses. The AP may not be operating on the configured channel for 2 reasons: Uniform spreading is enabled or radar was encountered on the configured channel.

5. Refer to the **Traffic** field for the following information:

Pkts per second	Displays the average total packets per second that cross the selected radio. The Rx column displays the average total packets per second received on the selected radio. The Tx column displays the average total packets per second sent on the selected radio. The number in black represents this statistic for the last 30 seconds and the number in blue represents this statistic for the last hour.

Throughput	Displays the average throughput in Mbps on the selected radio. The Rx column displays the average throughput in Mbps for packets received on the selected radio. The Tx column displays the average throughput for packets sent on the selected radio. The number in black represents this statistic for the last 30 seconds and the number in blue represents this statistic for the last hour.
Avg Bit Speed	Displays the average bit speed in Mbps on the selected radio. This includes all packets that are sent and received. The number in black represents this statistic for the last 30 seconds and the number in blue represents this statistic for the last hour.
Non-unicast Pkts	Displays the percentage of the total packets for the selected radio that are non-unicast packets. Non-unicast packets include broadcast and multicast packets. The number in black represents this statistic for the last 30 seconds and the number in blue represents this statistic for the last hour.

6. Refer to the **RF Status** field for the following information:

Avg Station Signal	Displays the average RF signal strength in dBm for all MUs associated with the selected radio. The number in black represents this statistic for the last 30 seconds and the number in blue represents this statistic for the last hour.
Avg Station Noise	Displays the average RF noise for all MUs associated with the selected radio. The number in black represents this statistic for the last 30 seconds and the number in blue represents this statistic for the last hour.
Avg Station SNR	Displays the average Signal to Noise Ratio (SNR) for all MUs associated with the selected radio. The Signal to Noise Ratio is an indication of overall RF performance on your wireless network.

7. Refer to the **Errors** field for the following information:

Avg Num of retries	Displays the average number of retries for all MUs associated with the selected radio. The number in black represents this statistic for the last 30 seconds and the number in blue represents this statistic for the last hour.
% Gave Up Pkts	Displays the percentage of packets the switch gave up on for all MUs associated with the selected radio. The number in black represents this statistic for the last 30 seconds and the number in blue represents this statistic for the last hour.
% of Undecryptable Pkts	Displays the percentage of undecryptable packets for all MUs associated with the selected radio. The number in black represents this statistic for the last 30 seconds and the number in blue represents this statistic for the last hour.

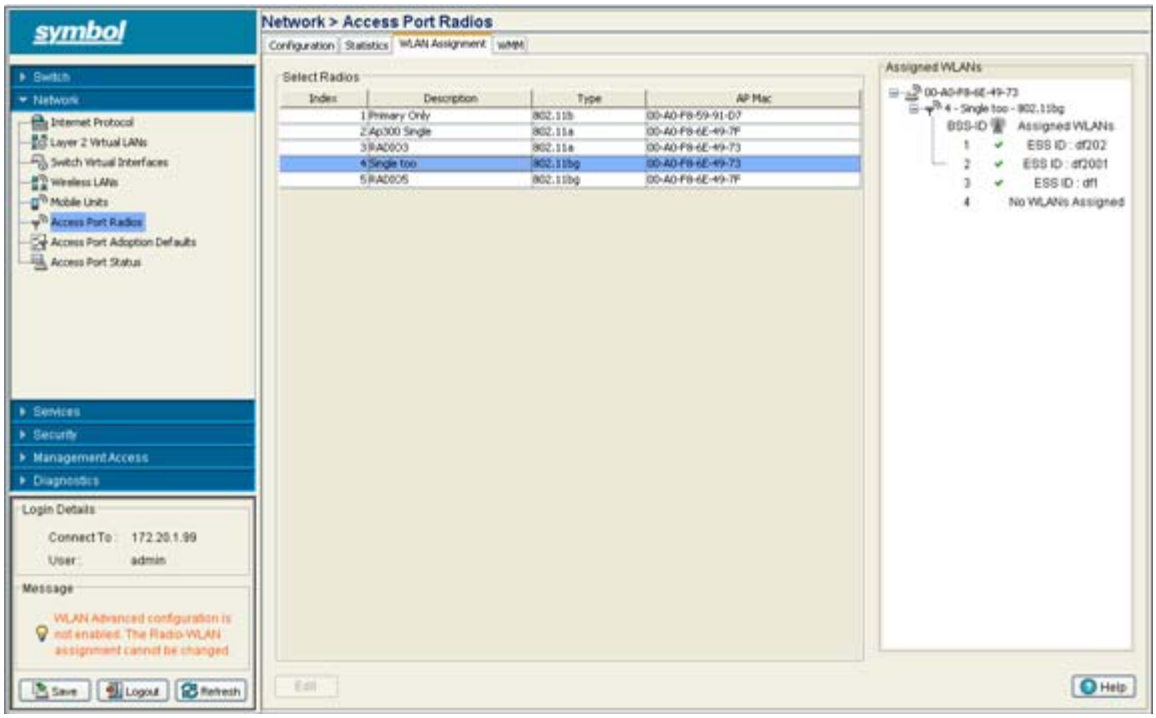
8. Click **Refresh** to update the content of the screen with the latest values.
9. Refer to the **Status** field for the current state of the requests made from applet. This field displays error messages if something goes wrong in the transaction between the applet and the switch.
10. Click **Cancel** to close the dialog without committing updates to the running configuration.

4.7.3 Configuring WLAN Assignment

The **WLAN Assignment** tab displays a high-level description of the radio. It also displays the radios WLAN and BSSID assignments on a panel on the right-hand side of the screen.

To view existing WLAN Assignments:

1. Select **Network > Access Port Radios** from the main menu tree.
2. Click the **WLAN Assignment** tab.
3. Select a radio from the table to view WLAN assignment information.



The WLAN Assignment tab is divided into two fields: **Select Radios** and **Assigned WLANs**.

4. Refer to the **Select Radios** field for the following information:

Index	Displays the numerical index (device identifier) used with the radio. Use this index (along with the radio description) to differentiate the radio from other radios with similar configurations.
Description	Displays a description of the Radio. Modify the description as required to name the radio by its intended coverage area or function.
Type	Displays whether the radio is an 802.11a radio or an 802.11 bg radio.
AP Mac	Displays the MAC address of the port in AA-BB-CC-DD-EE-FF format.

The **Assigned WLANs** section displays the WLANs associated to each of the BSSIDs used by the radios within the radio table. The information is displayed in a tree structure. There can be 0 – 16 WLANs associated with each BSS. Out of these, one WLAN must be the primary WLAN and this is indicated by the green tick mark.

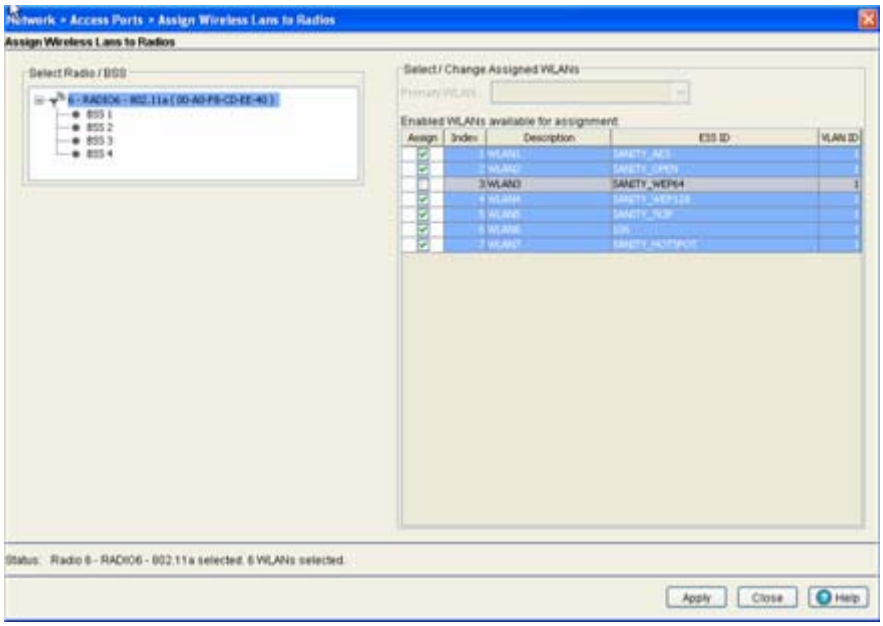
5. Select a WLAN Assignment (by index) and click the **Edit** button to modify its properties.For more information, see *Editing a WLAN Assignment on page 4-74*.

4.7.3.1 Editing a WLAN Assignment

The properties of an existing WLAN assignment can be modified to meet the changing needs of your network,

To edit an exiting WLAN assignment:

1. Select **Network** > **Access Port Radios** from the main menu tree.
2. Click the **WLAN Assignment** tab.
3. Select a radio from the table and click the **Edit** button.



The Select Radio/BSS sections displays the WLANs associated to each of the BSSIDs used by the radios within the radio table. The Select/Change Assigned WLANs section can be used to edit the WLAN assignment.

4. Select any of the WLANs from the table to unassign/disable it from the list of available WLANs.
5. Refer to the **Status** field for the current state of the requests made from applet. This field displays error messages if something goes wrong in the transaction between the applet and the switch.
6. Click the **Apply** button to save the modified WLAN assignment.
7. Click **Close** to exit the screen without committing updates to the running configuration.

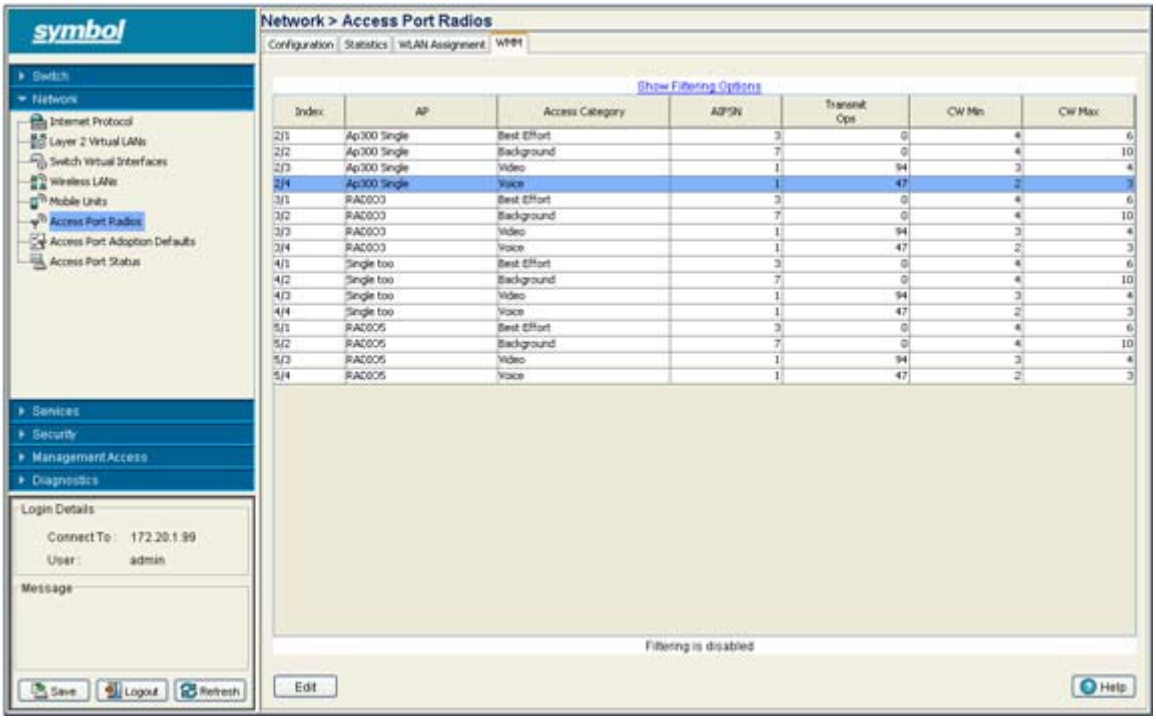
4.7.4 Configuring WMM

Use the **WMM** tab to review each radio's current index (numerical identifier) the Access Category that defines which data type (Video, Voice, Best Effort and Background) the radio has been configured to process as well as the transmit intervals defined for the target access category.

To view existing WMM Settings:

1. Select **Network > Access Port Radios** from the main menu tree.
2. Click the **WMM** tab.

   WMM information displays per radio with the following information:



Index	Displays the identifier assigned to each WLAN index, each index is assigned a unique identifier such as (1/4, 1/3, etc.).
Access port	Displays the name of the access port associated with the index. The access port name comes from the description field in the Radio Configuration screen.
Access Category	Displays the Access Category currently in use. There are four categories: Video, Voice, Best Effort and Background. Click the Edit button to change the current Access Category. Ensure the Access Category reflects the radio's intended network traffic.
AIFSN	Displays the current Arbitrary Inter-frame Space Number. Higher-priority traffic categories should have lower AIFSNs than lower-priority traffic categories. This will causes lower-priority traffic to wait longer before trying to access the medium.
TX Op	Displays the maximum duration a device can transmit after obtaining a transmit opportunity. For Higher-priority traffic categories, this value should be set higher.

CW Min	Displays the CW Max to make the Contention Window. From this range, a random number is selected for the back off mechanism. Lower values are used for higher priority traffic.
CW Max	Displays the CW Min to make the Contention Window. From this range, a random number is selected for the back off mechanism. Lower values are used for higher priority traffic.

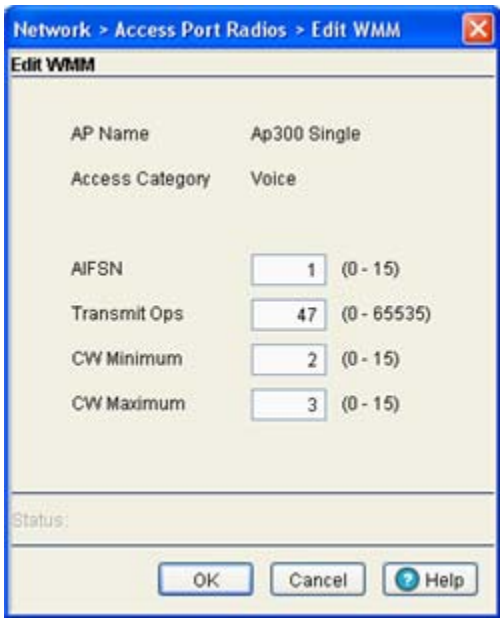
3. Select a radio and click the **Edit** button to modify its properties. For more information, see *Editing WMM Settings on page 4-76*.

4.7.4.1 Editing WMM Settings

Use the Edit screen to modify a WMM profile's properties (AIFSN, Tx Op, Cw Min and CW Max). Modifying these properties may be necessary as Access Categories are changed and transmit intervals need to be adjusted to compensate for larger data packets and contention windows.

To edit existing WMM Settings:

1. Select **Network > Access Port Radios** from the main menu tree.
2. Click the **WMM** tab.
3. Select a radio from the table and click the **Edit** button to launch a screen displaying the WMM configuration for that radio.



4. Enter a number between 0 and 15 for the **AIFSN** value for the selected radio.

   The AIFSN value is the current Arbitrary Inter-frame Space Number. Higher-priority traffic categories should have lower AIFSNs than lower-priority traffic categories. This will causes lower-priority traffic to wait longer before trying to access the medium.

5. Enter a number between 0 and 65535 for the **Transmit Ops** value.

   The Transmit Ops value is the maximum duration a device can transmit after obtaining a transmit opportunity. For Higher-priority traffic categories, this value should be set higher.

6. Enter a value between 0 and 15 for the Contention Window minimum value.

The CW Minimum is combined with the CW Maximum to make the Contention Window. From this range, a random number is selected for the back off mechanism. Lower values are used for higher priority traffic.

7. Enter a value between 0 and 15 for the Contention Window maximum value.

   The CW Maximum is combined with the CW Minimum to make the Contention Window. From this range, a random number is selected for the back off mechanism. Lower values are used for higher priority traffic.

8. Refer to the **Status** field for the current state of the requests made from applet. This field displays error messages if something goes wrong in the transaction between the applet and the switch.
9. Click **OK** to use the changes to the running configuration and close the dialog.
10. Click **Cancel** to close the dialog without committing updates to the running configuration.

4.8 Viewing Access Port Adoption Defaults

Use the **Access Port Adoption Defaults** screen to configure the current radio adoption configurations, assigning WLANs and security schemes and to review each radio type, as well as the Access Category that defines which data type (Video, Voice, Best Effort and Background) the radio has been configured to process. It has the following tabs:

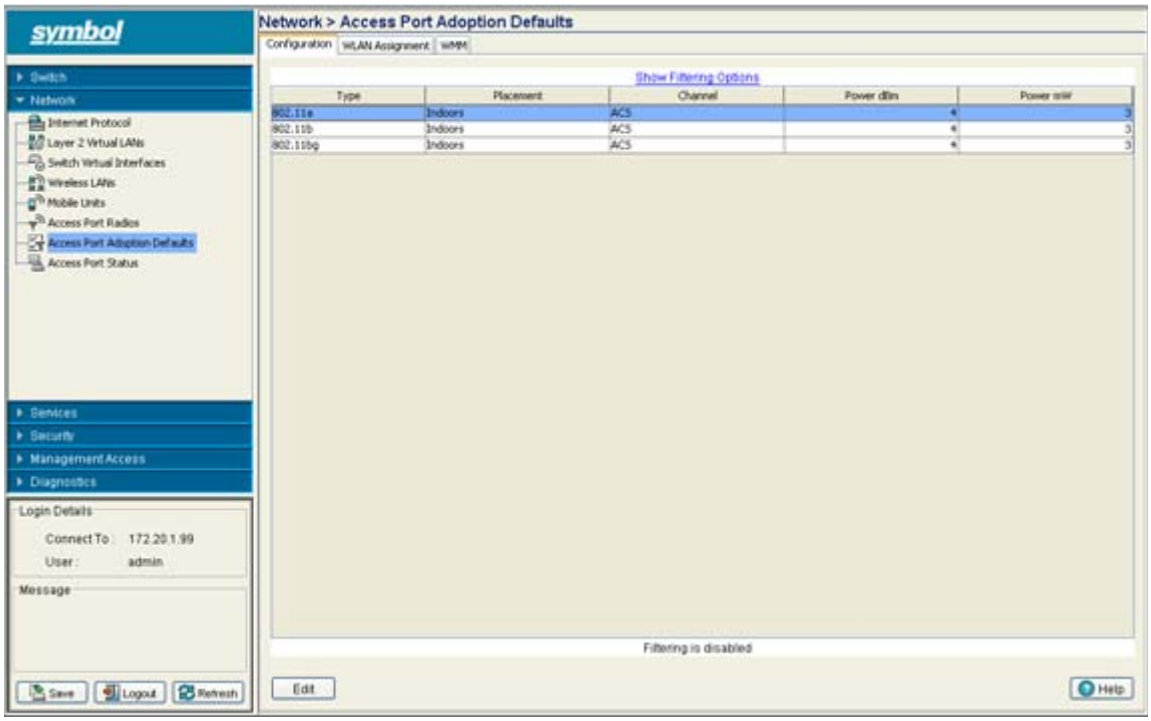
- *Configuring AP Adoption Defaults*
- *Configuring WLAN Assignment*
- *Configuring WMM*

4.8.1 Configuring AP Adoption Defaults

The **Configuration** tab displays the current radio adoption configuration including radio type, placement, channel setting and power settings. Many of these settings can be modified (as well as radio's current rate settings) by selecting a radio and clicking the Edit button. These settings are the default configurations when the radios are set to auto-adopt.

To view existing Radio Configuration information:

1. Select **Network** > **Access Port Adoption Defaults** from the main menu tree.
2. Click the **Configuration** tab.



3. Refer to the following information as displayed within the **Configuration** tab:

Type	Displays whether the radio is an 802.11a radio or an 802.11 bg model radio
Placement	Displays the default placement when an radio auto-adopts and takes on the default settings. Options include Indoor or Outdoor. Default is Indoor.

Channel	Displays the default channel when an radio auto-adopts and takes on the default settings. This value can be a specific channel, Random, or ACS. Random assigns each radio a random channel. ACS (Automatic Channel Selection) allows the switch to systematically assign the channel. Default is random.
Power dBm	Displays the default power when an radio auto-adopts and takes on the default settings. Defaults are 20 dBM for 802.11bg) and 17 dBm for 802.11a.
Power mW	Displays the default transmit power in mW (derived from the Power dBm setting). Defaults are 100 mW for 802.11bg and 50 mW for 802.11a.

4. To modify a radio's adoption defaults, select a radio and click the **Edit** button. For more information, see *Editing Default Radio Adoption Settings on page 4-79*.

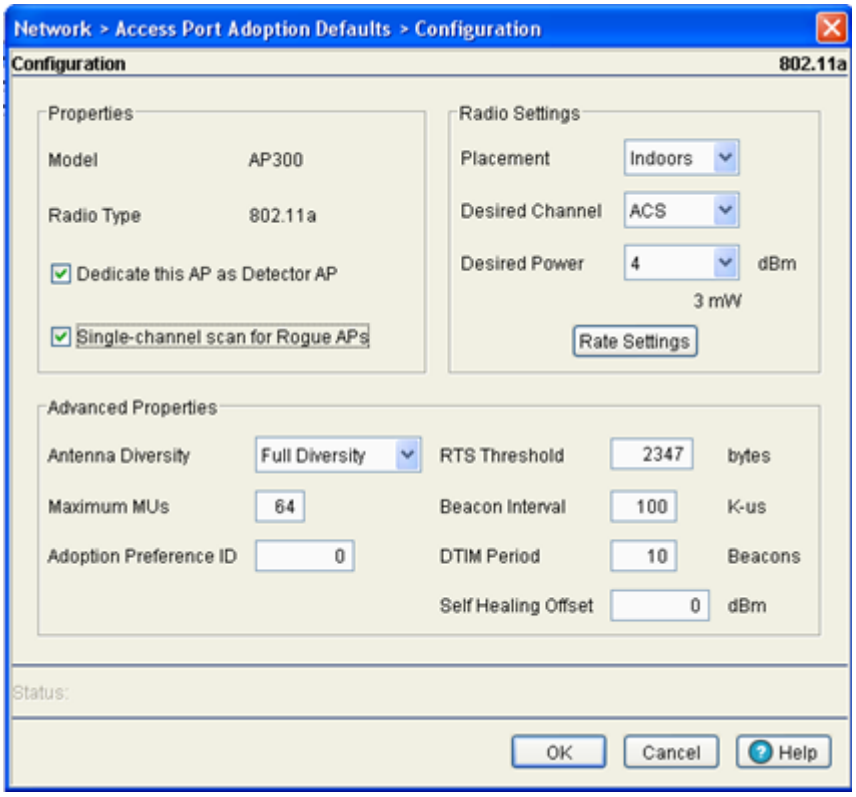
4.8.1.1 Editing Default Radio Adoption Settings

Use the **Edit** screen to dedicate a target radio as a detector radio, as well as change the radios settings (placement, power and channel) and advanced properties (antenna setting, maximum associations, adoption preference etc.).

To edit radio adoption configuration settings:

1. Select **Network Setup** > **Radio Adoption Defaults** from the main menu tree.
2. Click the **Configuration** tab.
3. Select a radio from the table.

4. Click the **Edit** button to display a screen to change the radio adoption default values for the currently selected radio type (either 802.11a or 802.11bg).



The **Properties** field displays the model family for the selected access port. The model is read only and cannot be modified. The **Radio Type** displays the radio type (802.11a or 802.11bg). This value is read only and cannot be modified

5. To use this radio as a detector to identify rogue APs on your network, check the box titled **Dedicate this Radio as Detector.** Setting this radio as a detector will dedicate this radio to detecting rogue APs on the network. Dedicated detectors are not connected to by clients and is disabled by default.
6. Select the **Single-channel scan for Rogue APs** checkbox to enable the switch to detect rogue devices using its only its current channel of operatin.
7. Within the Radio Settings field, configure the **Placement** of the radio as either **Indoors** or **Outdoors**. The setting will affect the selection channel and power levels. Default is Indoor.
8. Select a channel for communications between the access port and MUs in the **Desired Channel** field.

   The selection of a channel determines the available power levels. The range of legally approved communication channels varies depending on the installation location and country. The selected channel can be a specific channel, "Random," or "ACS." Random assigns each radio a random channel. ACS (Automatic Channel Selection) allows the switch to systematically assign channels. Default is Random.
9. After first selecting a channel, select a power level in dBm for RF signal strength in the **Desired Power (dBm)** field.

   The optimal power level for the specified channel is best determined by a site survey prior to installation. Available settings are determined according to the selected channel. Set a higher power level to ensure RF coverage in WLAN environments that have more electromagnetic interference or

greater distances between the access port and MUs. Decrease the power level according to the proximity of other access ports. Overlapping RF coverage may cause lost packets and difficulty for roaming devices trying to engage a access port. After setting a power level, channel and placement the RF output power for the access port is displayed in mW. Default is 20 dBm (802.11bg), 17 dBm (802.11a)**)**

NOTE After setting a power level, channel and placement the RF output power for the access port is displayed below in mW.

10. To configure optional rate settings, click the **Rate Settings** button to display a new dialogue containing rate setting information. Instructions on configuring rate settings are described in *Configuring Rate Settings on page 4-67*.
11. In most cases, the default settings for the **Advanced Properties** section are sufficient for most users. If needed, additional radio settings can be modified for the following properties:

Antenna Mode	Use the drop-down menu to configure the Antenna Diversity settings for access ports using external antennas. Options include: • Full Diversity: Utilizes both antennas to provide antenna diversity. • Primary Only: Enables only the primary antenna. • Secondary Only: Enables only the secondary antenna. Antenna Diversity should only be enabled if the access port has two matching external antennas. Default value is **Full Diversity**
Maximum Stations	Sets the maximum number of MUs that can associate to a radio. The maximum number of stations that can associate to a radio are 64.
Adoption Preference ID	The Adoption Preference ID defines the preference ID of the switch.The value can be set between 1 and 65535. To make the radios preferred, the access port preference ID should be same as adoption preference ID. The adoption preference id is used for RP load-balancing. A switch will preferentially adopt access ports which have the same adoption-preference-id as the switch itself.

RTS Threshold

Specify a *Request To Send* (RTS) threshold (in bytes) for use by the WLAN's adopted access ports.

RTS is a transmitting station's signal that requests a Clear To Send (CTS) response from a receiving station. This RTS/CTS procedure clears the air where many MUs (or nodes) are contending for transmission time. Benefits include fewer data collisions and better communication with nodes that are hard to find (or hidden) because of other active nodes in the transmission path.

Control RTS/CTS by setting an RTS threshold. This setting initiates an RTS/CTS exchange for data frames larger than the threshold, and simply sends (without RTS/CTS) any data frames that are smaller than the threshold.

Consider the trade-offs when setting an appropriate RTS threshold for the WLAN's access ports. A lower RTS threshold causes more frequent RTS/CTS exchanges. This consumes more bandwidth because of the additional latency (RTS/CTS exchanges) before transmissions can commence. A disadvantage is the reduction in data-frame throughput. An advantage is quicker system recovery from electromagnetic interference and data collisions. Environments with more wireless traffic and contention for transmission make the best use of a lower RTS threshold.

A higher RTS threshold minimizes RTS/CTS exchanges, consuming less bandwidth for data transmissions. A disadvantage is less help to nodes that encounter interference and collisions. An advantage is faster data-frame throughput. Environments with less wireless traffic and contention for transmission make the best use of a higher RTS threshold. Default is 2346

Beacon Interval

Specify a beacon interval in units of 1,000 microseconds (K-us). This is a multiple of the DTIM value, for example, 100 : 10. (See "DTIM Period," below). A beacon is a packet broadcast by the adopted access ports to keep the network synchronized. Included in a beacon is information such as the WLAN service area, the radio-port address, the broadcast destination addresses, a time stamp, and indicators about traffic and delivery such as a DTIM.

Increase the DTIM/beacon settings (lengthening the time) to let nodes sleep longer and preserve battery life. Decrease these settings (shortening the time) to support streaming-multicast audio and video applications that are jitter-sensitive. Default is 100 K-us

DTIM Period	Specify a period for the *Delivery Traffic Indication Message* (DTIM). This is a divisor of the beacon interval (in milliseconds), for example, 10 : 100. (See "Beacon Interval," above). A DTIM is periodically included in the beacon frame transmitted from adopted access ports. The DTIM period determines how often the beacon contains a DTIM, for example, 1 DTIM for every 10 beacons. The DTIM indicates that broadcast and multicast frames (buffered at the access port) are soon to arrive. These are simple data frames that require no acknowledgement, so nodes sometimes miss them. Increase the DTIM/beacon settings (lengthening the time) to let nodes sleep longer and preserve their battery life. Decrease these settings (shortening the time) to support streaming-multicast audio and video applications that are jitter-sensitive. The default DTIM period is 2 beacons.
Self Healing Offset	When an RP increases its power to compensate for a failed RP, power is increased to the country's regulatory maximum. Set the Self Healing Offset to reduce the country's regulatory maximum power if RPs are situated close to each other or if RPs use external antennas. For additional information on determining the offset value, see the documentation shipped with the RP.

12. Refer to the **Status** field for the current state of the requests made from applet. This field displays error messages if something goes wrong in the transaction between the applet and the switch.
13. Click **OK** to use the changes to the running configuration and close the dialog.
14. Click **Cancel** to close the dialog without committing updates to the running configuration.

Configuring Rate Settings

Use the **Rate Settings** screen to define a set of basic and supported rates for the target radio. This allows the radio to sync with networks using varying data rates and allows the radio to default to a predefined set of data rates when higher data rates cannot be maintained.

To configure a radio's rate settings:

1. Click the **Rate Settings** button in the radio edit screen to launch a screen wherein rate settings can be defined for the radio.
2. Check the boxes next to all **Basic Rates** you want supported by this radio.

   Basic Rates are used for management frames, broadcast traffic and multicast frames. If a rate is selected as a basic rate it is automatically selected as a supported rate.
3. Check the boxes next to all **Supported Rates** you want supported by this radio.

Supported Rates allow an 802.11 network to specify the data rate it supports. When a station attempts to join the network, it checks the data rate used on the network. If a rate is selected as a basic rate it is automatically selected as a supported rate.

4. Click the **Clear all rates** button to uncheck all of the Basic and Supported rates.
5. Refer to the **Status** field for the current state of the requests made from applet. This field displays error messages if something goes wrong in the transaction between the applet and the switch.
6. Click **OK** to use the changes to the running configuration and close the dialog.
7. Click **Cancel** to close the dialog without committing updates to the running configuration.

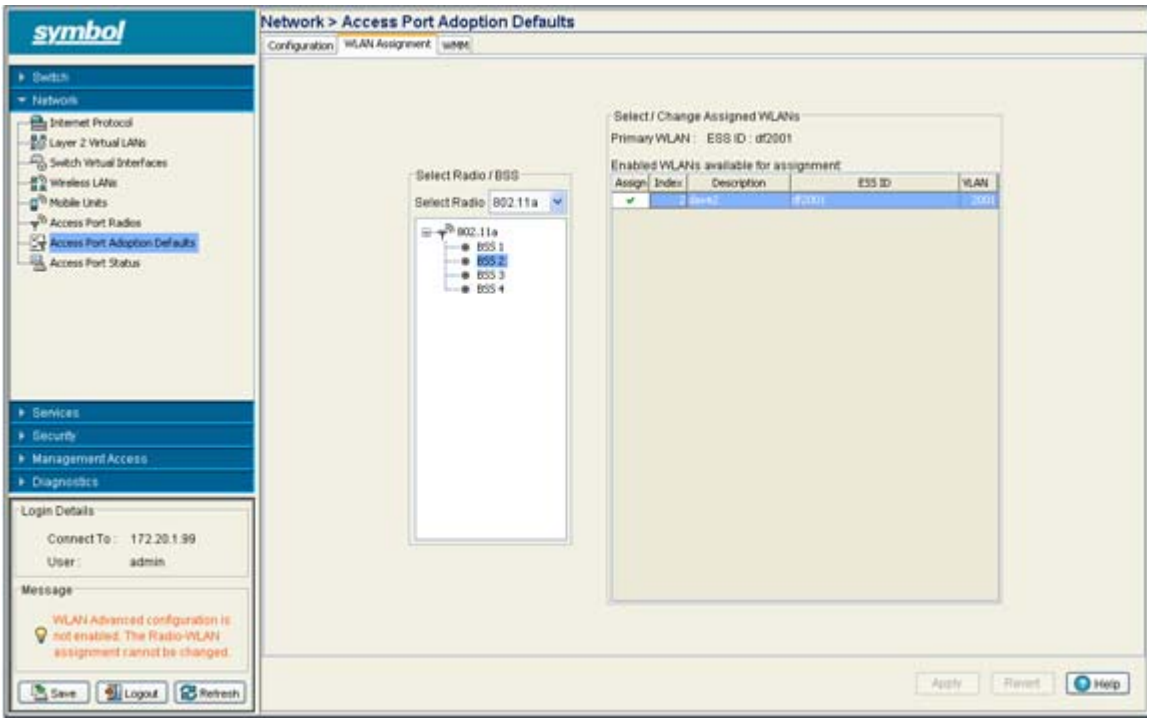
4.8.2 Configuring WLAN Assignment

Use the **WLAN Assignment** tab to assign WLANs and security schemes.

To view existing WLAN Assignments:

1. Select **Network >Access Port Adoption Defaults** from the main menu tree.

2. Click the **WLAN Assignment** tab.



The Assigned WLANs tab is broken into two fields: **Select Radios/BSS** and **Select/Change Assigned WLANs**.

3. With the **Select Radios/BSS** field, select the radio type to configure (802.11a or 802.11bg) from the **Select Radio** drop-down menu.
4. Select the desired BSS from the **BSS list** or select a **Radio** (802.11a or 802.11bg) to modify.
5. Refer to the **Select/Change Assigned WLAN** field for the following information:

Primary WLAN	If a specific BSS was selected from the **Select Radio/BSS** area, choose one of the selected WLANs from the drop-down menu as the primary WLAN for the BSS. If the radio was selected, the applet will automatically assign one WLAN to each BSS in order, and that WLAN will be set as the **Primary WLAN** for the BSS. If the number of WLANs selected is greater than the number of BSSIDs, the remaining WLANs are included with the last BSS.
Assign	Assign the WLAN to the selected BSS or Radio.
Index	Displays (in ascending order) the numerical index assigned to each SSID. Use the index (along with the WLANs name) as a mean of identifying particular WLANs after they have been assigned to different radio BSSIDs. A BSSID cannot support two WLANs with the same numerical index value.
Description	Use the WLAN Description (along with the WLANs index) as a means of identifying particular WLANs after they have been assigned to different radio BSSIDs. A BSSID cannot support two WLANs with the same description.

SSID	Displays the assigned SSID uniquely distributed between the WLANs assigned to the BSSIDs.
VLAN	Displays the VLAN ID of VLANs assigned to WLANs. By default, all WLANs are assigned to VLAN 1.

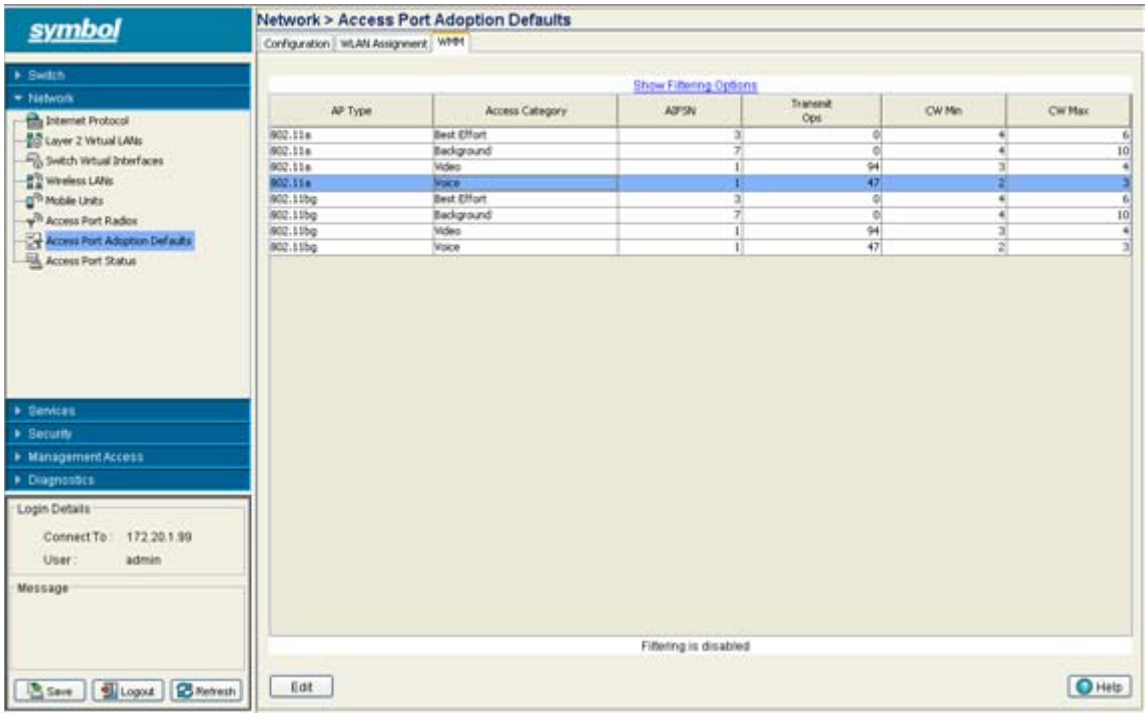
6. Click **Apply** to save the changes made within the screen.
7. Click **Revert** to cancel the changes made and revert back to the last saved configuration.

4.8.3 Configuring WMM

Use the **WMM** tab to review each radio type, as well as the Access Category that defines which data type (Video, Voice, Best Effort and Background) the radio has been configured to process. Additionally, the WMM screen displays the transmit intervals defined for the target access category. Radio WMM parameters are for downstream while WLAN WMM parameters are for upstream

To view existing WMM Settings:

1. Select **Network Setup** > **Radio Adoption Defaults** from the main menu tree.
2. Click the **WMM** tab.



3. Refer to the WMM table for the following information:

Radio Type	Displays whether the radio is an 802.11a radio or an 802.11 bg radio. This value is read-only and cannot be modified
Access Category	Displays the Access Category currently in use. There are four categories: Video, Voice, Best Effort and Background. Click the Edit button to change the current Access Category. Ensure the Access Category reflects the radios intended network traffic.

AIFSN	Displays the current Arbitrary Inter-frame Space Number. Higher-priority traffic categories should have lower AIFSNs than lower-priority traffic categories. This will causes lower-priority traffic to wait longer before trying to access the medium
Transmit Ops	Displays the maximum duration a device can transmit after obtaining a transmit opportunity. For Higher-priority traffic categories, this value should be set higher.
CW Min	The CW Min is combined with the CW Max to make the Contention Window. From this range, a random number is selected for the back off mechanism. Lower values are used for higher priority traffic.
CW Max	The CW Max is combined with the CW Min to make the Contention Window. From this range, a random number is selected for the back off mechanism. Lower values are used for higher priority traffic.

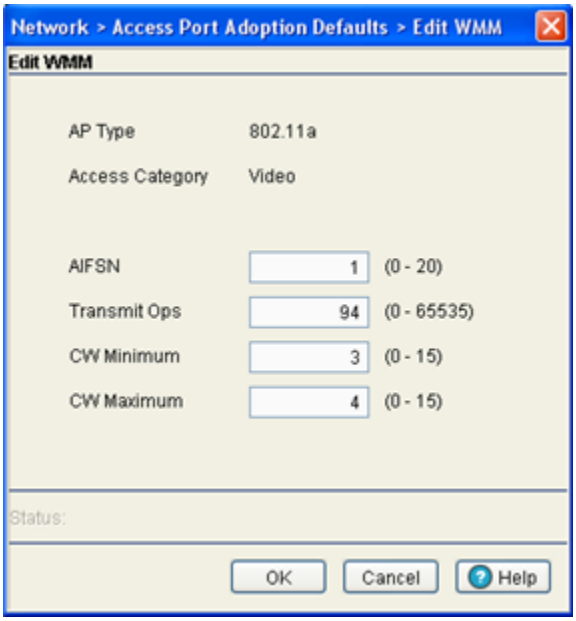
4. To modify the properties of WMM Adoption Settings, select a radio and click the Edit button. For more information, see *Editing Access Port Adoption WMM Settings on page 4-87*.

4.8.3.1 Editing Access Port Adoption WMM Settings

Use the **Edit** screen to modify a WMM profile's properties (AIFSN, Transmit Ops, Cw Min and CW Max). Modifying these properties may be necessary as Access Categories are changed and transmit intervals need to be adjusted to compensate for larger data packets and contention windows.

To edit the existing WMM settings:

1. Select **Network Setup> Radio Adoption Defaults** from the main menu tree.
2. Click the **WMM** tab.
3. Select a radio from the table and click the **Edit** button.



The **AP Type** identifies whether the radio is an 802.11a radio or an 802.11 bg radio. This value is read-only and cannot be modified. There are four access categories: Video, Voice, Best Effort and Background.

4. Enter a number between 0 and 15 for the **AIFSN** value for the selected radio.

   The AIFSN value is the current Arbitrary Inter-frame Space Number. Higher-priority traffic categories should have lower AIFSNs than lower-priority traffic categories. This will causes lower-priority traffic to wait longer before trying to access the medium.

5. Enter a number between 0 and 65535 for the **Transmit Ops** value.

   The Transmit Ops value is the maximum duration a device can transmit after obtaining a transmit opportunity. For Higher-priority traffic categories, this value should be set higher.

6. Enter a value between 0 and 15 for the **Contention Window minimum** value.

   The CW Minimum is combined with the CW Maximum to make the Contention Window. From this range, a random number is selected for the back off mechanism. Lower values are used for higher priority traffic.

7. Enter a value between 0 and 15 for the **Contention Window maximum** value.

   The CW Maximum is combined with the CW Minimum to make the Contention Window. From this range, a random number is selected for the back off mechanism. Lower values are used for higher priority traffic.

8. Refer to the **Status** field for the current state of the requests made from applet. This field displays error messages if something goes wrong in the transaction between the applet and the switch.
9. Click **OK** to use the changes to the running configuration and close the dialog.
10. Click **Cancel** to close the dialog without committing updates to the running configuration.

4.9 Viewing Access Port Status

Use the **Access Port Status** screen to view device hardware address and software version information for adopted and unadopted access ports. The Access Port Status screen has the following tabs:

- *Viewing Adopted Access Ports*
- *Viewing Unadopted Access Ports*

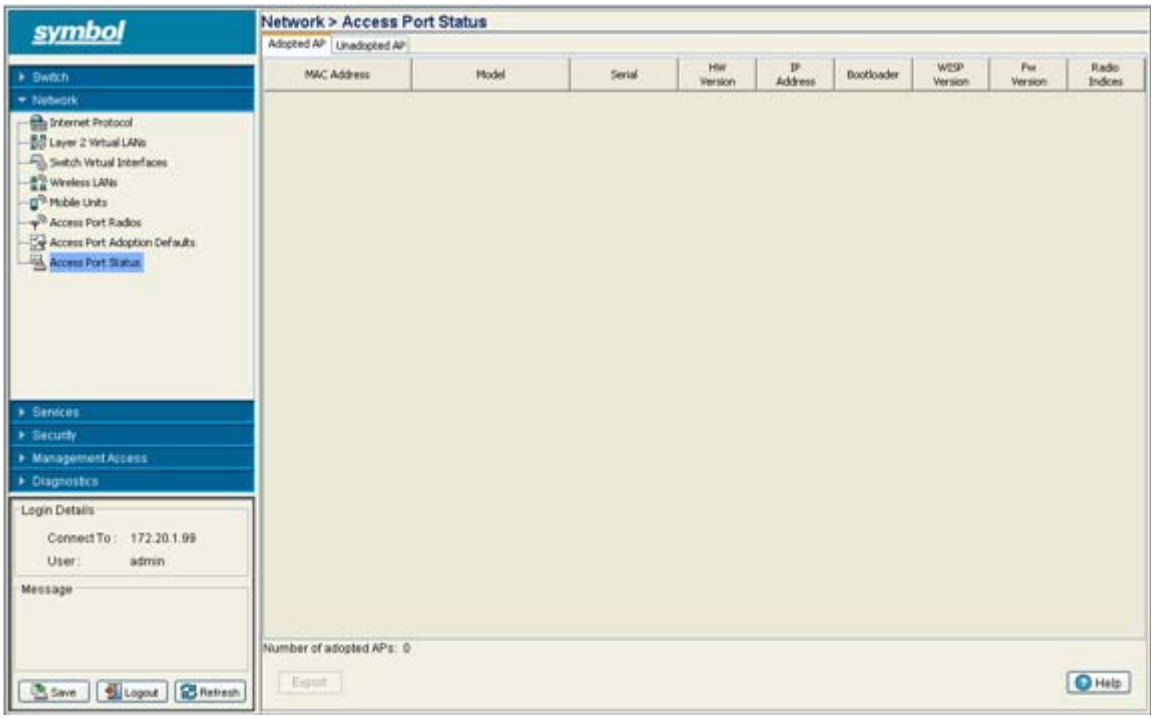
4.9.1 Viewing Adopted Access Ports

Use the **Adopted AP** tab for gathering device hardware address and software version information for the access port.

To view existing Radio Configuration information:

1. Select **Network** > **Access Port Status** from the main menu tree.

2. Click the **Adopted AP** tab.



3. Refer to the **Adopted AP** screen for the following information:

MAC Address	Displays the radio's first MAC address when it is adopted by the switch.
Model	Displays s the Model Number of the access port.
Serial	Displays the serial number of the access port, and is used for management purposes by the switch. It is read-only and cannot be modified.
HW Version	Displays the Hardware Version of the access port. This information can be helpful when troubleshooting problems with the access port.
IP Address	Displays the IP address of the adopted access port.
Bootloader	The Bootloader value displays the software version the access port boots from. This information can be helpful when troubleshooting problems.
Protocol Ver.	Displays the version of the interface protocol between the access port and the Switch. This information can be helpful when troubleshooting problems with the access port.
FW Version	Displays the firmware version on the access port at run time. Use this information to assess whether the software requires an upgrade for better compatibility with the Switch.
Radios Indices	Displays the indices of the radios belonging to the selected access port. These indices are equivalent to a numerical device recognition identifier for the radio.

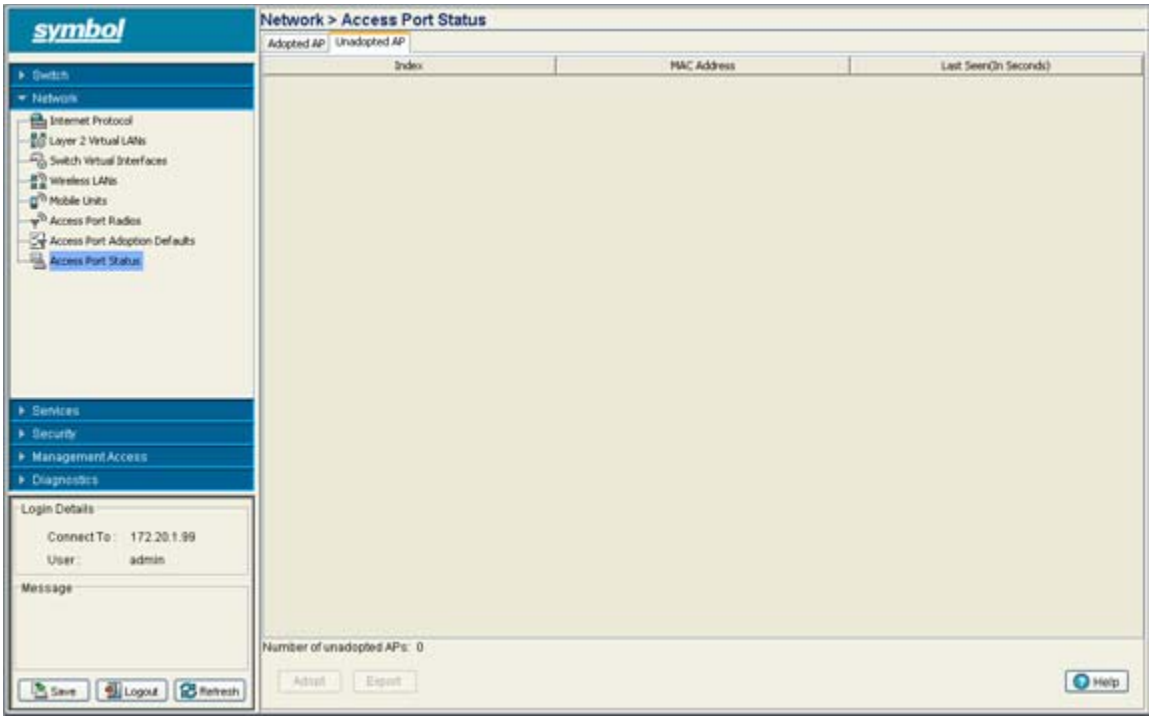
4. Click the **Export** button to export the contents of the table to a Comma Separated Values file (CSV).

4.9.2 Viewing Unadopted Access Ports

Use the **Unadopted AP** tab for gathering device hardware address and software version information for the access port.

To view existing Radio Configuration information:

1. Select **Network > Access Port Status** from the main menu tree.
2. Click the **Unadopted AP** tab.



The **Unadopted AP** tab displays the following information:

Index	Displays a numerical identifier used to associate a particular access port with a set of statistics and can help differentiate the access port from other access ports with similar attributes.
MAC Address	Displays the unique Hardware or *Media Access Control* (MAC) address for the access port. access ports with dual radios will have a unique MAC address for each radio. The MAC address is hard coded at the factory and cannot be modified.
Last Seen (In Seconds)	Displays the time the access port was last seen (observed within the switch managed network). This value is expressed in seconds. Use this value to assess if the access port is no longer in communications with the switch.
Number of Unadopted APs	Displays the total number of access ports (at the bottom of the screen) that have been recognized, but not adopted by the switch.

3. Click the **Export** button to export the contents of the table to a Comma Separated Values file (CSV).

5 Switch Services

This chapter describes the following Services main menu information used to configure the switch.

NOTE HTTPS must be enabled to access the switch applet. Ensure that HTTPS access has been enabled before using the login screen to access the switch applet.

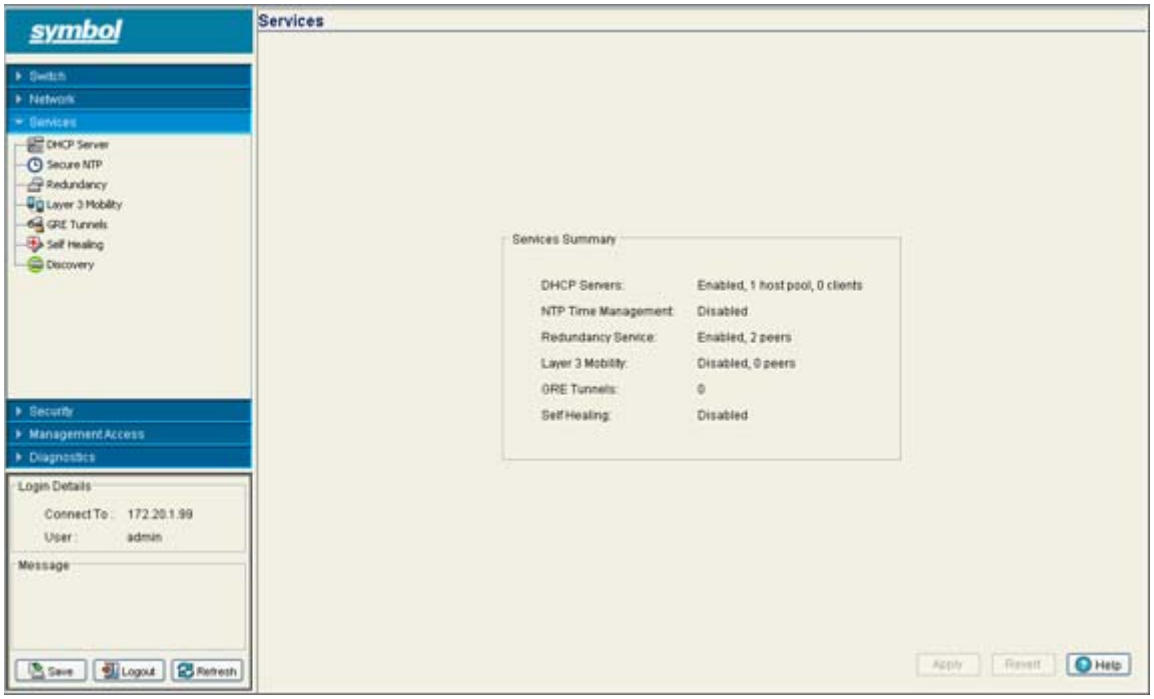
5.1 Displaying the Services Interface

Refer to the **Services** main menu interface to review a summary describing the availability of several of the central features within the Services main menu item.

NOTE When the switch's configuration is successfully updated (using the Web UI), the effected screen is closed without informing the user their change was successful. However, if an error were to occur, the error displays within the effected screen's Status field and the screen remains displayed. In the case of file transfer operations, the transfer screen remains open during the transfer operation and remains open upon completion (with status displayed within the Status field).

To display a **Services Summary**:

1. Select **Services** from the main menu tree.



2. Refer to the **Services Summary** field for the following information relating to configurable values within the Services main menu item.

DHCP Servers	Displays whether DHCP Servers is enabled and the current configuration. For information on configuring DHCP Server support for the switch, see *DHCP Server Settings on page 5-4*.
NTP Time Management	Displays whether time management is currently enabled or disabled. *Network Time Protocol* (NTP) manages time and/or network clock synchronization within the switch managed network environment. NTP is a client/server implementation.

Redundancy Service	Displays whether Redundancy is currently enabled or disabled for the switch. One or more switches can be configured as members of a redundancy group to significantly reduce the chance of a disruption in service to WLANs and associated MUs in the event of failure of a switch or intermediate network failure. For more information, see *Configuring Switch Redundancy on page 5-24*.
Layer 3 Mobility	Displays whether Layer 3 Mobility is currently enabled or disabled for the switch. Layer 3 mobility is a mechanism which enables a MU to maintain the same Layer 3 address while roaming throughout a multi-VLAN network. This enables transparent routing of IP datagrams to MUs during their movement, so data sessions can be initiated while they roam (in for voice applications in particular). Layer 3 mobility enables TCP/UDP sessions to be maintained in spite of roaming among different IP subnets. For more information on configuring Layer 3 Mobility, see *Layer 3 Mobility on page 5-34*.
GRE Tunnels	Displays the number of GRE tunnels currently configured on the switch. Tunneling involves encapsulating a packet that supports one protocol within another packet, which may run on the same protocol or on a different protocol. It is generally used to support evolving networks, its capacity and security requirements. *Generic Routing Encapsulation* (GRE) is one of the many commonly used protocols for IP tunneling. For information on configuring GRE tunneling, see *Configuring GRE Tunnels on page 5-40*.
Self Healing	Displays whether Self Healing is currently enabled on the switch. Self healing enables radios to take action when one or more radios fail. To enable the feature the user must specify radio neighbors that would self heal if either one goes down. The neighbor radios do not have to be of the same type. Therefore, an 11bg radio can be the neighbor of a 11a radio and either of them can self heal when one of them fails. For information on configuring self healing, see *Configuring Self Healing on page 5-45*.

5.2 DHCP Server Settings

The DHCP Server Settings section contains the following activities:

- *Configuring the Switch DHCP Server*
- *Viewing the Attributes of Existing Host Pools*
- *Viewing Excluded IP Address Information*
- *Viewing DHCP Server Relay Information*
- *Viewing DHCP Server Status*

5.2.1 Configuring the Switch DHCP Server

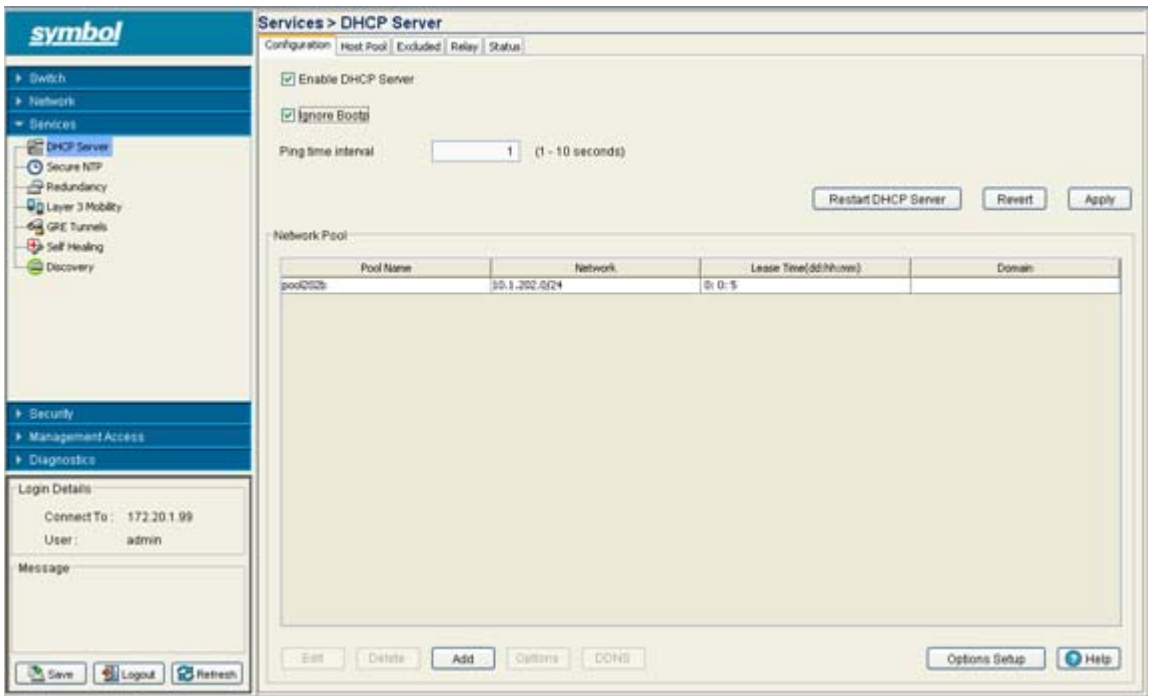
The switch contains an internal *Dynamic Host Configuration Protocol* (DHCP) Server. DHCP can provide the dynamic assignment of the IP addresses automatically. DHCP is a protocol that includes mechanisms for IP address allocation and delivery of host-specific configuration parameters from a DHCP server to a host. Some of these parameters are IP address, network mask, and gateway.

When a DHCP server allocates an address for a client, the client is assigned a lease, which expires after an amount of time chosen by the administrator. Before leases expire, the clients to which leases are assigned are expected to renew them to continue to use the addresses. Once a lease has expired, the client to which that lease was assigned is no longer permitted to use the leased IP address.

NOTE DHCP Server setting updates are only implemented when the switch is restarted.

To configure DHCP:

3. Select **Services** > **DHCP Server** from the main menu tree.
   The DHCP Server screen displays with the **Configuration** tab displayed.



4. Select the **Enable DHCP Server** checkbox to enable the switch's internal DHCP Server for use with global pools.
5. Select the **Ignore BOOTP** checkbox to bypass a DHCP request for a DHCP/ BOOTP server to acquire HTML, firmware or network configuration files when the switch boots.
6. Define an interval (from 1 -10 seconds) within the **Ping time interval** variable the switch uses to intermittently ping its DHCP server.
7. If the switch's DHCP server needs to be restarted, click the **Restart DHCP Server** button.
8. Refer to the following information as displayed within **Network Pool** field.

Pool Name	Displays the name of the IP pool from which IP addresses can be issued to DHCP client requests on the current interface. The pool is the range of IP addresses for which addresses can be assigned. However, the relationship between pools and interfaces is implicit, not explicit as was the case with previous implementations of the switch.
Network	Displays the IP address for the clients on this interface.
Lease Time (dd:hh:mm)	When a DHCP server allocates an address for a DHCP client, the client is assigned a lease, which expires after a designated interval defined by the administrator. The lease time is the number of seconds an IP address is reserved for re-connection after its last use. Using very short leases, DHCP can dynamically reconfigure networks in which there are more computers than there are available IP addresses. This is useful, for example, in education and customer environments where mobile-unit users change frequently. Use longer leases if there are fewer users.
Domain	Displays the domain name for the current interface.

9. Click the **Edit** button to modify the properties displayed on an existing DHCP pool. For more information, see *Editing the Properties of an Existing DHCP Pool on page 5-6*.
10. To delete an existing DHCP pool from the list of those available to the switch, highlight the pool from within the Network Pool field and click the **Delete** button.
11. Click the **Add** button to create a new DHCP pool. For more information, see *Adding a New DHCP Pool on page 5-7*.
12. Click the **Options** button to insert a global pool name into the list of available pools. However, individual pool options require initial setup using the **Options Setup** functionality before they can be made available for use with individual pools. For more information, see *Configuring DHCP Global Options on page 5-8*.
13. Click the **DDNS** button to configure a DDNS domain and server address that can be used with the list of available pools. For more information, see *Configuring DHCP Server DDNS Values on page 5-9*.
14. Click the **Options Setup** button to initially configure individual pool options available using the Options button. Pool options require initial configuration using the Options Setup functionality before they can be selected using the Options button.
15. Click **Apply** to save any changes to the screen. Navigating away from the screen without clicking the Apply button results in all changes to the screen being lost.
16. Click the **Revert** button to display the last saved configuration. Unapplied changes are not saved and must be re-entered.

5.2.1.1 Editing the Properties of an Existing DHCP Pool

The properties of an existing pool can be modified to suit the changing needs of your network.

To modify the properties of an existing pool:

1. Select **Services** > **DHCP Server** from the main menu tree.

   The DHCP Server screen displays with the **Configuration** tab displayed.
2. Select an existing pool from those displayed within the Network Pool field and click the **Edit** button.
3. Modify the name of the IP pool from which IP addresses can be issued to client requests on this interface.
4. Modify the **Domain** name as appropriate for the interface using the pool.
5. Modify the **NetBios Node** used with this particular pool. The NetBios Node could have one of the following types:
   - A **b-broadcast** (broadcast node) uses broadcasting to query nodes on the network for the owner of a NetBIOS name.
   - A **p-peer** (peer-to-peer node) uses directed calls to communicate with a known NetBIOS name server, such as a Windows Internet Name Service (WINS) server, for the IP address of a NetBIOS machine.
   - A **m-mixed** is a mixed node that uses broadcasted queries to find a node, and failing that, queries a known p-node name server for the address.
   - A **h-hybrid** is a combination of two or all of the nodes mentioned above.
6. Change the name of the boot file used for this pool within the **Boot File** parameter.
7. From the **Network** field, define the **IP Address** and **Subnet Mask** used for DHCP discovery and requests between the DHCP Server and DHCP clients.

NOTE The IP address and subnet mask of the pool are required to match the addresses of the layer 3 interface in order for the addresses to be supported through that interface.

8. Within the **Lease Time** field, define one of the two kinds of leases the DHCP Server assigns to its clients:
   - Infinite - If selected, the client can used the assigned address indefinitely.
   - Actual Interval - Select this checkbox to manually define the time interval for clients to use the DHCP server assigned addresses. The default lease time is 600 seconds, with a minimum setting of 10 seconds and a maximum value of 946080000 seconds.
9. Within the **Servers** field, change the server type used with the pool and use the **Insert** and **Remove** buttons to add and remove the IP addresses of the routers used.
10. Modify the **Included Ranges** (starting and ending IP addresses) for this particular pool.

    Use the **Insert** and **Remove** buttons as required to define the range of supported IP addresses.

    A network pool without any include range is as good as not having a pool, because it won't be useful in assigning addresses.
11. Click **OK** to save and add the changes to the running configuration and close the dialog.
12. Refer to the **Status** field.

The Status is the current state of the requests made from the applet. Requests are any "SET/GET" operation from the applet. The Status field displays error messages if something goes wrong in the transaction between the applet and the switch.

13. Click **Cancel** to close the dialog without committing updates to the running configuration.

5.2.1.2 Adding a New DHCP Pool

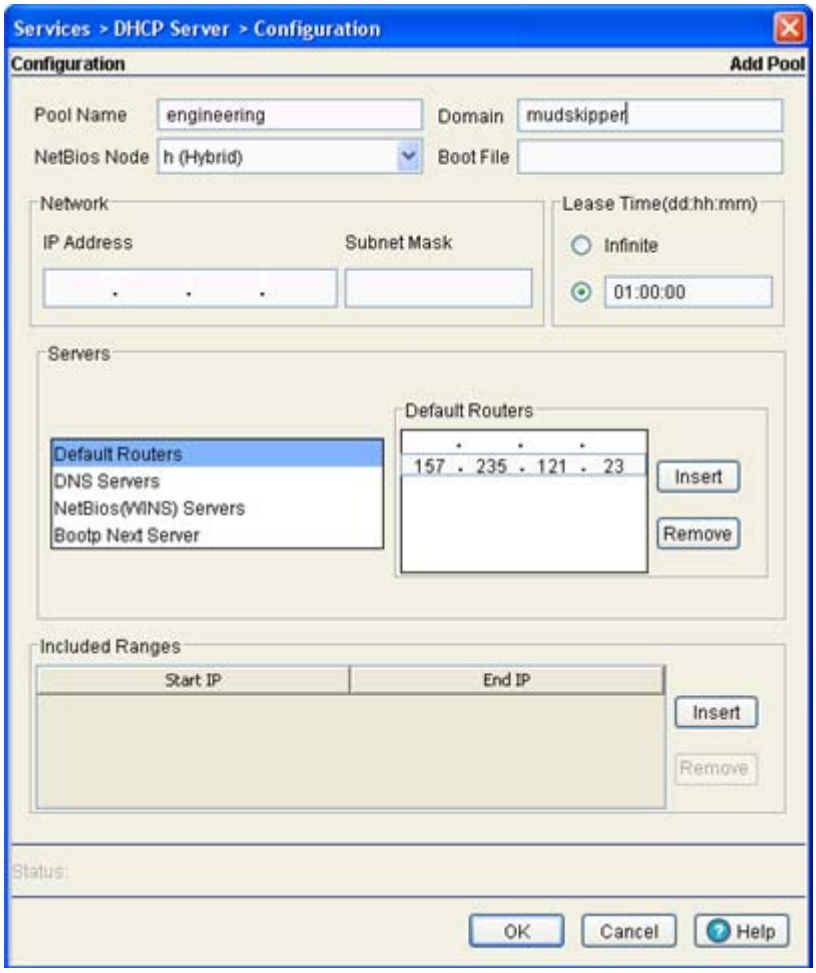
Add a new DHCP pool as needed to suit the needs of your network.

To add a DHCP pool:

1. Select **Services** > **DHCP Server** from the main menu tree.

   The DHCP Server screen displays with the **Configuration** tab displayed.

2. Click the **Add** button at the bottom of the screen.



3. Enter the name of the IP pool from which IP addresses can be issued to client requests on this interface.
4. Provide the **Domain** name as appropriate for the interface using the pool.
5. Enter the **NetBios Node** used with this particular pool. The NetBios Node could have one of the following types:
   - A **b-broadcast** (broadcast node) uses broadcasting to query nodes on the network for the owner of a NetBIOS name.

- A **p-peer** (peer-to-peer node) uses directed calls to communicate with a known NetBIOS name server, such as a Windows Internet Name Service (WINS) server, for the IP address of a NetBIOS machine.
- An **m-mixed** is a mixed node that uses broadcasted queries to find a node, and failing that, queries a known p-node name server for the address.
- An **h-hybrid** is a combination of two or all of the nodes mentioned above.

6. Enter the name of the boot file used for this pool within the **Boot File** parameter.
7. From the **Network** field, define the **IP Address** and **Subnet Mask** used for DHCP discovery and requests between the DHCP Server and DHCP clients.

NOTE The IP address and subnet mask of the pool are required to match the addresses of the layer 3 interface in order for the addresses to be supported through that interface.

8. Within the **Lease Time** field, define one of the two kinds of leases the DHCP Server assigns to its clients:
   - Infinite - If selected, the client can used the assigned address indefinitely.
   - Actual Interval - Select this checkbox to manually define the time interval for clients to use the DHCP server assigned addresses. The default lease time is 600 seconds, with a minimum setting of 10 seconds and a maximum value of 946080000 seconds.
9. Within the **Servers** field, change the server type used with the pool and use the **Insert** and **Remove** buttons to add and remove the IP addresses of the routers used.
10. Provide the **Included Ranges** (starting and ending IP addresses) for this particular pool.

    Use the **Insert** and **Remove** buttons as required to define the range of supported IP addresses.

    A network pool without any include range is as good as not having a pool, because it won't be useful in assigning addresses.
11. Click **OK** to save and add the changes to the running configuration and close the dialog.
12. Refer to the **Status** field.

    The Status is the current state of the requests made from the applet. Requests are any “SET/GET” operation from the applet. The Status field displays error messages if something goes wrong in the transaction between the applet and the switch.
13. Click **Cancel** to close the dialog without committing updates to the running configuration

5.2.1.3 Configuring DHCP Global Options

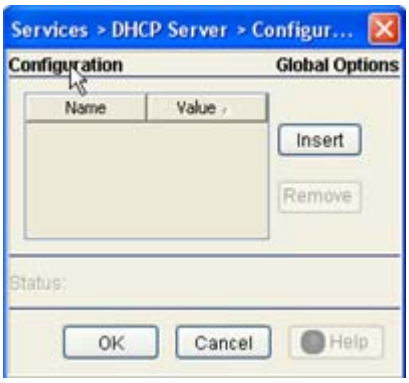
The DHCP Server screen’s Configuration and Host Pool tabs can be used to display an additional **Global Options** screen used to make pool info changes and update the other peer switches within the mobility domain.

To define new global name and value and send it to other peer swathes in the mobility domain:

1. Select **Services** > **DHCP Server** from the main menu tree.

   The DHCP Server screen displays with the **Configuration** tab displayed.

2. Highlight an existing pool name from within either the Configuration or Host Pool tab and click the **Options** button at the bottom of the screen.



3. Click the **Insert** button to display an editable field wherein the name and value of the DHCP option can be added.
4. Highlight an entry from within the Global Options screen and click the **Remove** button to delete the name and value.
5. Click **OK** to save and add the changes to the running configuration and forward the updates to the other peer switches comprising the mobility domain.
6. Refer to the **Status** field.

   The Status is the current state of the requests made from the applet. Requests are any "SET/GET" operation from the applet. The Status field displays error messages if something goes wrong in the transaction between the applet and the switch.
7. Click **Cancel** to close the dialog without committing updates to the running configuration

5.2.1.4 Configuring DHCP Server DDNS Values

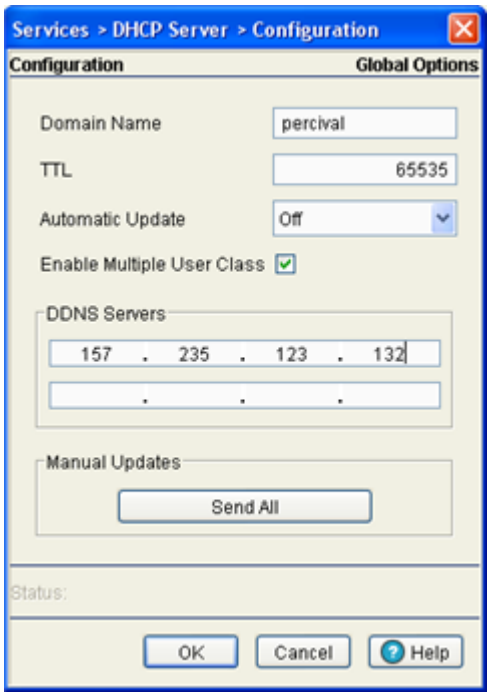
The DHCP Server screen's Configuration and Host Pool tabs can be used to display an additional **DDNS** screen. Use this screen to define a DDNS domain name and address that can be sent to other peer switches comprising the mobility domain.

To configure a global domain name and DDNS server address:

1. Select **Services** > **DHCP Server** from the main menu tree.

   The DHCP Server screen displays with the **Configuration** tab displayed.

2. Highlight an existing pool name from within either the Configuration or Host Pool tab and click the **DDNS** button at the bottom of the screen.



3. Enter a **Domain Name** representative of the layer 2 and layer 3 traffic proliferating the mobility domain.
4. Define the **TTL** (Time to Live) to specify how many more hops a packet can travel before being discarded or returned. The maximum value is 65535.
5. Use the **Automatic Update** drop-down menu to specify whether the automatic update feature is on or off. Select **Override Clients** to use the setting defined within this screen on both mobility domain peer switches and MUs.
6. Select the **Enable Multiple User Class** checkbox to enable all users (despite their designation) access to DHCP server resources and the mobility domain.
7. Use the **DDNS Servers** field to define the IP addresses used by the mobility domain to pass layer 2 and layer 3 traffic amongst peer switches.
8. Click the **Send All** button (within the **Manual Updates** field) to send manual DDNS updates to all servers.
9. Click **OK** to save and add the changes to the running configuration and close the dialog.
10. Refer to the **Status** field.

    The Status is the current state of the requests made from the applet. Requests are any “SET/GET” operation from the applet. The Status field displays error messages if something goes wrong in the transaction between the applet and the switch.
11. Click **Cancel** to close the dialog without committing updates to the running configuration

5.2.2 Viewing the Attributes of Existing Host Pools

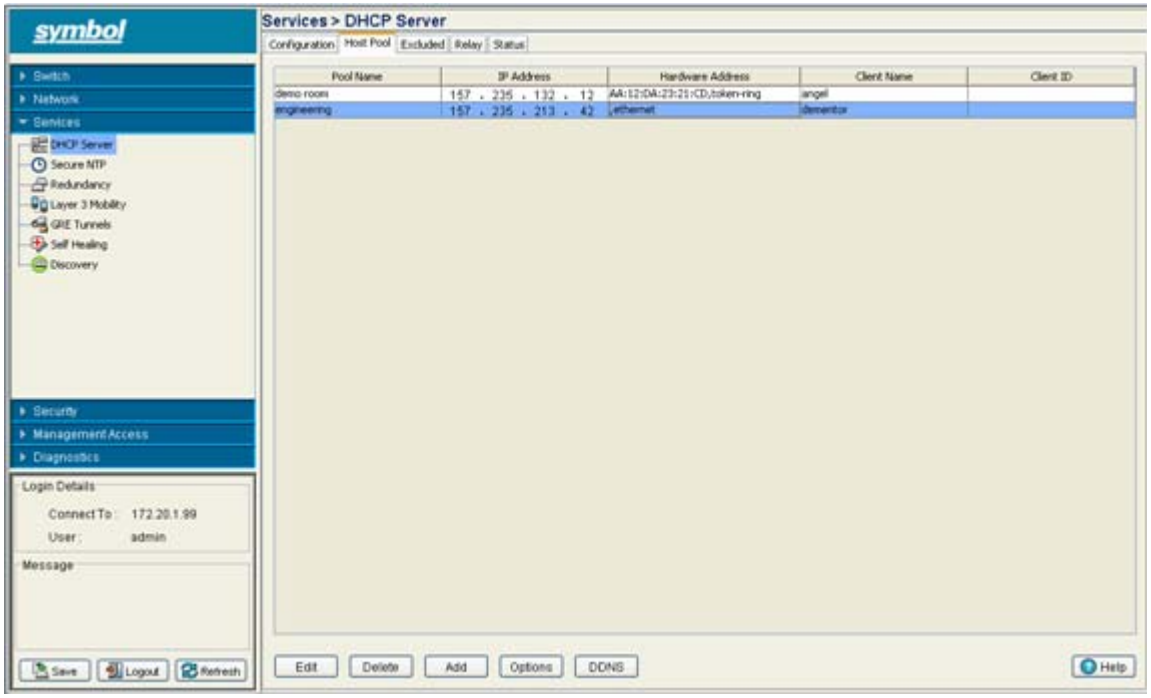
Refer to the **Host Pool** tab within the DHCP Server screen to view how the host pools reserve IP addresses for specific MAC addresses. This information can be an asset in determining if a new pool needs to be created or an existing pool requires modification.

To view the attributes of existing host pools:

1. Select **Services** > **DHCP Server** from the main menu tree.

   The DHCP Server screen displays with the **Configuration** tab displayed.

2. Select the **Host Pool** tab



3. Refer to the following information to assess whether the existing group of DHCP pools is sufficient:

Pool Name	Displays the name of the IP pool from which IP addresses can be issued to DHCP client requests on the current interface. The pool is the range of IP addresses for which addresses can be assigned.
IP Address	Displays the IP address for the client on this interface using the pool name listed.
Hardware Address	Displays the type of interface used to pass DHCP discover and request exchanges between the switch DHCP server and DHCP Clients.
Client Name	Displays the name of the client requesting DHCP Server support over this interface. This name is ready only cannot be modified using the host pool edit option.
Client ID	Displays the client MAC address using the pool name listed on the left-hand side of the table. This is the MAC having an IP address assigned by the host pool.

4. Click the **Edit** button to modify the properties displayed on an existing DHCP pool. For more information, see *Editing the Properties of an Existing DHCP Pool on page 5-6*.
5. To delete an existing DHCP pool from the list of those available to the switch, highlight the pool from within the Network Pool field and click the **Delete** button.
6. Click the **Add** button to create a new DHCP pool. For more information, see *Adding a New DHCP Pool on page 5-7*.
7. Click the **Options** button to insert a global pool name into the list of available pools. For more information, see *Configuring DHCP Global Options on page 5-8*.
8. Click the **DDNS** button to configure a DDNS domain and server address that can be used with the list of available pools. For more information, see *Configuring DHCP Server DDNS Values on page 5-9*.

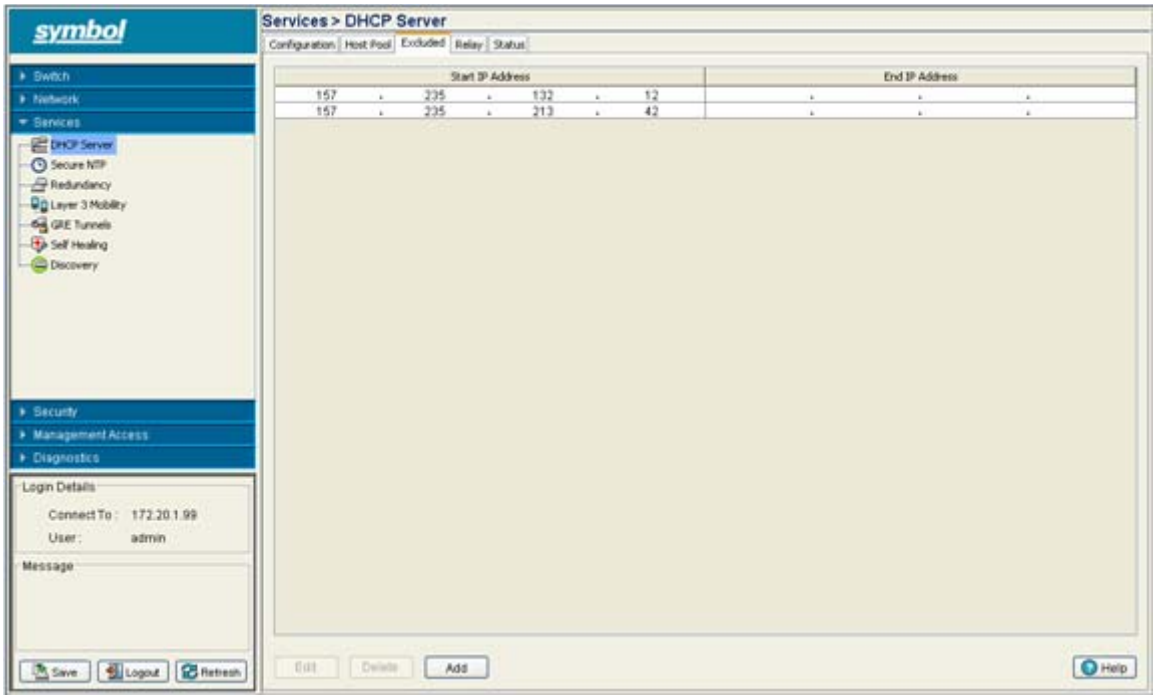
5.2.3 Viewing Excluded IP Address Information

The DHCP Server may have some IP addresses unavailable to it when assigning IP address ranges for a pool. If IP addresses have been manually assigned and fixed, they need to be made available for the administrator to exclude from possible selection.

To view excluded IP address ranges:

1. Select **Services** > **DHCP Server** from the main menu tree.

   The DHCP Server screen displays with the **Configuration** tab displayed.
2. Click the **Excluded** tab.



   The Excluded tab displays those “fixed” IP addresses that have been statically assigned and are unavailable for assignment with a pool.
3. Click the **Edit** button to modify the IP address range displayed. For more information, see *Editing the Properties of an Existing DHCP Pool on page 5-6*.
4. To delete an existing DHCP pool from the list of those available to the switch, highlight the pool from within the Network Pool field and click the **Delete** button.

5. Click the **Add** button to create a new IP address range for a target host pool. For more information, see *Adding a New DHCP Pool on page 5-7*.

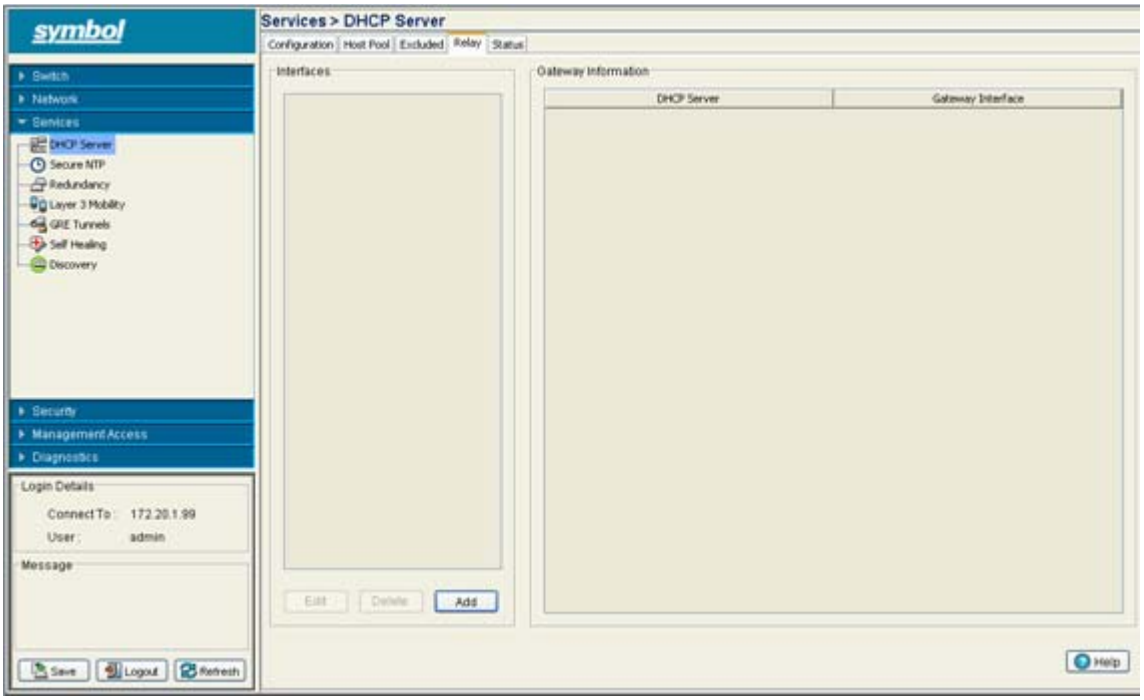
5.2.4 Viewing DHCP Server Relay Information

Refer to the **Relay** tab to view the current interfaces available to the switch's DHCP server. The Relay tab also displays DHCP Server and Gateway Interface address information helpful in the selection the interface best suiting the data routing requirements between DHCP Server and client.

To view DHCP relay information:

1. Select **Services** > **DHCP Server** from the main menu tree.

   The DHCP Server screen displays with the **Configuration** tab displayed.
2. Click the **Relay** tab.



3. Refer to the **Interface** field for the names of the interfaces available to route information between the DHCP Server and DHCP clients. If this information is insufficient, consider creating a new IP pool or edit an existing pool.
4. Refer to the **Gateway Information** field for DHCP Server and Gateway Interface IP addresses ensure these address are in no way in conflict with the addresses used to route data between DHCP Server and client. The gateway address should not be set to any VLAN interface used by the switch.
5. Click the **Edit** button to modify the properties displayed on an existing DHCP pool. For more information, see *Editing the Properties of an Existing DHCP Pool on page 5-6*.
6. To delete an existing DHCP pool from the list of those available to the switch, highlight the pool from within the Network Pool field and click the **Delete** button.
7. Click the **Add** button to create a new DHCP pool. For more information, see *Adding a New DHCP Pool on page 5-7*.

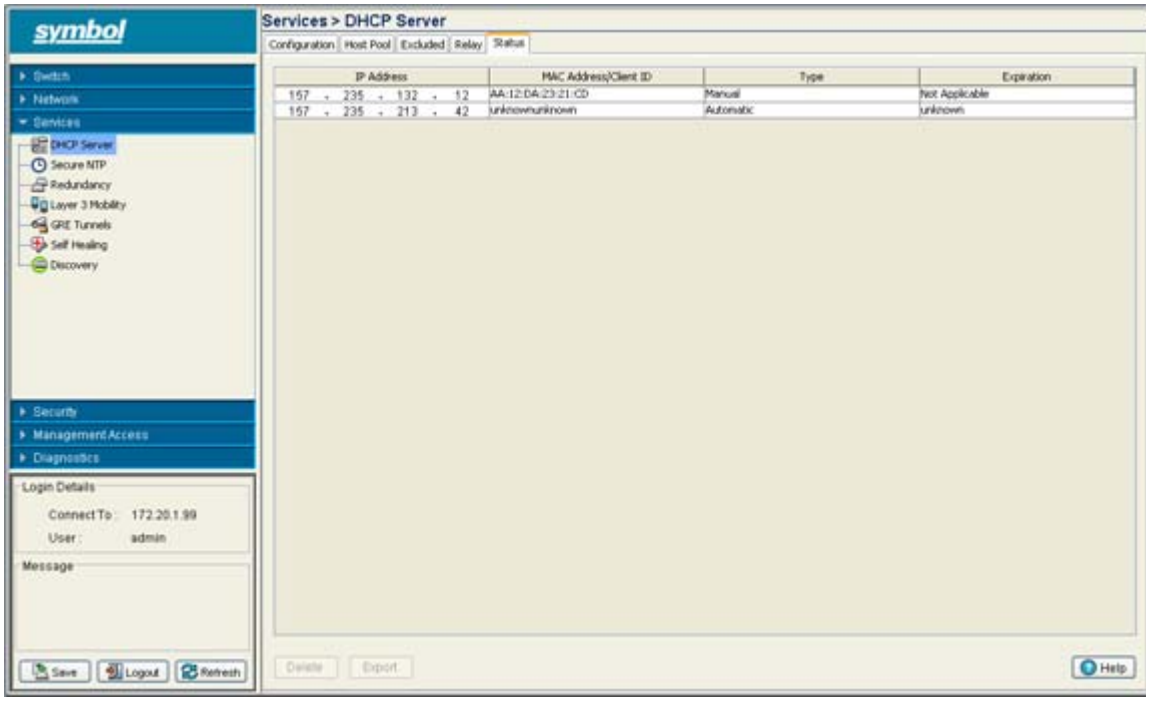
5.2.5 Viewing DHCP Server Status

The switch DHCP Server screen can display a tab with information on the MUs using a leased IP address from the switch DHCP server. User this information to assess whether the MU is still a viable client for receiving switch DHCP sources.

To view detailed DHCP Server status:

1. Select **Services** > **DHCP Server** from the main menu tree.

   The DHCP Server screen displays with the **Configuration** tab displayed.
2. Click the **Status** tab.



3. Refer to the contents of the **Status** tab for the following:

IP Address	Displays the IP address for the client with the MAC Address listed in the MAC Address/Client ID column.
MAC Address/Client ID	Displays the MAC address (client ID) of the client using the switch's DHCP Server to access switch resources. The MAC address is read-only and cannot be modified.
Type	Displays the client type interoperating with the switch's DHCP server.
Expiration	Displays the expiration date for the lease used by this particular DHCP client interoperating with the switch's DHCP server.

4. To delete an entry from the list, highlight the address (by IP or MAC address) and click the **Delete** button.
5. Click the **Export** button to display a screen used to export DHCP Server status to secure location.
6. Click the **Add** button to create a new IP address range for a target host pool. For more information, see *Adding a New DHCP Pool on page 5-7*.

5.3 Configuring Secure NTP

Secure Network Time Protocol (SNTP) is central for networks that rely on their switch managed infrastructure to supply system time. Without an SNTP implementation, switch time is unpredictable, which can result in data loss, failed processes and compromised security. With network speed, memory and capability increasing at an exponential rate, the accuracy, precision and synchronization of time is essential in a switch managed enterprise network. The switch can either use a dedicated server to supply system time or can use several forms of SNTP messaging to sync system time with network traffic authenticated and found secure for switch interoperation.

The SNTP configuration activity is divided amongst the following tasks:

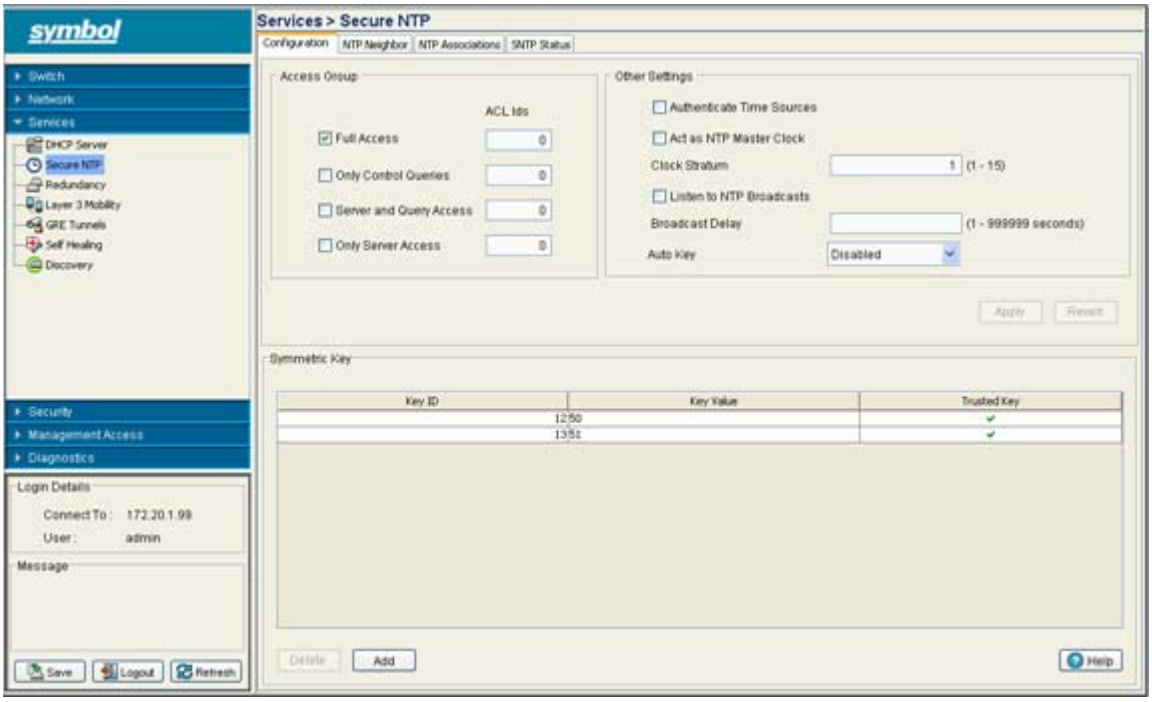
- *Defining the SNTP Configuration*
- *Defining a SNTP Neighbor Configuration*
- *Viewing SNTP Associations*
- *Viewing SNTP Status*

5.3.1 Defining the SNTP Configuration

SNTP provides synchronized timekeeping between the switch and a time server. Use the Configuration tab to define how SNTP resources are authenticated before interacting with the switch and enable ACL IDs to be mapped to SNTP access groups.

To define the SNTP configuration:

1. Select **Services** > **Secure NTP** from the main menu tree.
2. Select the **Configuration** tab.



3. Refer to the **Access Group** field to define the following:

Full Access	Select this checkbox and supply a numeric ACL ID to enable the supplied ACL ID full access.
Only Control Queries	Select this checkbox and supply a numeric ACL ID to enable the supplied ACL ID only control query access to SNTP resources.
Server and Query Access	Select this checkbox and supply a numeric ACL ID to enable the supplied ACL ID server and query access to SNTP resources.
Only Server Access	Select this checkbox and supply a numeric ACL ID to enable the supplied ACL ID only server access to SNTP resources.

4. Refer to the **Other Settings** field to define the following:

Authenticate Time Sources	Select this checkbox to ensure a credential authentication step is included between the SNTP server and the switch. When this checkbox is selected, the Apply and Revert buttons become enabled to save or cancel settings within the Other Settings field.
Act As NTP Master Clock	When this checkbox is selected, the Apply and Revert buttons become enabled to save or cancel settings within the Other Settings field.
Clock Stratum	Define how many hops (from 1 to 15) the switch is from a SNTP time source. The switch automatically chooses the SNTP resource with the lowest stratum number. The SNTP supported switch is careful to avoid synchronizing to a server that may not be accurate. Thus, the SNTP enabled switch never synchronizes to a machine not synchronized itself. The SNTP enabled switch compares the time reported by several sources, and does not synchronize to a time source whose time is significantly different than others, even if its stratum is lower.
Listen to NTP Broadcasts	Select this checkbox to allow the switch to listed over the network for SNTP broadcast traffic. Once enabled, the switch and the SNTP broadcast server must be on the same network.
Broadcast Delay	Enter the estimated round-trip delay (between 1 and 999999 seconds) for SNTP broadcasts between the SNTP broadcast server and the switch. Define the interval based on the priority of receiving accurate system time frequently. Typically, no more than one packet per minute is necessary to synchronize the switch to within a millisecond of the SNTP broadcast server.
Auto Key	Use use an **Auto Key** drop-down menu to specify whether the a key is disabled, enabled only on the host or enabled only on the client.

5. Click **Apply** to save any changes to the screen. Navigating away from the screen without clicking the Apply button results in all the changes on the screen being discarded.
6. Click the **Revert** button to undo the changes to the screen and revert to the last saved configuration.

7. Refer to the **Symmetric Key** field to view the following information.

Key ID	Displays a Key ID between 1-65534. The Key ID is a Key abbreviation allowing the switch to reference multiple passwords. This makes password migration easier and more secure between the switch and its NTP resource.
Key Value	Displays the authentication key value used to secure the credentials of the server providing system time to the switch.
Trusted Key	If a checkmark appears, a trusted key has been associated with a domain name. A trusted key is added when a public key is known, but cannot be securely obtained. Adding the trusted allows key information from the server to be considered secure. The authentication procedures requires that both the local and remote servers share the same key and key identifier. Therefore, using key information from a trusted source is important.

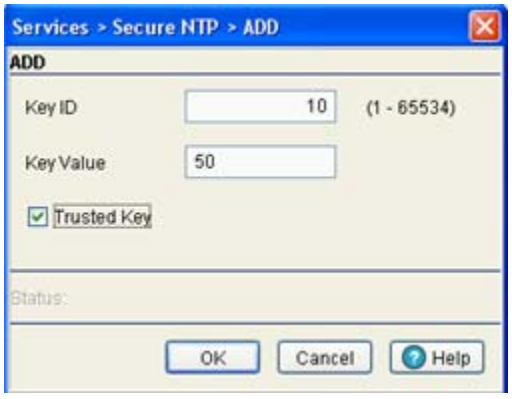
8. Select an existing Key and click the **Delete** button to permanently remove it from the list of Key IDs.
9. Click the **Add** button to create a new Symmetric Key that can be used by the switch. For more information on adding a new key, see *Adding a New SNTP Symmetric Key on page 5-17*.

CAUTION After an NTP synchronization using a Symmetric Key, the NTP status will not automatically be updated.

5.3.2 Adding a New SNTP Symmetric Key

To add a new key to the Configuration tab:

1. Select **Services** > **Secure NTP** from the main menu tree.
2. Select the **Configuration** tab.
3. Click the **Add** button.



4. Enter a Key ID between 1-65534. The **Key ID** is a Key abbreviation allowing the switch to reference multiple passwords. This makes password migration easier and more secure between the switch and its NTP resource.
5. Enter the authentication **Key Value** used to secure the credentials of the NTP server providing system time to the switch.

6. Select the **Trusted Key** checkbox to use a trusted key. A trusted key should be used when a public key is known, but cannot be securely obtained. Adding a trusted key allows data to be considered secure between the switch and its SNTP resource.
7. Refer to the **Status** field.

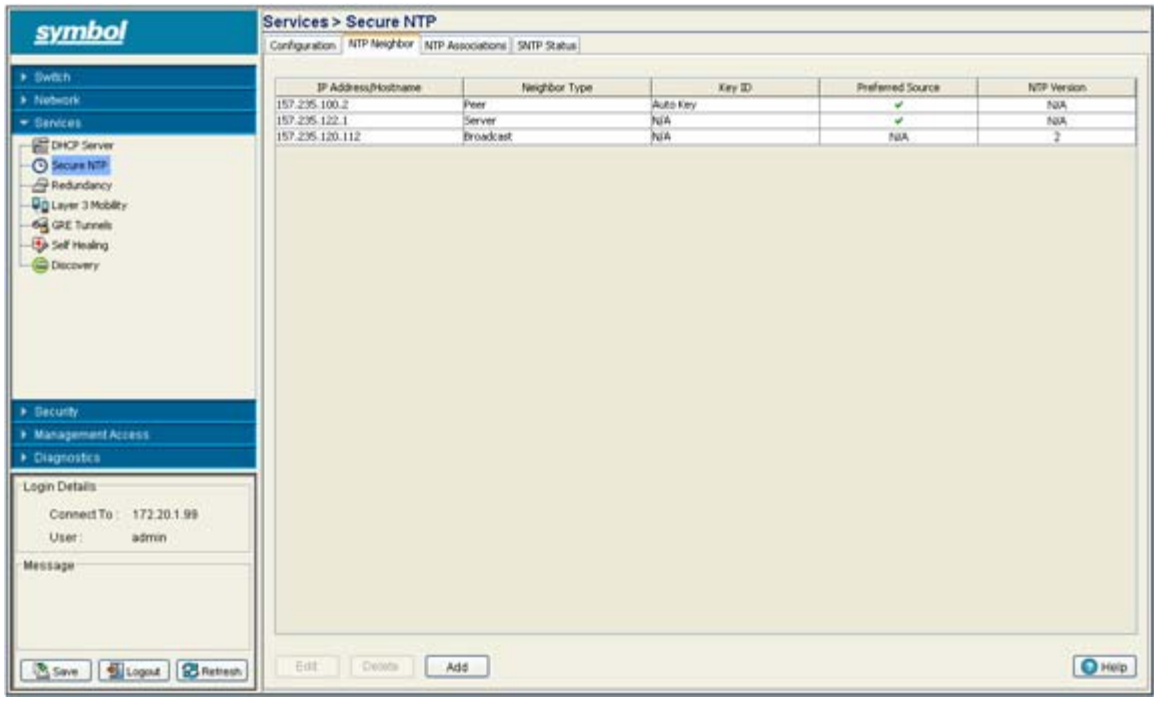
   The Status is the current state of the requests made from the applet. Requests are any "SET/GET" operation from the applet. The Status field displays error messages if something goes wrong in the transaction between the applet and the switch.
8. Click **OK** to save and add the changes to the running configuration and close the dialog.
9. Click **Cancel** to close the dialog without committing updates to the running configuration.

5.3.3 Defining a SNTP Neighbor Configuration

The switch's SNTP association can be either a neighboring peer (the switch synchronizes to another associated device) or a neighboring server (the switch synchronizes to a dedicated SNTP server resource). Refer to the **NTP Neighbor** tab to assess the switch's existing configurations (both peer and server) and, if necessary, modify the attributes of an existing peer or server configuration or create a new neighbor peer or server SNTP configuration.

To review the switch's existing NTP neighbor configurations:

1. Select **Services** > **Secure NTP** from the main menu tree.
2. Select the **NTP Neighbor** tab.



3. Refer to the following information (as displayed within the NTP Neighbor tab) to assess whether an existing neighbor configuration can be used as is, if an existing configuration requires modification or a new configuration is required.

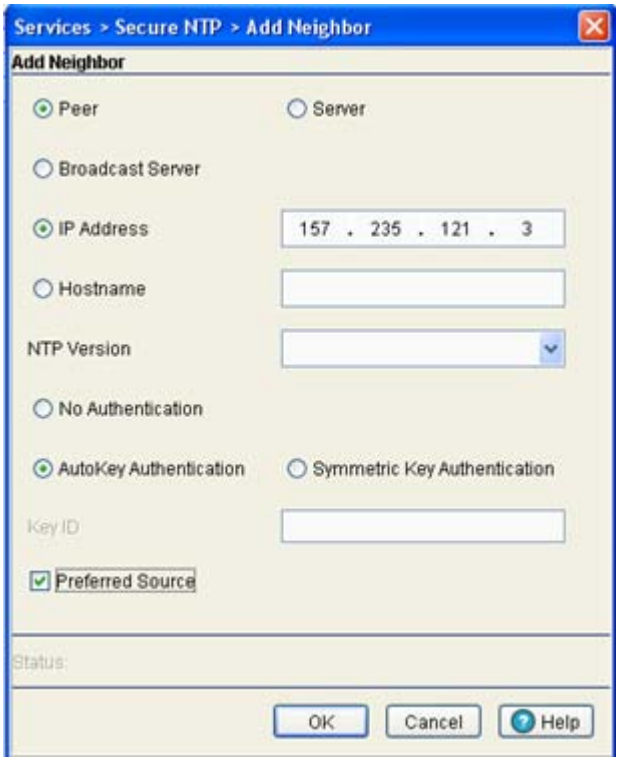
IP Address/Hostname	Displays the numeric IP address of the resource (peer or server) providing SNTP resources for the switch. Ensure the server is on the same subnet as the switch in order to provide SNTP support.
Neighbor Type	Displays whether the NTP resource is a Peer (another associated peer device capable of SNTP support) or a Server (a dedicated SNTP server resource). This designation is made when adding or editing an NTP neighbor.
Key ID	Displays whether AutoKey Authentication or Symmetric Key Authentication is used to secure the interaction between the switch and its NTP resource. This designation is made when adding or editing an NTP neighbor.
Preferred Source	Displays whether this NTP resource is a preferred NTP resource. Preferred sources (those with a checkmark) are contacted before non-preferred resources. There can be more than one preferred source.
NTP Version	Displays a NTP version between 1 and 4. Currently version three and version four implementations of NTP are available. The latest version is NTPv4, but the official Internet standard is NTPv3.

4. Select an existing neighbor and click the **Edit** button to modify the existing peer or server designation, IP address, version, authentication key ID and preferred source designation.
5. Select an existing entry and click the **Delete** button to remove it from the table.
6. Click the **Add** button to define a new peer or server configuration that can be added to the existing configurations displayed within the NTP Neighbor tab.For more information, see *Adding an NTP Neighbor on page 5-19*.

5.3.4 Adding an NTP Neighbor

To add a new NTP peer or server neighbor configuration to those available to the switch for synchronization:

1. Select **Services** > **Secure NTP** from the main menu tree.
2. Select the **NTP Neighbor** tab.
3. Click the **Add** button.



4. Select the **Peer** checkbox if the SNTP neighbor is a peer to the switch (non FTP server) within the switch's current subnet.
5. Select the **Server** checkbox if the neighbor is a server within the switch's current subnet.
6. Select the **Broadcast Server** checkbox to allow the switch to listen over the network for NTP broadcast traffic.

   The switch's NTP configuration can be defined to use broadcast messages instead of messaging between fixed NTP synchronization resource addresses. Use a NTP broadcast to listen for NTP synchronization packets within a network. To listen to NTP broadcast traffic, the broadcast server (and switch) must be on the same subnet. NTP broadcasts reduces configuration complexity since both the switch and its NTP resources can be configured to send and receive broadcast messages.

NOTE If this checkbox is selected, the AutoKey Authentication checkbox is disabled, and the switch is required to use Symmetric Key Authentication for credential verification with its NTP resource. Additionally, if this option is selected, the broadcast server cannot be selected as a preferred source.

7. Enter the **IP Address** of the peer or server providing SNTP synchronization with this configuration.
8. Select the **Hostname** checkbox to assign a hostname to the server or peer for further differentiation of other devices with a similar configuration.
9. Use the **NTP Version** drop-down menu to select the version of SNTP to use with this configuration Currently version three and version four implementations of NTP are available. The latest version is NTPv4, but the official Internet standard is NTPv3.
10. If necessary, select the **No Authentication** checkbox to allow communications with the NTP resource without any form of security. This option should only be used with known NTP resources.

11. Select the **AutoKey Authentication** checkbox to use an Auto key protocol based on the public key infrastructure (PKI) algorithm. The SNTP server uses a fast algorithm and a private value to regenerate key information on the arrival of a message. The switch sends its designated public key to the server for credential verification and the two exchange messages. This option is disabled when the Broadcast Server checkbox is selected.
12. Select the **Symmetric Key Authentication** checkbox to use a single (symmetric) key for encryption and decryption. Since both the sender and the receiver must know the same key, it is also referred to as shared key cryptography. The key can only be known by the sender and receiver to maintain secure transmissions.
13. Enter an **Key ID** between 1-65534. The Key ID is a Key abbreviation allowing the switch to reference multiple passwords.
14. Select the **Preferred Source** checkbox if this NTP resource is a preferred NTP resource. Preferred sources are contacted before non-preferred resources. There can be more than one preferred source.
15. Refer to the **Status** field. The Status is the current state of the requests made from the applet. Requests are any "SET/GET" operation from the applet. The Status field displays error messages if something goes wrong in the transaction between the applet and the switch.
16. Click **OK** to save and add the changes to the running configuration and close the dialog.
17. Click **Cancel** to close the dialog without committing updates to the running configuration.

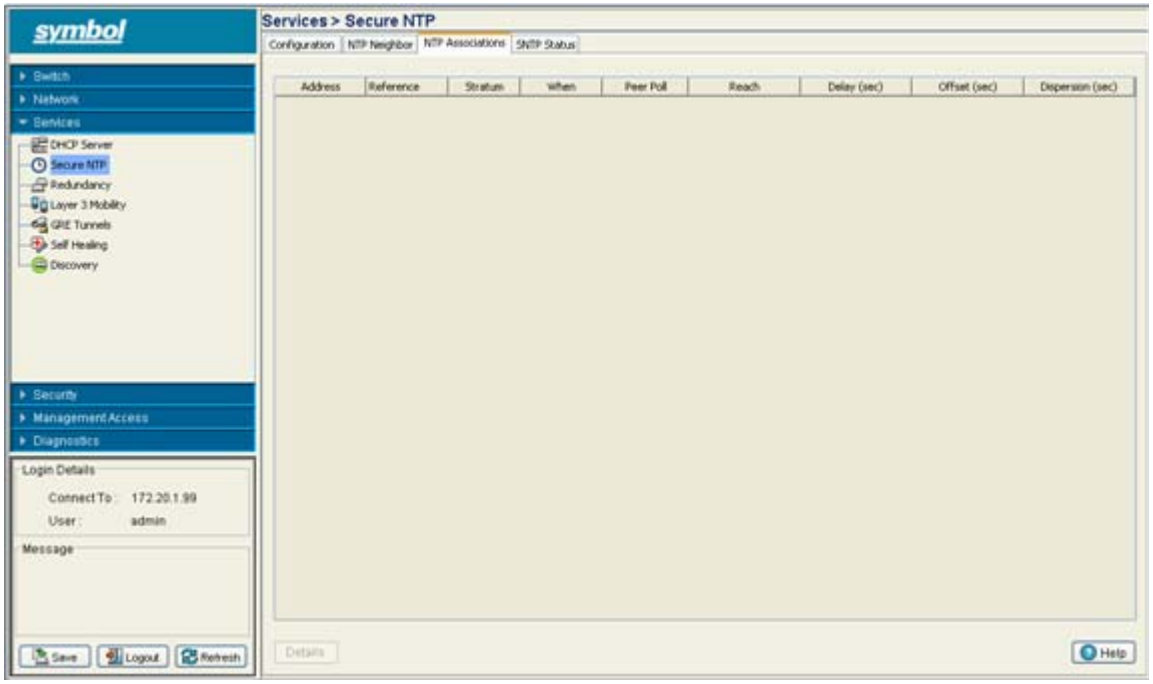
5.3.5 Viewing SNTP Associations

The interaction between the switch and a SNTP server constitutes an association. SNTP associations can be either a peer association (the switch synchronizes to the another system or allows another system to synchronize to it), or a server association (only the switch synchronizes to the SNTP resource, not the other way around).

To review the switch's current SNTP associations:

1. Select **Services** > **Secure NTP** from the main menu tree.

2. Select the **SNTP Associations** tab.



3. Refer to the following SNTP Association data for each SNTP association displayed:

Address	Displays the numeric IP address of the SNTP resource (Server) providing SNTP updates to the switch.
Reference	Displays the address of the time source the switch is synchronized to.
Stratum	Displays how many hops the switch is from a SNTP time source. The switch automatically chooses the SNTP resource with the lowest stratum number. The SNTP supported switch is careful to avoid synchronizing to a server that may not be accurate. Thus, the NTP enabled switch never synchronizes to a machine not synchronized itself. The SNTP enabled switch compares the time reported by several sources, and does not synchronize to a time source whose time is significantly different than others, even if its stratum is lower.
When	Displays the date and time when the SNTP association was initiated. Has the association been trouble free over that time?
Peer Poll	Displays the maximum interval between successive messages, in seconds to the nearest power of two.
Reach	Displays the status of the last eight SNTP messages. If an SNTP packet is lost, the lost packet is tracked over the next eight SNTP messages.
Delay (sec)	Displays the round-trip delay (in seconds) for SNTP broadcasts between the SNTP server and the switch.

Offset	Displays the calculated offset (in milliseconds) between the switch and SNTP server. The switch adjusts its clock to match the server's time value. The offset gravitates toward zero over time, but never completely reduces its offset to zero.
Dispersion	Displays how scattered the time offsets are (in seconds) from a SNTP time server

4. Select an existing NTP association and click the **Details** button to display additional information useful in discerning whether the association should be maintained.

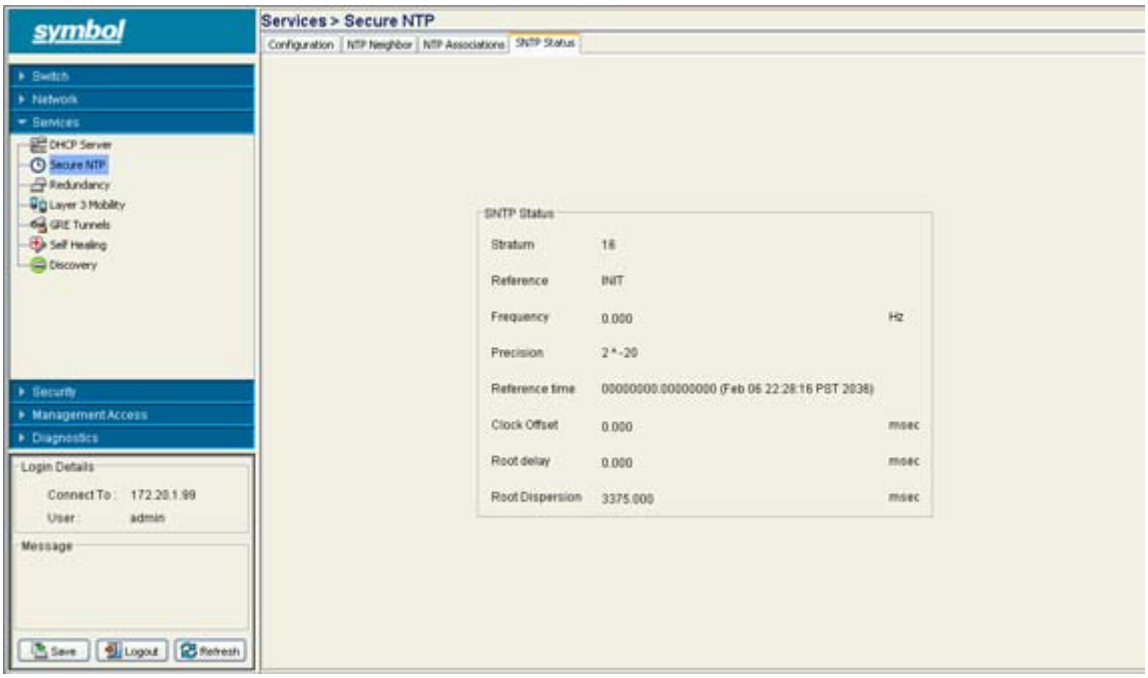
5.3.6 Viewing SNTP Status

Refer to the **SNTP Status** tab to display performance (status) information relative to the switch's current NTP association. Verifying the switch's SNTP status is important to assess which resource the switch is currently getting its system time from, as well as the time server's current differences in time attributes as compared to the current switch time.

CAUTION After an NTP synchronization using a Symmetric Key, the NTP status will not automatically be updated.

To review the switch's current NTP associations:

1. Select **Services** > **Secure NTP** from the main menu tree.
2. Select the **SNTP Status** tab.



3. Refer to the **SNTP Status** field to review the accuracy and performance of the switch's ability to synchronize with a NTP server:

Stratum	Displays how many hops the switch is from its current NTP time source.
Reference	Displays the address of the time source the switch is synchronized to.
Frequency	A SNTP server clock's skew (difference) for the switch
Precision	Displays the precision (accuracy) of the switch's time clock (in Hz). The values that normally appear in this field range from -6 for mains-frequency clocks to -20 for microsecond clocks found in some workstations.
Reference time	Displays the time stamp at which the local clock was last set or corrected.
Root delay	The total round-trip delay in seconds.This variable can take on both positive and negative values, depending on the relative time and frequency offsets. The values that normally appear in this field range from negative values of a few milliseconds to positive values of several hundred milliseconds.
Root Dispersion	Displays the nominal error relative to the primary time source in seconds. The values that normally appear in this field range from 0 to several hundred milliseconds.

5.4 Configuring Switch Redundancy

One or more switches can be configured as members of a redundancy group to significantly reduce the chance of a disruption in service to WLANs and associated MUs in the event of failure of a switch or intermediate network failure.

A switch, by default, does not participate in any redundancy group and is 'standalone'. To achieve 'redundancy' for a set of switches, a network administrator must configure a unique redundancy group ID on each.

A member can be in Active or Standby mode. In the redundancy group, all 'Active' members adopt the access-ports and load-balance number of the Access Ports among them. All 'Standby' members adopt radio-ports only when an 'Active' member has failed or sees an access-port not adopted by any switch in the network.

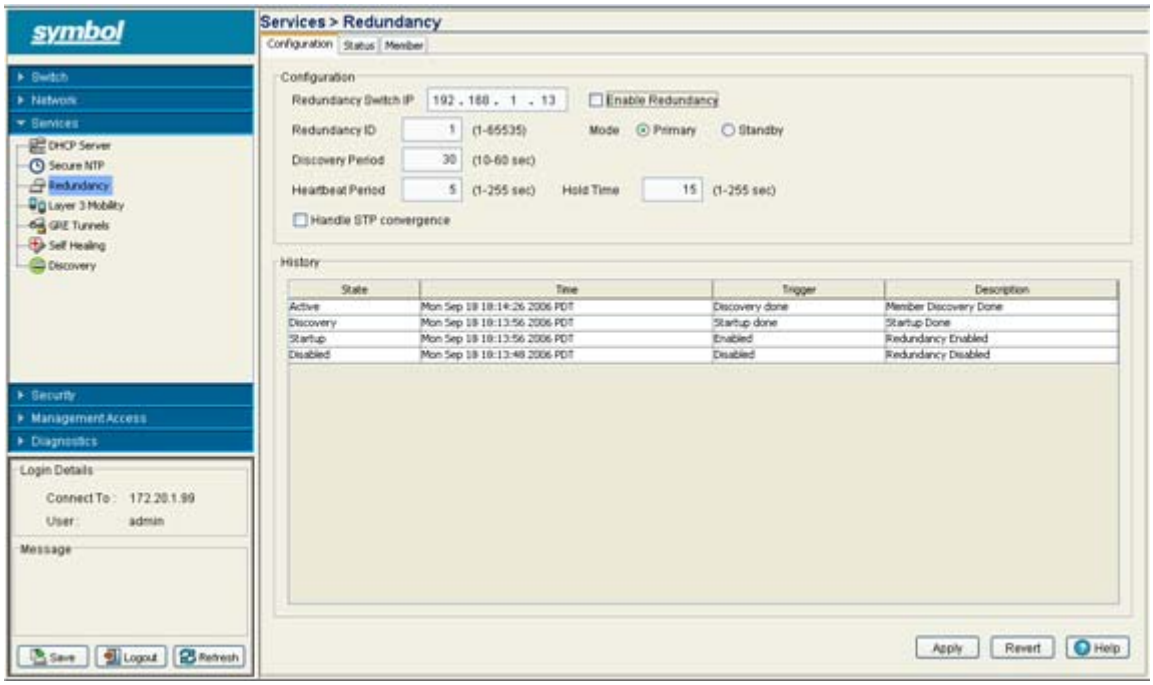
To view status and membership information, refer to the following:

- *Reviewing Redundancy Status*
- *Configuring Redundancy Group Membership*

To configure switch redundancy:

1. Select **Services** > **Redundancy** from the main menu tree.

The Redundancy screen displays with the Configuration tab selected.



2. Refer to the **Configuration** field to define the following:

Redundancy Switch IP	Define the IP address the redundancy feature uses to send heartbeats and update messages.
Enable Redundancy	Select this checkbox to enable/disable clustering. Clustering must be disabled to set any redundancy related parameter. All the modifiable values are grayed out if redundancy is enabled
Redundancy ID	Define an ID for the cluster group. All the switches configured in the cluster should have the same Cluster ID. The valid range for an ID is 1-65535.
Mode	A member can be in either an **Primary** or **Standby** mode. In the redundancy group, all 'Active' members adopt the access ports except the 'Standby' members who adopt access ports only when an 'Active' member has failed or sees an access-port not adopted by a switch.
Discovery Period	Use the **Discovery Period** field to configure the cluster member discovery time. During the discovery time, a switch discerns the existence of other switches within the redundancy group.
Heartbeat Period	The **Heartbeat Period** is the interval heartbeat messages are sent. Heartbeat messages are used to discover the existence and status of other members within the redundancy group.
Hold Time	Define the **Hold Time** for a redundancy group. If there are no heartbeats received from a peer during the hold time, the peer is considered to be down. In general, the hold period is configured for three times the heartbeat period. Meaning, if three consecutive heartbeats are not received from the peer, the peer is assumed down and unreachable.

Handle STP convergence	Select the **Handle STP convergence** checkbox to enable STP convergence for the switch. STP stands for *Spanning Tree Protocol*. In general, this protocol is enabled in layer 2 networks to prevent network looping. If the network is enabled for STP to prevent looping, the network forward is data only after STP convergence. Enabling STP convergence delays the redundancy state machine execution until the STP convergence is completed (the standard protocol value for STP convergence is 50 seconds). Delaying the state machine execution is important to load balance Access Ports at startup.

3. Refer to the **History** field to view the current state of the redundancy group. e

State	Displays the new state (status) of the redundancy protocol after a Trigger event has occurred.
Time	Displays the Timestamp (time zone specific) when the state change occurred.
Trigger	Displays the event causing the redundancy group state change on the switch
Description	Displays a redundancy event description defining the redundancy group state change on the switch

4. Click **Apply** to save any changes to the screen. Navigating away from the screen without clicking the Apply button results in all the changes on the screen being discarded.
5. Click the **Revert** button to undo the changes to the screen and revert to the last saved configuration.

5.4.1 Reviewing Redundancy Status

The switch is capable of displaying the status of the collective membership of the cluster. Use this information to assess the overall health and performance of the group.

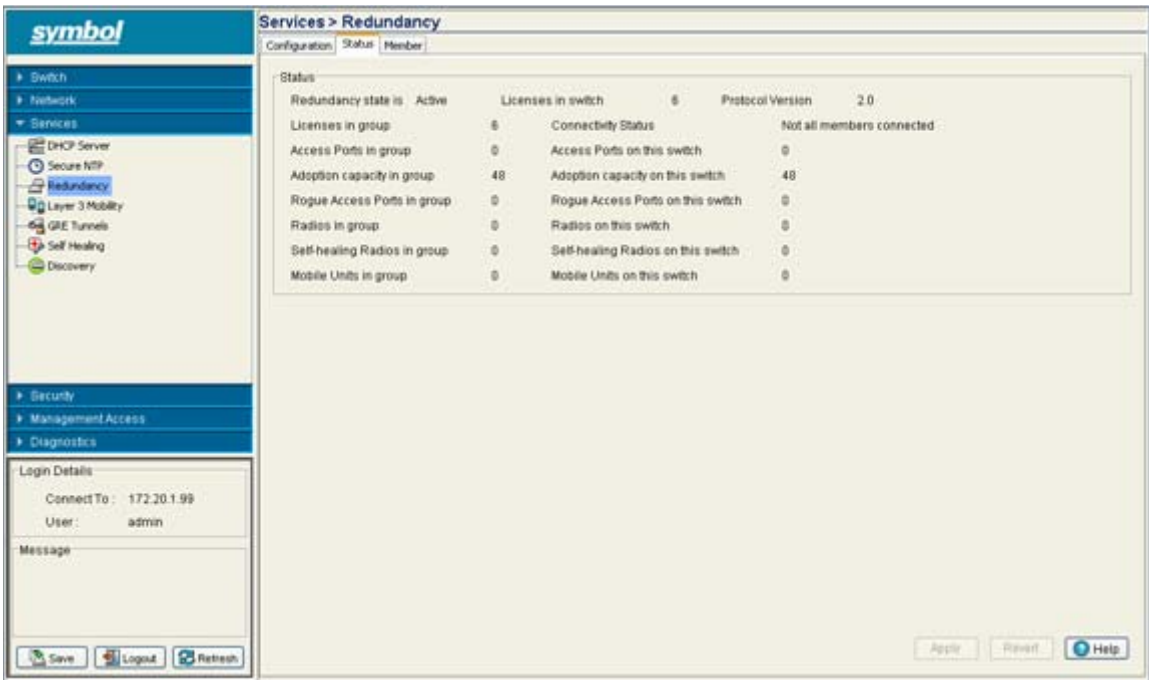
NOTE When ETH2 of one of the group members is unplugged, the other members report this member as gone, but an AP will continue to be adopted by the switch with no ETH2 connectivity.

To configure switch redundancy memberships:

1. Select **Services** > **Redundancy** from the main menu tree.

   The Redundancy screen displays with the Configuration tab selected.

2. Select the **Status** tab.



3. Refer to the **Status** field to assess the current state of the redundancy group.

Redundancy state is	Displays the state of the redundancy group. When the redundancy feature is disabled, the state is "Disabled." When enabled, it goes to "Startup" state. From "startup" it goes to "Discovery" state immediately if the STP convergence is not enabled. Otherwise, it remains in "Startup" state for a period of 50 seconds (the standard STP convergence time). During the discover state, the switch exchanges heartbeats and update messages to discover other members and determine the redundancy group authorization level. After discerning memberships, it moves to an Online state. There is no difference in state execution for the Primary and Standby modes of operation.
Licenses in switch	Displays the number of licenses installed to adopt access ports on the current switch.

Protocol Version	The Cluster Protocol should be set to an identical value for each switch in the redundancy group. The protocol version is one of the parameters used to determine whether two peers can form a group
Licenses in Group	Displays the number of access ports that can be adopted in the redundancy group. This value is calculated when a member starts-up, is added, is deleted or a license changes (downgrade and upgrade.) This value is equal to the highest license level of its members. It is NOT the sum of the license level of its members
Access Ports in group	Displays the total of the number of access ports adopted by the entire membership of the redundancy group.
Adoption capacity in group	Displays the combined AP adoption capability for each switch radio comprising the cluster. Compare this value with the adoption capacity on this switch to determine if the cluster members have adequate adoption capabilities.
Rogue Access Ports in group	Displays the cumulative number of rogue APs detected by the members of the group. Compare this value with the number of rogues detected by this AP to discern whether an abundance of rogues has been located by a particular switch and thus escalates a security issue with a particular switch.
Radios in group	Displays the combined number (sum) of radios a amongst all the members of the redundancy group.
Self-healing radios in group	Displays the number of radios within the cluster that have self-healing capabilities enabled. Compare this value with the total number of radios within the group to determine how effectively the radios within the cluster can self-heal if problems exist.
Mobile Units in group	Displays the combined number of MU associations for all the members of the redundancy group. Compare this number with the number of MUs on this switch to determine how effectively MU associations are distributed within the cluster.
Connectivity Status	Displays the current connectivity status of the cluster membership.
Access Ports on this switch	Displays the total of the number of access ports adopted by this switch within the redundancy group.
Adoption capacity on this switch	Displays the AP adoption capability for this switch. Compare this value with the adoption capacity for the entire cluster to determine if the cluster members (or this switch) have adequate adoption capabilities.
Rogue Access Ports on this switch	Displays the number of rogue APs detected by this switch. Compare this value with the cumulative number of rogues detected by the group to discern whether an abundance of rogues has been located by a particular switch and thus escalates a security issue with a particular (or this) switch.
Radios on this switch	Displays the number of radios used with this switch.
Self-healing radios on this switch	Displays the number of radios on this switch with self-healing enabled. Compare this value with the total number of radios within the group to determine how effectively the radios within the cluster can self-heal if problems exist.

Mobile Units on this switch	Displays the number of MUs currently associated with the radio(s) used with this particular switch. Compare this number with the number of MUs within the group to determine how effectively MUs are distributed within the cluster.

4. The **Apply** and **Revert** buttons are unavailable for use with the Status screen, as there are no editable parameters to save or revert.

5.4.2 Configuring Redundancy Group Membership

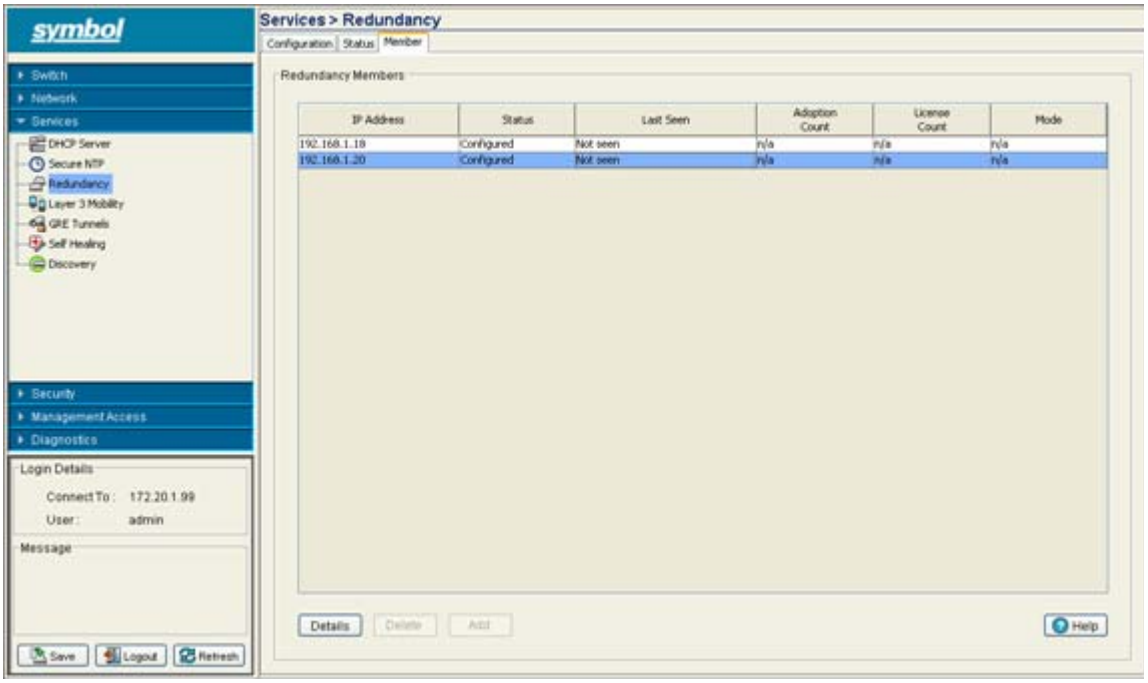
The redundancy group should be disabled to conduct an Add/Delete operation. There are a minimum of 2 members needed to comprise a Redundancy Group, including the initiating switch

To configure switch redundancy memberships:

1. Select **Services** > **Redundancy** from the main menu tree.

   The Redundancy screen displays with the Configuration tab selected.

2. Select the **Member** tab.



3. Refer to the following information within the Member tab:

IP Address	Displays the IP addresses of the redundancy group member.

Status	Displays the current status of this group member. This status could have the following values: • Configured: The member is configured on the current wireless service module. • Seen: Heartbeats can be exchanged between the current switch and this member. • Invalid: Critical redundancy configuration parameter(s) of the peer (heartbeat time, discovery time, hold time, Redundancy ID, Redundancy Protocol version of this member) do not match this switch's parameters. • Not Seen: The member is no more seen by this switch. • Established: The member is fully established with this current module and licensing information already been exchanged between this switch and the member.
Last Seen	Displays the time when this member was last seen by the switch
Adoption Count	Displays the number of access ports adopted by this member.
License Count	Displays the number of licenses installed on this member.
Mode	The Redundancy Mode could be Active or Standby depending on the mode configuration on the member. Refer to the Configuration screen to change the mode.

4. Select a row, and click the **Details** button to display additional details for this member. For more information, see *Confiding Redundancy Member Details on page 5-30*.
5. Select a row and click the **Delete** button to remove a member from the redundancy group. The redundancy group should be disabled to conduct an Add or Delete operation.
6. Click the **Add** button to add a member to the redundancy group. The redundancy group should be disabled to conduct an Add or Delete operation. For more information, see *Adding a Redundancy Group Member on page 5-32*.

5.4.2.1 Confiding Redundancy Member Details

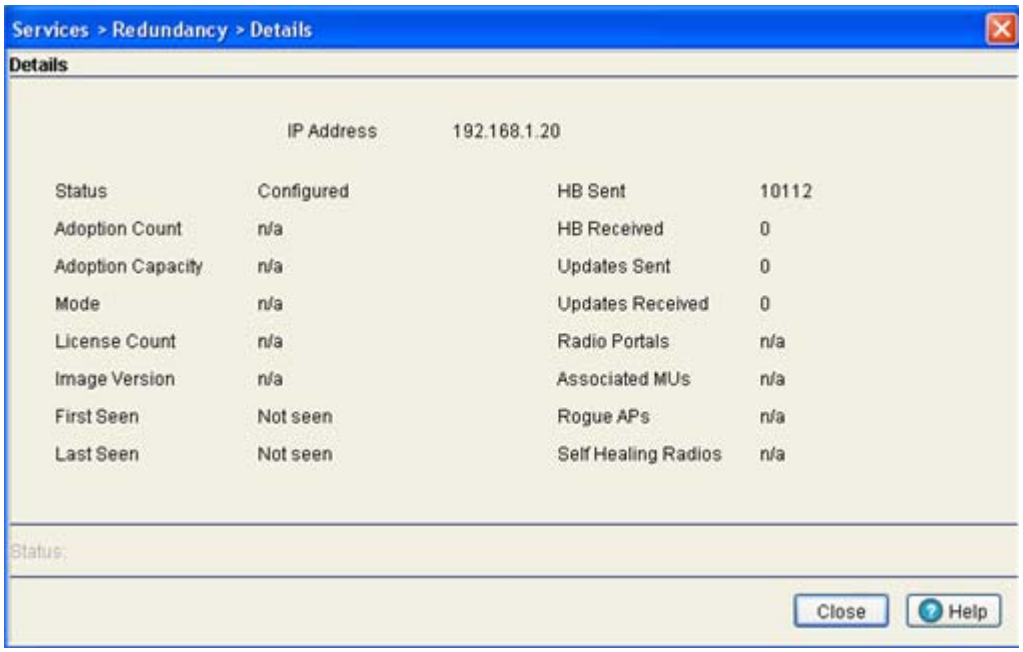
Use the **Details** screen (in conjunction with its parent Member screen) to display additional (more detailed) information on the redundancy group (cluster) member selected within the Member screen.

To review the details

1. Select **Services** > **Redundancy** from the main menu tree.

   The Redundancy screen displays with the Configuration tab selected.
2. Select the **Member** tab.

3. Highlight a member of the group and select the **Details** button.



4. Refer to the following redundancy member information:

IP Address	Displays the IP addresses of the members of the redundancy group. There are a minimum of 2 members needed to define a redundancy group, including this current module
Status	Displays the current status of this group member. This status could have the following values: • Configured: The member is configured on the current wireless service module. • Seen: Heartbeats can be exchanged between the current switch and this member. • Invalid: Critical redundancy configuration parameter(s) of the peer (heartbeat time, discovery time, hold time, Redundancy ID, Redundancy Protocol version of this member) do not match this switch's parameters. • Not Seen: The member is no more seen by this switch. • Established: The member is fully established with this current module and licensing information already been exchanged between this switch and the member.
Adoption Count	Displays the number of access ports adopted by this member.
Adoption Capacity	Displays the maximum number of access ports this member is licensed to adopt.
Mode	The Redundancy Mode could be Active or Standby depending on the mode configuration on the member. Refer to the Configuration screen to change the mode
License Count	Displays the number of port licenses available for this switch.
Image Version	Displays the image version currently running on the selected member. Is this version complimentary with this switch's version?

First Seen	Displays the time this member was first seen by the switch.
Last Seen	Displays the time this member was last seen by the switch.
HB Sent	Displays the number of heartbeats sent from the switch to this member since the last reboot of the switch.
HB Received	Displays the number of heartbeats received by the switch since the last reboot.
Updates Sent	Displays the number of updates sent from the switch since the last reboot. Updates include, authorization level, group authorization level and number of access ports adopted.
Updates Received	Displays the number of updates received by the current Switch from this member since the last reboot.
Radio Portals	Displays the number of radio portals detected on each redundancy member listed.
Associated MUs	Display the number of MUs associated with each member listed.
Rogue APs	displays the number of Rogue APs detected by each member listed. Use this information to discern whether these radios represent legitimate threats to other members of the redundancy group.
Self Healing Radios	Displays the number of self healing radios on each detected member. These radios can be invaluable if other radios within the redundancy group were to experience problems requiring healing by another radio.

5. Refer to the **Status** field.

   The Status is the current state of the requests made from the applet. Requests are any “SET/GET” operation from the applet. The Status field displays error messages if something goes wrong in the transaction between the applet and the switch.
6. Click **Close** to close the dialog without committing updates to the running configuration.

5.4.2.2 Adding a Redundancy Group Member

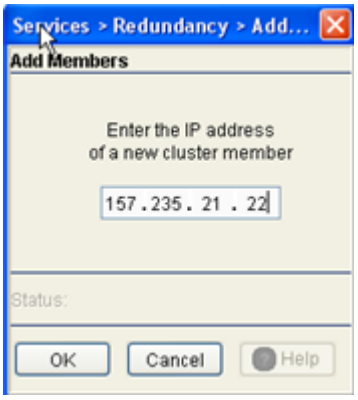
Use the **Add** screen as the means to add a new member (by adding their IP address) to an existing redundancy group (cluster).

To add a new member to a redundancy group:

1. Select **Services** > **Redundancy** from the main menu tree.

   The Redundancy screen displays with the Configuration tab selected.
2. Select the **Member** tab.

3. Select the **Add** button.



4. Enter the IP Address of a new member.
5. Click **OK** to save and add the changes to the running configuration and close the dialog.
6. Refer to the **Status** field.

   The Status is the current state of the requests made from the applet. Requests are any "SET/GET" operation from the applet. The Status field displays error messages if something goes wrong in the transaction between the applet and the switch.
7. Click **Cancel** to close the dialog without committing updates to the running configuration.

5.5 Layer 3 Mobility

Refer to the following sections to configure Layer 3 Mobility:

5.5.1 Configuring Layer 3 Mobility

Layer 3 mobility is a mechanism which enables a MU to maintain the same Layer 3 address while roaming throughout a multi-VLAN network. This enables transparent routing of IP datagrams to MUs during their movement, so data sessions can be initiated while they roam (in for voice applications in particular). Layer 3 mobility enables TCP/UDP sessions to be maintained in spite of roaming among different IP subnets.

A mobility domain comprises of a network of switches among which an MU can roam seamlessly without changing its IP address. Each switch in the mobility domain needs to be configured to be part of the same mobility domain (using a mobility domain string identifier) such that MUs roaming between these switches can retain their Layer 3 address and thus maintain application-layer connectivity.

When a MU enters a mobility domain by associating with a switch, it is first assigned a home switch. The home switch is responsible for assigning a VLAN for the MU and communicating the MU's mobility-related parameters to the other switches in the mobility domain. The home switch does not change for the remainder of the MU's presence in the mobility domain. All data packets transmitted/received by the MU including DHCP and ARP are tunneled through the home switch. The IP address for the MU is assigned from the VLAN to which the MU belongs (as determined by the home switch).

The current switch for the MU is the switch in the mobility domain to which it is currently associated to, and keeps changing as the MU continues to roam amongst. The current switch is also responsible for delivering data packets from the MU to its home switch and vice-versa.

Key aspects of Layer 3 Mobility include:

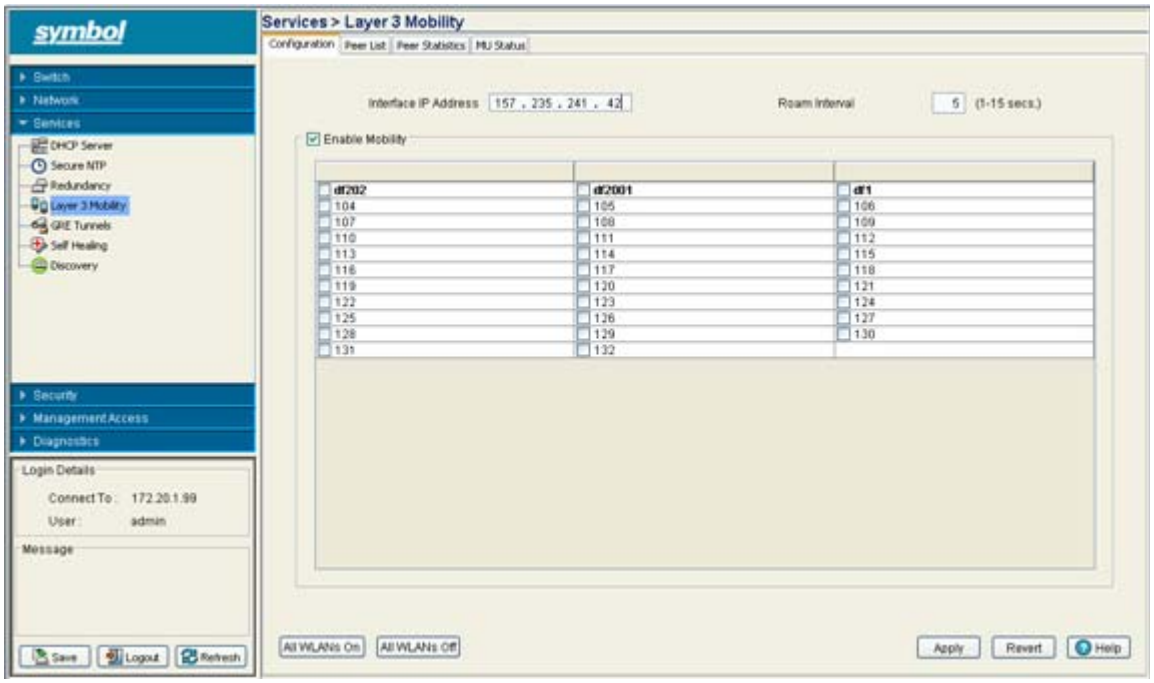
- Seamless MU roaming between switches on different Layer 3 subnets, while retaining the same IP address.
- Static configuration of mobility peer switches.
- Layer 3 support does not require any changes to the MU. In comparison, other solutions require special functionality and software on the MU. This creates numerous inter-working problems with working with MUs from different legacy devices which do not support Layer
- Support for a maximum of 20 peers, each handling up to a maximum of 500 MUs.
- A full mesh of GRE tunnels can be established between mobility peers. Each tunnel is between a pair of switches and can handle data traffic for all MUs (for all VLANs) associated directly or indirectly with the MU.
- Data traffic for roamed MUs is tunneled between switches by encapsulating the entire L2 packet inside GRE with a proprietary code-point.
- When MUs roam within the same VLAN (L2 Roaming), the behavior is retained by re-homing the MU to the new switch so extra hops are avoided while forwarding data traffic.
- MUs can be assigned IP addresses statically or dynamically.

- Forward and reverse data paths for traffic originating from and destined to MUs that have roamed from one L3 subnet to another are symmetric.

To configure Layer 3 Mobility for the switch:

1. Select **Services** > **Layer 3 Mobility** from the main menu tree.

   The **Layer 3 Mobility** screen appears with the Configuration tab displayed.



2. Carefully define the IP addresses used by the MUs roaming amongst different Layer 3 subnets within the **Interface IP Address** parameter.
3. Use the **Roam Interval** to define maximum length of time MUs within selected WLAN are allowed to roam amongst different subnets.
4. Refer to the table of WLANs and select the checkboxes of those WLANs you wish to enable Layer 3 mobility for.

   Once the settings are applied, these MUs within these WLANs will be able to roam amongst different subnets.
5. Select the **Enable Mobility** checkbox to enable a MU to maintain the same Layer 3 address while roaming throughout a multi-VLAN network.
6. Select the **All WLANs On** checkbox to enable mobility for each WLAN listed.

   If unsure you want to enable mobility for each WLAN, manually select just the few you want to enable.
7. Select the **All WLANs Off** checkbox to disable mobility for each WLAN listed.
8. Click the **Apply** button to save the changes made within this screen. Clicking Apply overwrites the previous configuration.
9. Click the **Revert** button to disregard any changes made within this screen and revert back to the last saved configuration.

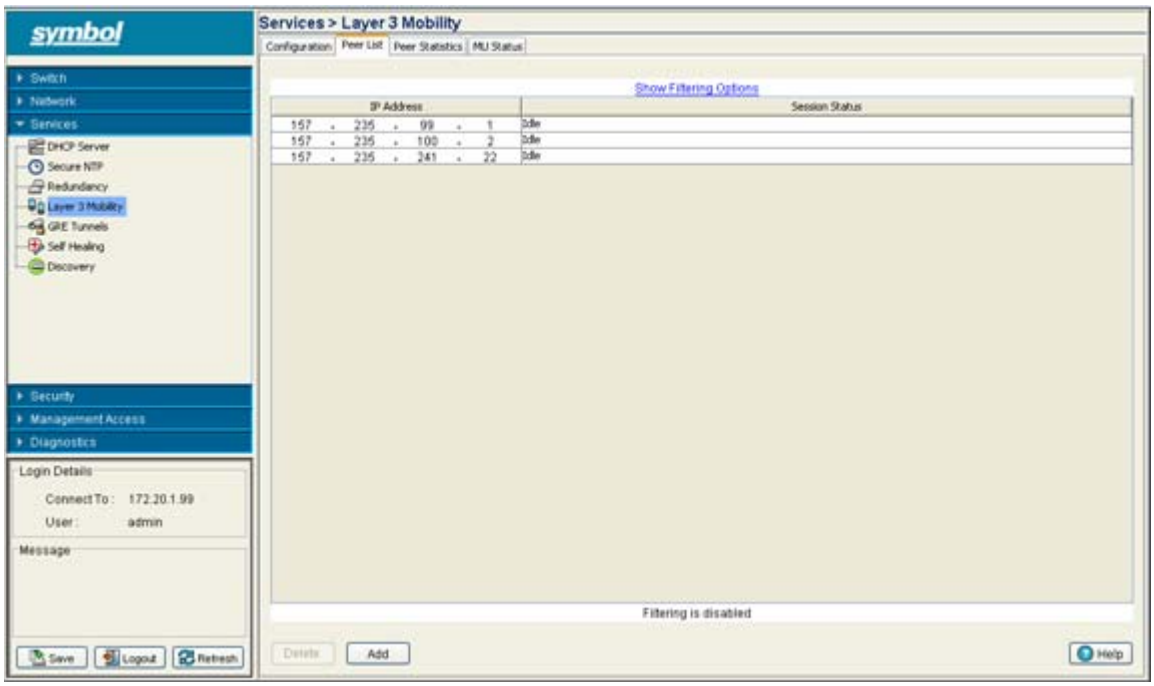
5.5.2 Defining the Layer 3 Peer List

The Layer 3 Peer List contains the IP addresses MUs are using to roam amongst various subnets. This screen is helpful in display the IP addresses available to the MUs requiring access to different subnet resources.

To define the Layer 3 Peer List:

1. Select **Services** > **Layer 3 Mobility** from the main menu tree.

   The **Layer 3 Mobility** screen appears with the Configuration tab displayed.
2. Select the **Peer List** tab.



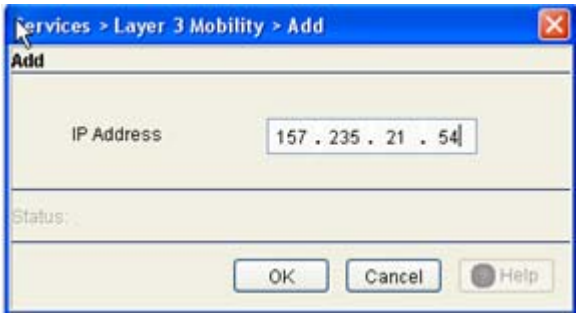
3. Refer to the **Filter Options** field to define IP addresses properties for the Peer List.

   Use the **contains** drop-down menu to define IP addresses with the following properties:

   - exactly matches - IP addresses must exactly match the entry made.
   - starts with - Define the beginning attributes for the IP address. Entries added to the Peer List must match these beginning attributes.
   - ends with - Define the ending attributes for the IP address. Entries added to the Peer List must match these ending attributes.
4. Refer to the contents of the Peer List table for the IP addresses and their Layer 3 MU session status.

   Use this information to determine whether a new IP address needs to be added to the list or an existing address needs to be removed.
5. Select an IP address from those deposed within the list of addresses and click the **Delete** button to remove the address from the list available for MU Layer 3 roaming amongst subnets.

6. Click the **Add** button to display a screen used for adding the IP address to the list of addresses available for MU Layer 3 roaming.



   Enter the IP addresses in the area provided and click the **OK** button to add the addresses to the list displayed within the **Peer List** screen.

5.5.3 Reviewing Layer 3 Peer List Statistics

When a MU roams to a current switch on the same layer 3 network, it sends a L2-ROAM message to the home switch to indicate the MU has roamed within the same VLAN. The old home switch forwards the information to all its peers. The MU is basically re-homed to the new current switch, but gets to keep its old IP address. The same procedure is followed even if the new current switch is on a different layer 3 subnet, but uses the same VLAN ID (overlapping VLAN scenario). However the MU must send a DHCP request again and obtain a new IP address.

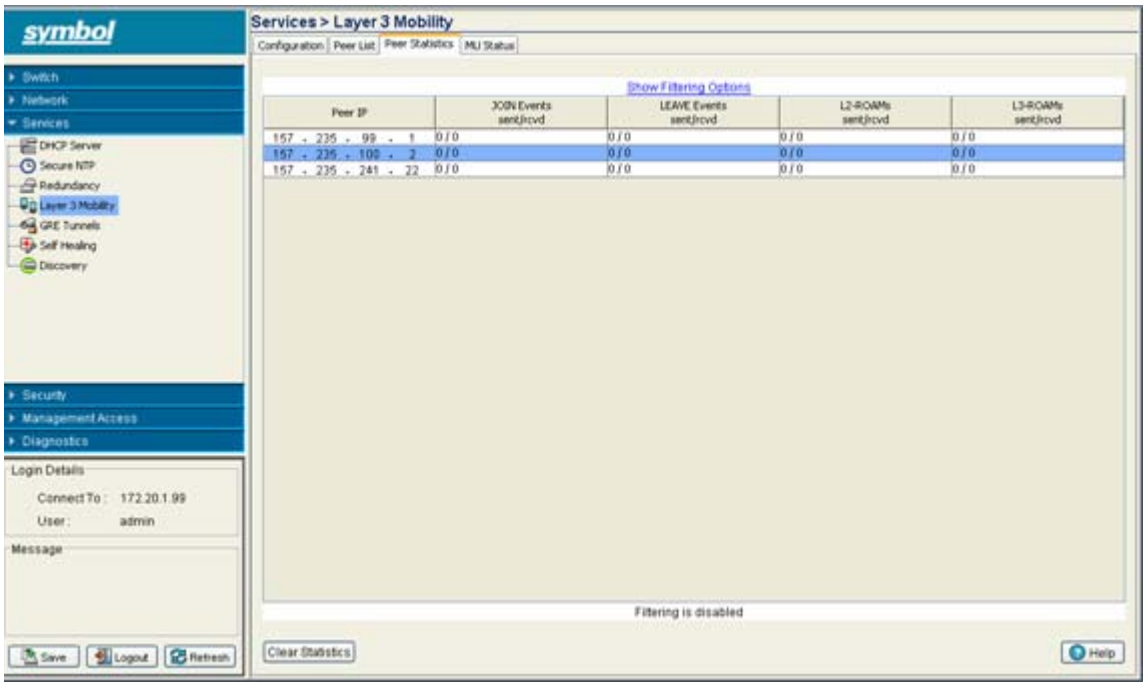
Tracking these message counts is important to gauge the behavior within the mobility domain.The Layer 3 Mobility screen contains a tab dedicated to tracking the message sent between the current switch, home switch and MU.

To view layer 3 peer statistics

1. Select **Services** > **Layer 3 Mobility** from the main menu tree.

   The **Layer 3 Mobility** screen appears with the Configuration tab displayed.

2. Select the **Peer Statistics** tab.



3. Refer to the following information within the Peer Statistics tab:

Peer IP	Displays the IP addresses of the peer switches within the mobility domain. Each peer can handle up to a maximum of 500 MUs.
JOIN Events sent/rcvd	Displays the number of JOIN messages sent and received. JOIN messages advertise the presence of MUs entering the mobility domain for the first time. When a MU (currently not present in the MU database) associates with a switch, it immediately sends a JOIN message to the host switch with the its MAC, VLAN and IP information (both current and home switch IP info). The home switch forwards the JOIN to all its peers, except the one from which it received the original message. JOIN messages are always originated by the current switch. JOIN messages are also used during the home switch selection phase to inform a candidate home switch about a MU. The current switch selects the home switch (based on its local selection mechanism) and sends a JOIN message to the home switch that is forwarded it to all its peers.
LEAVE Events sent/ rcvd	Displays the number of LEAVE messages sent and received. LEAVE messages are sent when the switch decides a MU originally present in the MU database is no longer present in the mobility domain. The criterion to determine the MU has actually left the network is implementation specific. The current switch sends the LEAVE message with the MU's MAC address information to the home switch, which eventually forwards the message to each mobility peer.

L2-ROAMs sent/rcvd Displays the number Layer 2 ROAM messages sent and received. When a MU roams to a new switch on a different layer 3 network (MU is mapped to a different VLAN ID), it sends a L3-ROAM message to the home switch with the new IP information for the current switch it is associated with. The L3-ROAM message is then forwarded by the home switch to each peer.

L3-ROAMs sent/rcvd Displays the number Layer 3 ROAM messages sent and received. When a MU roams to a new current switch on the same layer 3 subnet as the old current switch), it sends a L2-ROAM message to the old home switch with the new home switch-IP and current switch-IP information. This L2-ROAM message is then forwarded by the old home switch to each peer.

4. Click the **Clear Statistics** button to remove the data displayed for the selected peer IP address.

5.5.4 Reviewing Layer 3 MU Status

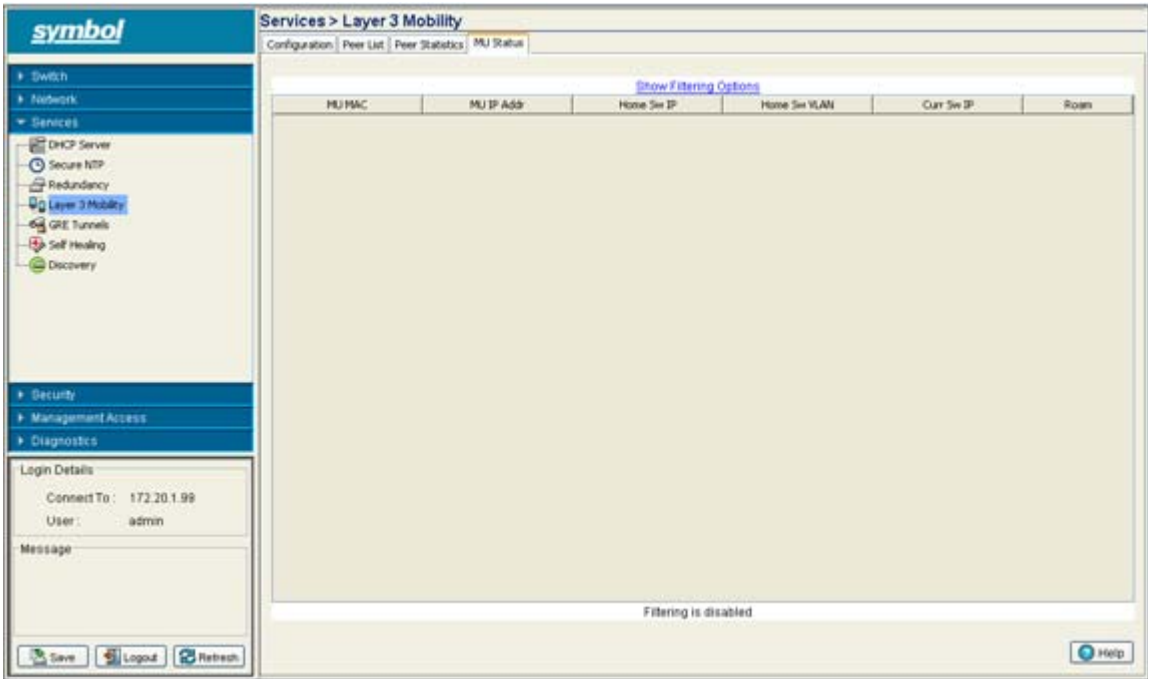
The Layer 3 Mobility **MU Status** tab displays a set of MU stats for associated MUs within the mobility domain. Use the MU status information to familiarize yourself with these MUs and their mobility-related parameters to distinguish new MUs entering the network from existing MUs roaming within the mobility domain.

To view Layer 3 mobility MU statistics

1. Select **Services** > **Layer 3 Mobility** from the main menu tree.

   The **Layer 3 Mobility** screen appears with the Configuration tab displayed.

2. Select the **MU Status** tab.



3. Refer to the following information within the MU Status tab:

MU MAC Displays the factory hardcoded MAC address of the MU. This value is set at the factory and cannot be modified. Thus, it should be consistent as the MU roams within the mobility domain.

MU IP Addr	Displays the IP address the MU is using within the mobility domain. Again, this may not be the IP address used by the MU for initial association with the switch, but it is the IP address set for the MU to roam amongst subnets. For more information, see *Configuring Layer 3 Mobility on page 5-34*.
Home Sw IP	Displays the MU's home switch IP address. This is the IP address of the switch the MU is initially associated with, before roaming across subnets as part of its layer 3 mobility activity.
Home Sw VLAN	Displays the MU's home switch VLAN identifier. This is the VLAN index value set for the MU when it was originally configured as part of a VLAN with its home switch.
Curr Sw IP	Displays the IP address of the switch the MU is currently associated to within the mobility domain.
Roam	Displays the number of times the MU has roamed to a different layer 3 subnet.

5.6 Configuring GRE Tunnels

Tunneling involves encapsulating a packet that supports one protocol within another packet, which may run on the same protocol or on a different protocol. It is generally used to support evolving networks, its capacity and security requirements. *Generic Routing Encapsulation* (GRE) is one of the many commonly used protocols for IP tunneling.

IP Tunneling allows network designers to implement policies like:

- Assigning routes to different types of traffic
- Assigning priority to different types of traffic
- Assigning security levels to different types of traffic

The advantages of using Tunnel include:

1. It provides communication between sub-network that have invalid or non-contiguous network addresses.
2. Multiple protocols types can be consolidated on a common backbone for reduced operational cost.
3. Assurance of privacy and security in shared networks that support multiple enterprise customers.

GRE is a multi protocol carrier and it encapsulates IP and other packets inside IP tunnel. In a GRE tunnel, a router at each side of the tunnel encapsulates protocol-specific packets in an IP header and creates a virtual point-to-point link to the routers at the other end of an IPcloud, where the IP header is stripped off. By connecting multi-protocol sub-networks in a single-protocol backbone environment, IP tunneling allows network expansion across a single-protocol backbone environment.

Generic Routing Encapsulation allows a newly created tunnel to pass traffic to the other end of the tunnel. This enables the network administrator access to traffic mapped to the GRE tunnel. The switch provides a path to tunnel all WLAN traffic to the other end of the tunnel. This enables network administrators to forward MU traffic to a remote network without modifying their network configuration and thereby enabling them to span their subnet across the intermediate network. Each GRE tunnel however, must be on a unique subnet to function properly.

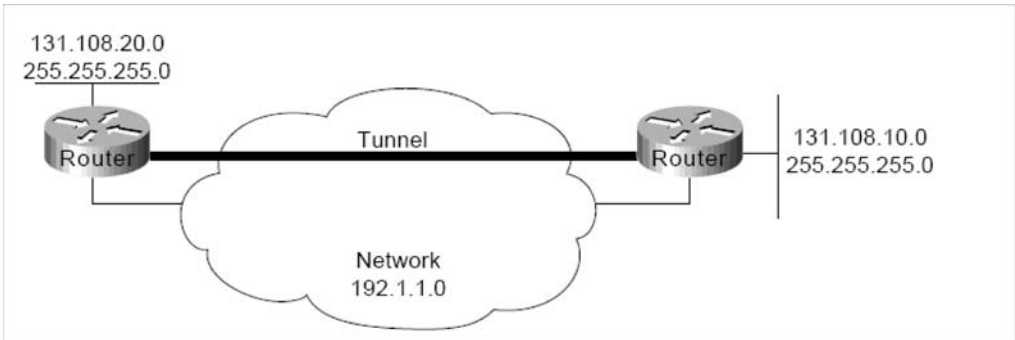
All data packets going from the configured WLAN to the GRE tunnel are forwarded to the mapped GRE tunnel using GRE encapsulation. The other end of the GRE tunnel is responsible for removing the GRE header and forwarding it to the destination IP.

The current implementation of GRE makes use of the management IP stack to route GRE encapsulated traffic. Encapsulation and decapsulation is done in the user space, which affects the performance of the switch. All the non-GRE packets continue to get forwarded as is.

GRE tunneling consists of three protocol types:

- Passenger—The protocol is encapsulated (IP)
- Carrier— GRE Protocol provides carrier services
- Transport—IP carries the encapsulated protocol.

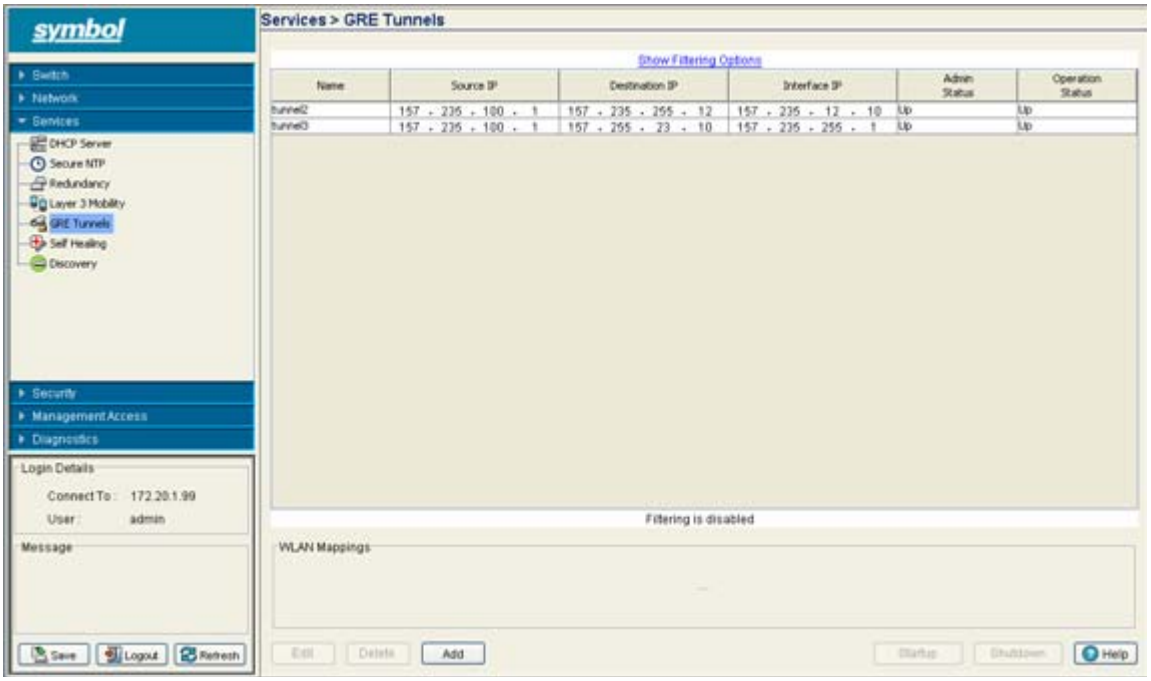
GRE tunneling allows desktop protocols to take advantage of the enhanced route selection capabilities of IP. With GRE Tunneling, it is possible for the two sub-networks of network 131.108.0.0 to talk to each other even though they are separated by another network.



To configure GRE tunnelling on the switch:

1. Select **Services** > **GRE Tunnels** from the main menu tree.

   The GRE Tunnels screen displays with existing GRE tunnels.



2. Refer to the top portion of the GRE Tunnels screen for the following information:

Name	Displays the names of each GRE tunnel defined for the switch.
Source IP	Displays the IP address where packets are originated by the switch and sent out through the tunnel interface. This defaults to the management VLAN's IP address.
Destinations IP	The destination IP address of the remote end of the GRE tunnel should be the default gateway for MUs that are associated on WLANs mapped to GRE tunnels. When the switch receives packets on the GRE tunnel interface, it first decapsulates the outer IP and GRE headers. An IP lookup is then performed on the destination IP of the inner IP packet using a MU table. If the lookup succeeds, the IP packet is encapsulated in an 802.11 frame (destined to the MU's MAC) and sent out on the WLAN port. If the lookup fails, the packet is dropped. Verify the gateway address has not been set to any VLAN interface used by the switch.
Interface IP	Displays the network IP address used to route GRE packets to their destination address.
Admin Status	Displays the status of a tunnel as either the active tunnel used currently for the switch or disabled.
Operation Status	Displays the status of tunnels as either the active (in use) or disabled.

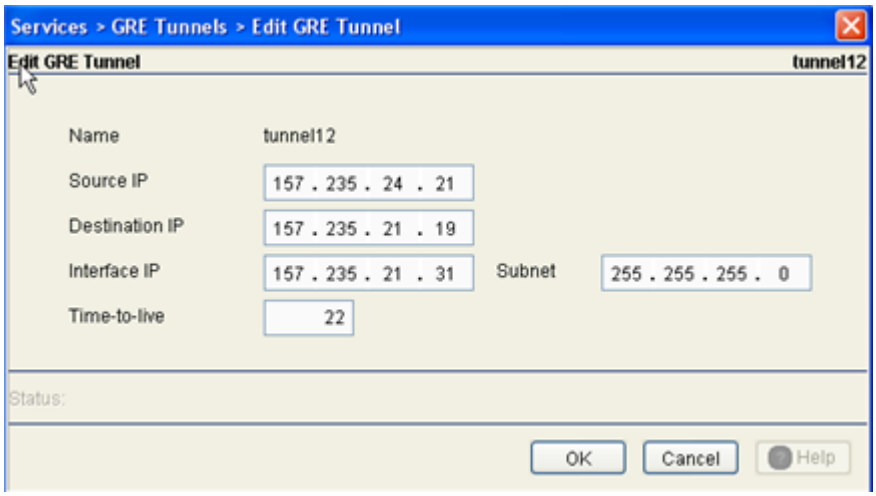
3. Highlight an existing tunnel and click the **Edit** button to modify the properties of an existing tunnel. For more information, see *Editing the Properties of a GRE Tunnel on page 5-43*.
4. Highlight an existing tunnel and click the **Delete** button to remove it from the list of tunnels available to the switch.
5. Click the Add button at the bottom of the screen to define the properties of a new tunnel. For more information, see *Adding a New GRE Tunnel on page 5-44*.
6. Highlight an existing tunnel and click the **Startup** button to make the selected tunnel active for the switch. Activating a new tunnel disables the previously enabled tunnel.
7. Highlight the active tunnel and click the **Shutdown** button to disable the selected tunnel.

5.6.1 Editing the Properties of a GRE Tunnel

Existing GRE tunnels can be selected and their properties modified as the source, end point or other existing tunnel information requires modification.

To edit the properties of an existing tunnel:

1. Select **Services** > **GRE Tunnels** from the main menu tree.
2. Highlight an existing tunnel and click the **Edit** button.



3. Refer to the following within the **Edit** screen and revise those properties necessary to re-create a functional tunnel

Name	Displays the read-only numerical name associated with the tunnel. To create a tunnel using a new name, you must click the Add button and configure a new GRE tunnel.
Source IP	Modify the IP address used in the src-IP field of the IP header when packets are originated by the switch and sent out through the tunnel interface. This would default to the management VLAN's IP address.
Destination IP	Traffic received on a GRE tunnel will be forwarded to MUs based on the Destination IP address defined.
Interface IP	Modify the network IP address (if necessary) used to route GRE packets to their destination address.
Subnet	Define the subnet address used to route GRE tunnel packets between end-points. Each GRE tunnel must have a unique subnet to function properly and independent of one another.
Time-to-live	Modify the period of time (in seconds) packets are kept alive between tunnel destinations. The defined interval ensures IP reachability between the tunnel end-points.

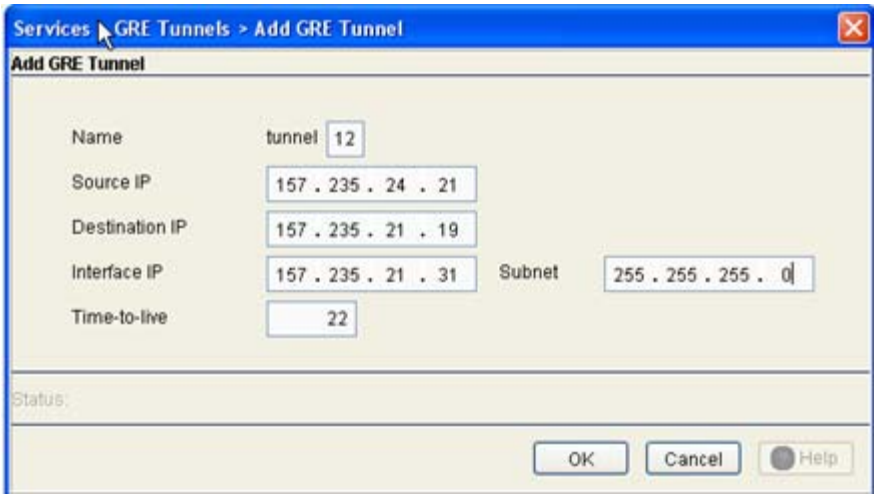
4. Click **OK** to save the contents of the screen and return to the main GRE Tunnels screen.
5. Click **Cancel** to exit the screen without updating the properties of the existing GRE tunnel.

5.6.2 Adding a New GRE Tunnel

If modifying an existing tunnel does not provide an adequate solution for your network, consider creating a new tunnel.

To create a new GRE tunnel:

1. Select **Services** > **GRE Tunnels** from the main menu tree.
2. Click the **Add** button from the bottom of the screen.



3. Configure the properties of the new GRE tunnel based on the following user-defined parameters.

Name	Define a numerical name for the tunnel.
Source IP	Define the IP address used in the src-IP field of the IP header when packets sent out through the tunnel interface.
Destination IP	Traffic received on a GRE tunnel will be forwarded to MUs based on this Destination IP address.
Interface IP	Define the network IP address used to route GRE packets to their destination address.
Subnet	Define the subnet address used to route GRE tunnel packets between end-points. Each GRE tunnel must have a unique subnet to function properly and independent of one another.
Time-to-live	Configure the period of time (in seconds) packets are kept alive between tunnel destinations. The defined interval ensures IP reachability between the tunnel end-points.

4. Click **OK** to save the contents of the screen and return to the main GRE Tunnels screen.
5. Click **Cancel** to exit the screen without updating the properties of the existing GRE tunnel.

5.7 Configuring Self Healing

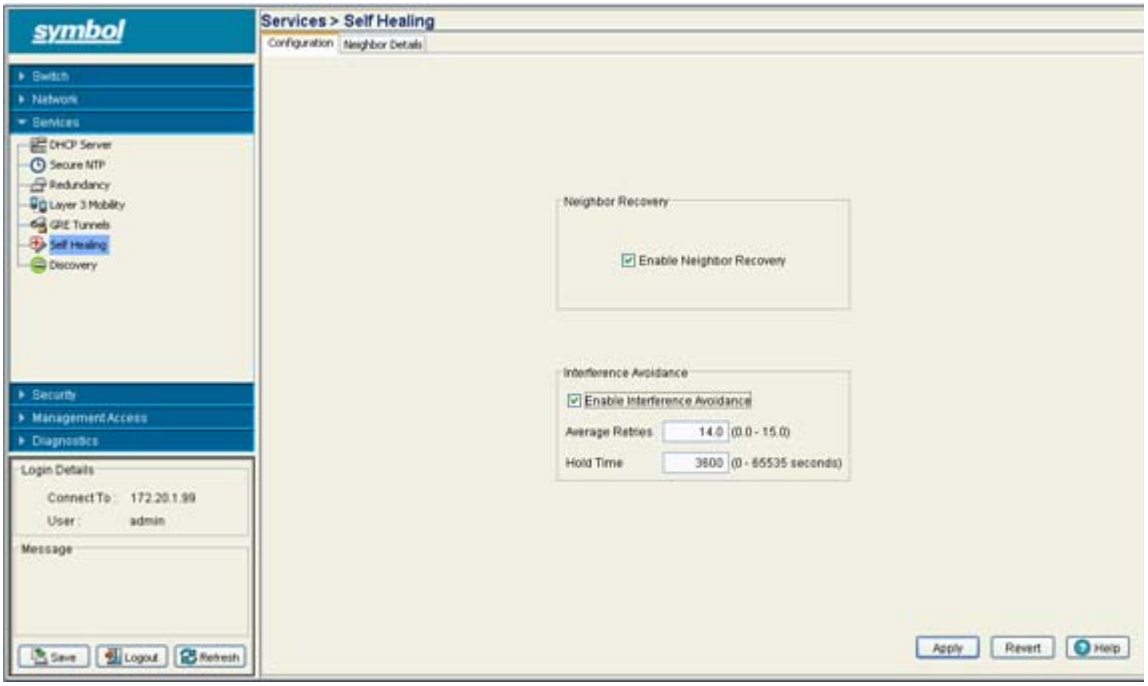
The switch supports a feature called Self Healing that enables radios to take action when one or more radios fail. To enable the feature the user must specify radio neighbors that would self heal if either one goes down. The neighbor radios do not have to be of the same type. Therefore, an 11bg radio can be the neighbor of a 11a radio and either of them can self heal when one of them fails.

The switch triggers the self healing action when it looses communication with the access port or when another radio (configured in detector mode) informs the switch a particular radio is not transmitting beacons.

To configure self-healing on the switch:

1. Select **Services** > **Self Healing** from the main menu tree.

   The Self Healing page launches with the **Configuration** tab displayed.



2. Select the **Enable Neighbor Recovery** checkbox.

   The Enable Neighbor Recovery checkbox is required to be selected to conduct manual neighbor detection.

3. Refer to the Interference Avoidance field to define the following settings:

Enable Interference Avoidance	Check the Enable Interference Avoidance box to enable the Interference Avoidance feature. The switch is capable of switching channels on an access port (Automatic Channel Selection) if the interference is observed on the current operating channel.
Average Retries	The Average Number of Retries is the average number of retries for a MU to communicate with a neighbor radio. Define a retry value between 0.0 and 15.0 retry attempts. The Average Retries is a threshold value, when exceeded ACS is initiated.

Hold Time — Set the interval (in seconds) that disables interference avoidance after detection. The hold time prevents the radio from re-running ACS continuously.

4. Click the **Apply** button to save the changes made within this screen. Clicking Apply overwrites the previous configuration.
5. Click the **Revert** button to disregard any changes made within this screen and revert back to the last saved configuration.

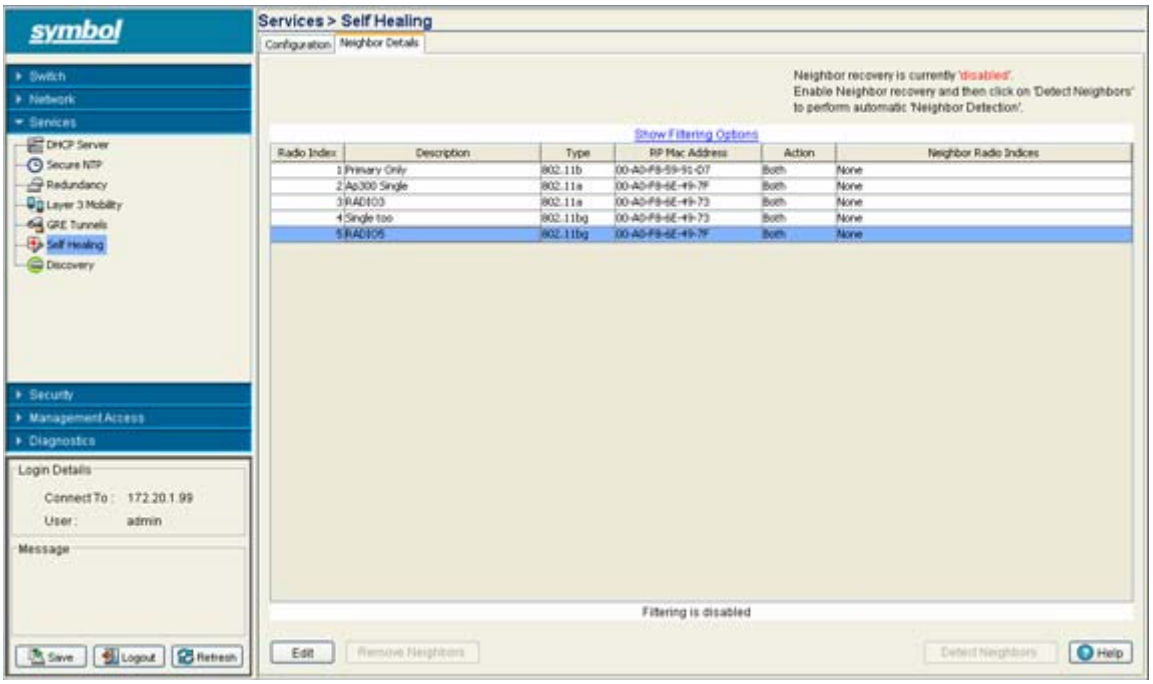
5.7.1 Configuring Self Healing Neighbor Details

The Neighbor Details page displays all the radios configured on the switch as well as their neighbors.

To configure self-healing on the switch:

1. Select **Services** > **Self Healing** from the main menu tree.

   The Self Healing page launches with the **Configuration** tab displayed.
2. Select the **Neighbor Details** tab.



The top right-hand corner of the screen displays whether the Neighbor recovery is currently enable or disabled. To change the state click the Enable Neighbor Recovery checkbox on the Self Healing Configuration screen.

3. Refer to the following information as displayed within the Neighbor Recovery screen.

   Radio Index — Displays a numerical identifier used (in conjunction with the radio's name) to differentiate the radio from its peers.

   Description — Displays an identifier used (in conjunction with the radio's index) to differentiate the radio from its peers.

   Type — Displays the radio as either a 802.11a or 802.11bg radio.

AP MAC Address	Displays the Ethernet MAC address of the access port. Use the Access Port MAC Address for the addition or deletion of the radio.
Action	Displays the self healing action configured for the radio. Options include: • Raise Power: The transmit power of the radio is increased when a neighbor radio is not functioning as expected. • Open Rates: Radio rates are decreased to support all rates when a neighbor radio is not functioning as expected. • Both: Increases power and increases rates when a neighbor radio is not functioning as expected. • None: No action is taken when a neighbor radio is not functioning as expected.
Neighbor Radio Index	Displays the indexes of the radio's neighbors.

4. Highlight an existing neighbor and click the **Edit** button to launch a screen designed to modify the self healing action and/or neighbors for the radio. For more information, see *Editing the Properties of a Neighbor on page 5-48*.
5. Select the **Remove Neighbors** button to remove all neighbors from the selected radio's neighbor list.
6. Click the **Detect Neighbors** button to auto-determine neighbors for the radios.

NOTE The **Detect Neighbors** button is enabled only when the **Enable Neighbor Recovery** checkbox is selected from within the Configuration tab. Ensure this option has been enabled before trying to detect neighbors manually.

Enabling this feature automatically makes each radio disassociate with their attached MUs, clear their current neighbor list and move into detection mode to detect neighboring radios.

Detect Neighbors only works properly if all the radios are configured and adopted. Starting the automatic neighbor detection feature disassociates all of the MUs and clears the current neighbor configuration.

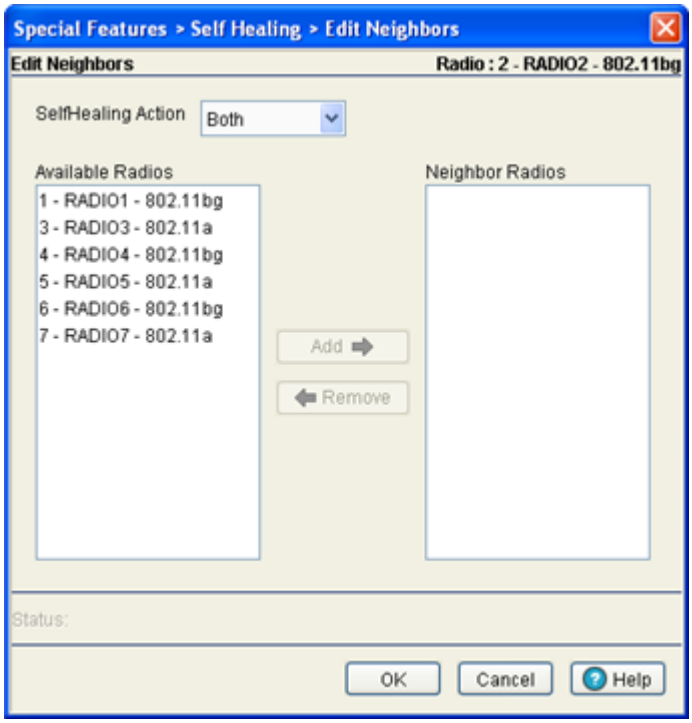
5.7.1.1 Editing the Properties of a Neighbor

Use the **Edit** screen to specify the neighbor of a selected radio and the action the radio performs in the event its neighbor radio fails.

To edit the properties of a neighbor:

1. Select **Services** > **Self Healing** from the main menu tree.

   The Self Healing page launches with the **Configuration** tab displayed.
2. Select the **Neighbor Details** tab.
3. Select an existing neighbor and click the **Edit** button.



   The radio index and description for the current radio display in the upper right corner of the screen. The **Available Radios** value represents the radios that can be added as a neighbor for the target radio. **Neighbor Radios** are existing radios (neighbors).
4. Select one of the following four actions from the Self Healing Action drop-down menu:
   - None: The radio takes no action at all when its neighbor radio fails
   - Open Rates: The radio will default to the factory-default rates when its neighbor radio fails.
   - Raise Power: The radio raises its transmit power to the maximum provided its power is lower than the maximum permissible value
   - Both: The radio will open its rates as well as raise its power
5. Click the **Add** button to move a radio from the Available Radios list to the Neighbor Radios list. Do this dedicate the neighbors for this radio.
6. Select a radio and click the **Remove** button to move a radio from Neighbor Radios list to Available Radios list.
7. Refer to the **Status** field for an update of the edit process.

The Status is the current state of the requests made from the applet. Requests are any "SET/GET" operation from the applet. The Status field displays error messages if something goes wrong in the transaction between the applet and the switch.

8. Click **OK** to save the changes to the running configuration and close the dialog.
9. Click **Cancel** to close the dialog without committing updates to the running configuration.

5.8 Configuring Switch Discovery

Switch discovery enables the SNMP discovery (location) of Symbol devices (running switch software version 3.0 or later). To discover devices in the specified range of IP addresses, the switch Web UI sends SNMP GET requests (using the user specified SNMP v2 or v 3 version) to all IP addresses of the specified network. If the value of the requested *object identifier* (OID) starts with Symbol enterprise OID the device is considered a Symbol device. The results of the discovery process are helpful for isolating devices compatible for operation within the locating switch, thus extending the potential coverage area and MU support base within the switch managed network.

Use the **Discovery Profiles** tab to view existing SNMP search profiles using a user defined range of IP addresses. Existing profiles can be modified or deleted and new profiles can be added as needed. Refer to the **Saved Devices** tab to view a table of devices discovered by the current discovery process. Each discovered device compatible with the locating switch is displayed in a shaded color to distinguish it from non-compatible devices.

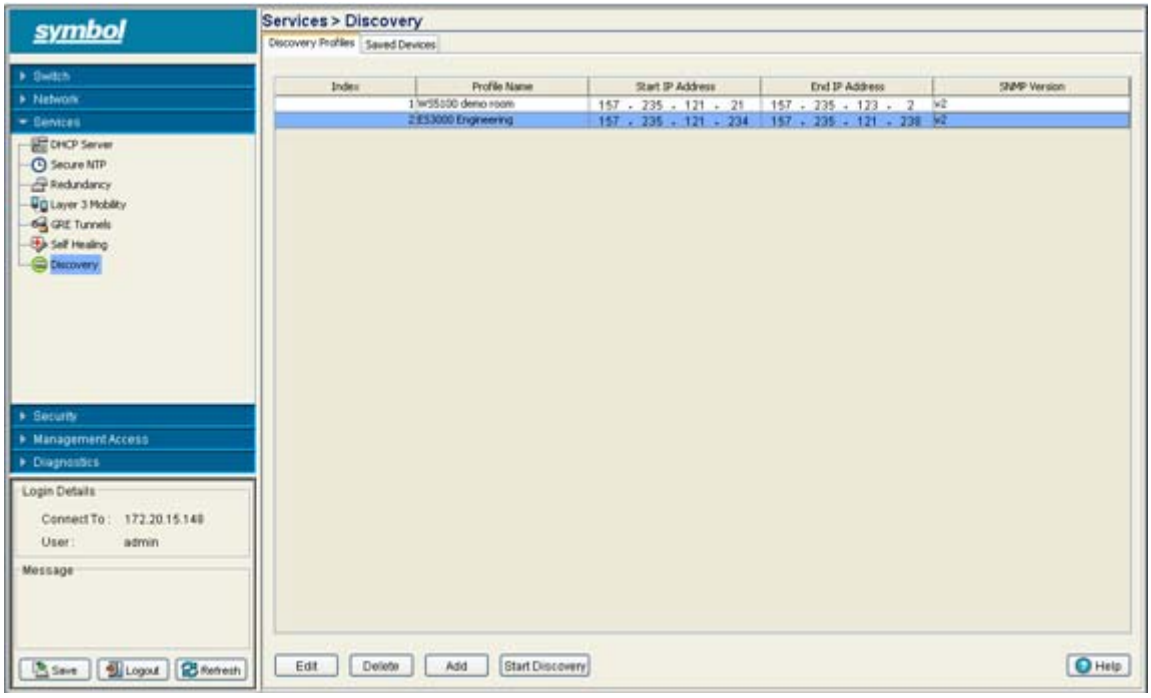
CAUTION Switch discovery can be a time consuming operation. However, the switch discovery operation is a standalone process. This allows users to perform other configuration operations when discovery is running in the background.

5.8.1 Configuring Discovery Profiles

To configure switch discovery:

1. Select **Services** > **Discovery** from the main menu tree.

The **Discovery** page launches with the **Discovery Profiles** tab displayed



2. Refer to the following information within the Discovery Profiles tab to discern whether an existing profile can be used as is, requires modification or deletion or if a new discovery profile is required.

Index	Displays the WEB UI supplied numerical identifier used to differentiate this profile from others with similar configurations. The index is supplied to new profiles sequentially.
Profile Name	Displays the user-assigned name used to title the profile. The profile name should associate the profile with the group of devices or area where the discovered devices are anticipated to be located.
Start IP Address	Displays the starting numeric (non DNS) IP address from where the search for available network devices is conducted.
End IP Address	Displays the ending numeric (non DNS) IP address from where the search for available network devices is conducted
SNMP Version	Displays the version of the SNMP (either SNMP v2 or v3) used for discovering available network devices.

3. Select an existing profile and click the **Edit** button to modify the profile name starting and ending IP address and SNMP version. Symbol recommends editing a profile only if some of its attributes are still valid, if the profile is obsolete, delete it and create a new one.
4. Selecting an existing profile and click the **Delete** button to remove this profile from the list of available profiles available for device discovery.
5. Click the Add screen to display a screen used to define a new switch discovery profile. For more information, see *Adding a New Discovery Profile on page 5-51*.
6. Click the **Start Discovery** button to display a **Read Community String** (SNMP v2) or V3 **Authentication** (SNMP v3) screen.

Storing SNMP credentials as a string within switch's discovery profile table (SNMP table) can compromise switch security. Therefore, when Start Discovery is selected, the switch prompts the user to verify their SNMP credentials against the SNMP credentials of discovered devices. SNMP v2 and v3 credentials must be verified before the switch displays the discovered devices within the Saved Devices table.

If SNMP v2 is used with a discovering profile, a **Read Community String** screen displays.The Community String entered is required to match the name used by the remote network management software of the discovered switch.

If SNMP v3 is used with a discovering profile, a **V3 Authentication** screen displays.The USer Name and Password entered is required to match the name used by the remote network management software of the discovered switch

When the credentials of the V2 Read Community or V3 Authentication screens are satisfied, the switch discovery process begins.

7. If necessary, click the **Stop Discovery** button (enabled only during the discovery operation) to stop the discovery operation.

5.8.1.1 Adding a New Discovery Profile

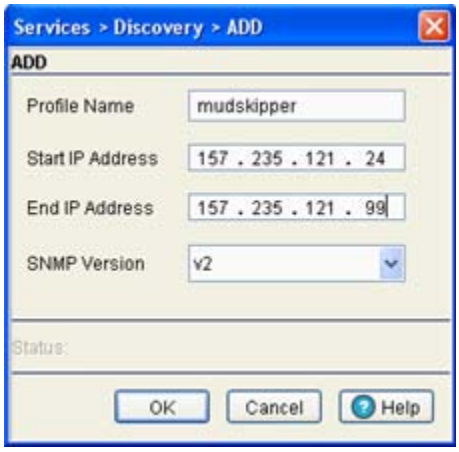
If the contents of an existing profile are to longer relevant enough to warrant modification using the Edit function, then a new switch discovery profile should be created.

To create a new switch discovery profile:

1. Select **Services** > **Discovery** from the main menu tree.

   The **Discovery** page launches with the **Discovery Profiles** tab displayed.

2. Click the **Add** button at the bottom of the screen.



3. Define the following parameters for the new switch discovery profile:

Profile Name	Define a user-assigned name used to title the profile. The profile name should associate the profile with the group of devices or area where the discovered devices are anticipated to be located.
Start IP Address	Enter the starting numeric (non DNS) IP address from where the search for available network devices is conducted.
End IP Address	Enter the ending numeric (non DNS) IP address from where the search for available network devices is conducted
SNMP Version	Use the SNMP Version drop-down menu to define the version of the SNMP (either SNMP v2 or v3) used for discovering available network devices.

4. Refer to the **Status** field for an update of the edit process.

   The Status is the current state of the requests made from the applet. Requests are any "SET/GET" operation from the applet. The Status field displays error messages if something goes wrong in the transaction between the applet and the switch.
5. Click **OK** to save the changes to the running configuration and close the dialog.
6. Click **Cancel** to close the dialog without committing updates to the running configuration.

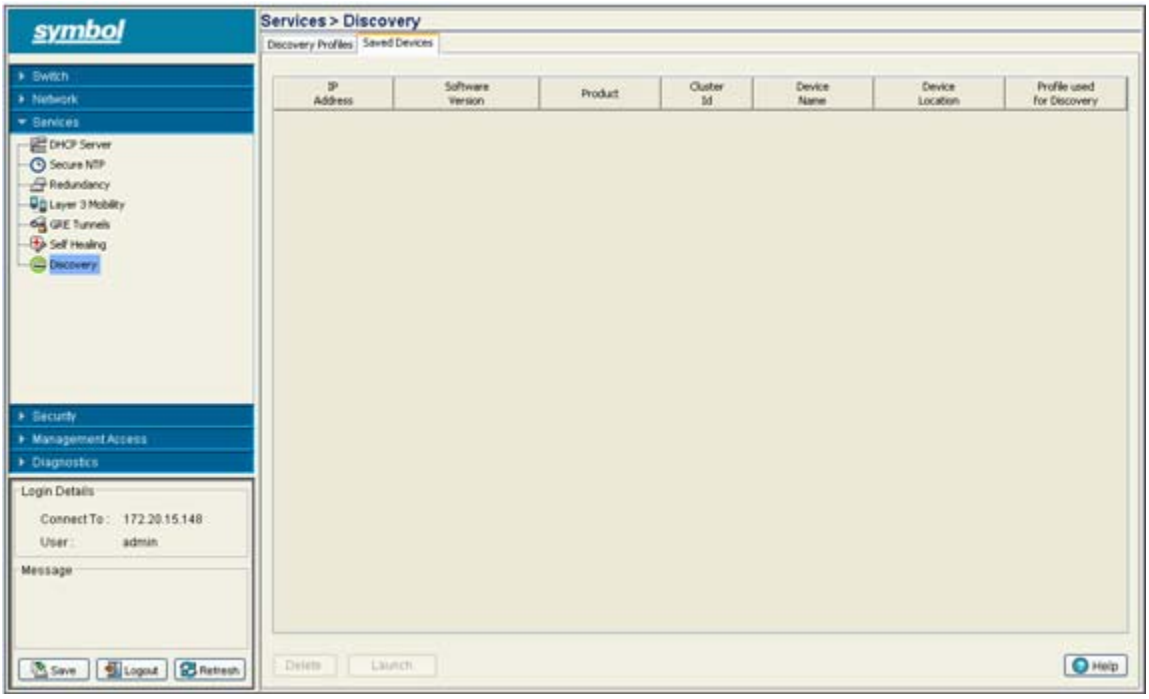
5.8.2 Viewing Discovered Switches

Refer to the **Saved Devices** tab to view a table of those devices discovered by the current discovery process. Each discovered device compatible with the locating switch (running switch software version 3.0 or higher) is displayed in a shaded color to distinguish it from non-compatible devices. The switch Web UI enables users display the Web UI of the discovered device in a separate browser window.

To view the devices located by the switch:

1. Select **Services** > **Discovery** from the main menu tree.

   The **Discovery** page launches with the **Discovery Profiles** tab displayed.
2. Select the **Saved Devices** tab.



3. Refer to the following information within the Saved Devices tab to discern whether a located device should be deleted from the list or selected to have its Web UI launched and its current configuration modified.

IP Address	Displays the IP address of the discovered switch. This IP address obviously falls within the range of IP addresses specified for the discovery profile used for the device search. If the IP addresses displayed do not meet your search expectations, consider creating a new discovery profile and launching a new search.
Software Version	Displays the software version running on the discovered device.
Product	Displays the name of the device discovered by the device search. If the list of devices discovered is unsatisfactory, consider configuring a new discovery policy and launching a new search.
Cluster ID	If the discovered device is part of a cluster (redundancy group), its cluster ID displays within this column. For the WS5100 (version 3.0) switch, the Redundancy ID would have been assigned using the Switch > Redundancy screen.
Device Name	Displays the device name assigned to the discovered device. For the WS5100 (version 3.0) switch, this name would have been assigned using the Switch > Configuration screen.
Device Location	Displays the device location defined to the discovered device. For the WS5100 (version 3.0) switch, the location would have been assigned using the Switch > Configuration screen.

Profile used for Discovery	Displays the profile selected from within the Discovery Profiles tab and used with the Start Discovery function to discover devices within the switch managed network. If the group of devices discovered and displayed within the Saved Devices tab does not represent the device demographic needed, consider going back to the Discovery Profiles tab and selected a different profile for the switch discovery process.

4. If a discovered switch is of no interest, select it from amongst the discovered devices displayed and click the **Delete** button.

   Once removed, the located device cannot be selected and its Web UI displayed.

5. Select a discovered device from amongst those located and displayed within the Saved Devices screen and click the **Launch** button to display the Web UI for that switch.

CAUTION When launching the Web UI of a discovered device, take care not to make configuration changes rendering the device ineffective in respect to the purpose of its current configuration.

6

Switch Security

This chapter describes the security mechanisms available to the switch. This chapter includes the following:

NOTE HTTPS must be enabled to access the switch applet. Ensure that HTTPS access has been enabled before using the login screen to access the switch applet.

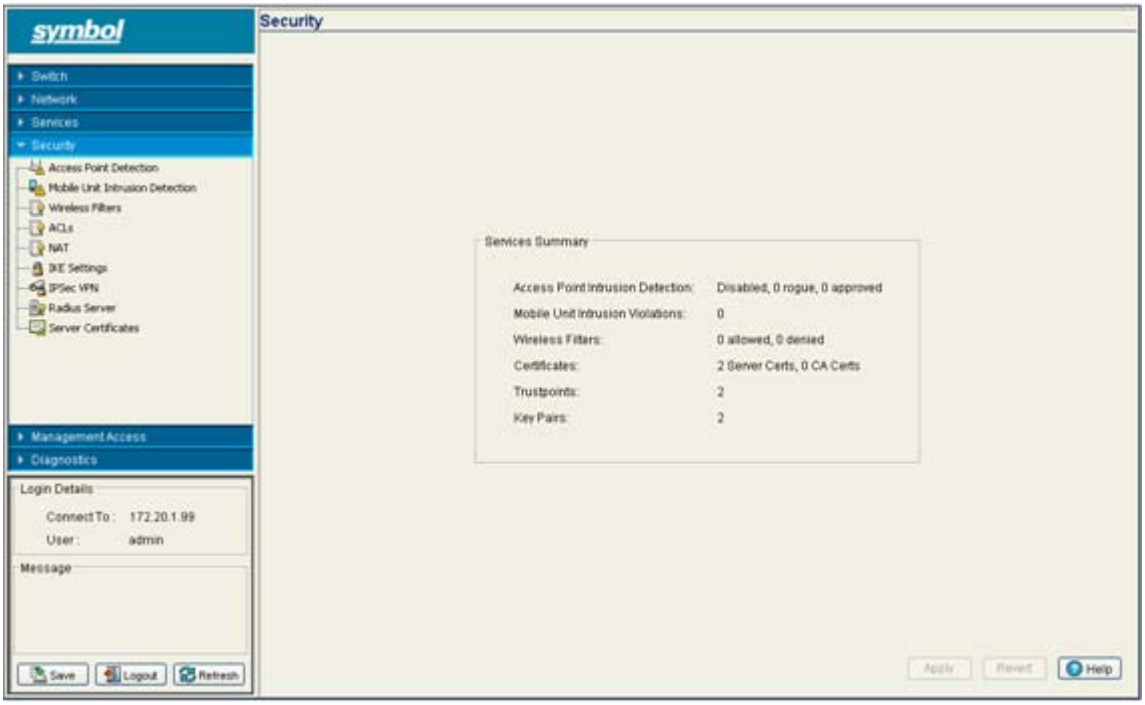
6.1 Displaying the Main Security Interface

Refer to main menu **Security** interface for a high level overview of the state of several device intrusion and switch access permission options.

NOTE When the switch's configuration is successfully updated (using the Web UI), the effected screen is closed without informing the user their change was successful. However, if an error were to occur, the error displays within the effected screen's Status field and the screen remains displayed. In the case of file transfer operations, the transfer screen remains open during the transfer operation and remains open upon completion (with status displayed within the Status field).

To view main menu security information:

1. Select **Security** from the main menu tree.



2. Refer to the following information to discern if configuration changes are warranted:

Access Port Intrusion Detection	Displays the Enable or Disable state of the switch to detect potentially hostile access ports (the definition of which defined by you). Once detected, these devices can be added to a list of devices either approved or denied from interoperating within the switch managed network. For more information, see *Configuring AP Detection*.
Mobile Unit Intrusion Detection	Displays the state of the switch protecting against threats from MUs trying to find network vulnerabilities. For more information, see *Configuring MU Intrusion Detection*.
Wireless Filters	Displays the state of the current filters used to either allow or deny a MAC address (or groups of MAC addresses) from associating with the switch. For more information, see *Configuring Wireless Filters*.

The **Apply** and **Cancel** buttons are greyed out within this screen, as there is no data to be configured or saved.

6.2 Configuring AP Detection

Use the **Internet Protocol** sub-menu to view and configure network related IP information. The Internet Protocol screen consists of the following tabs:

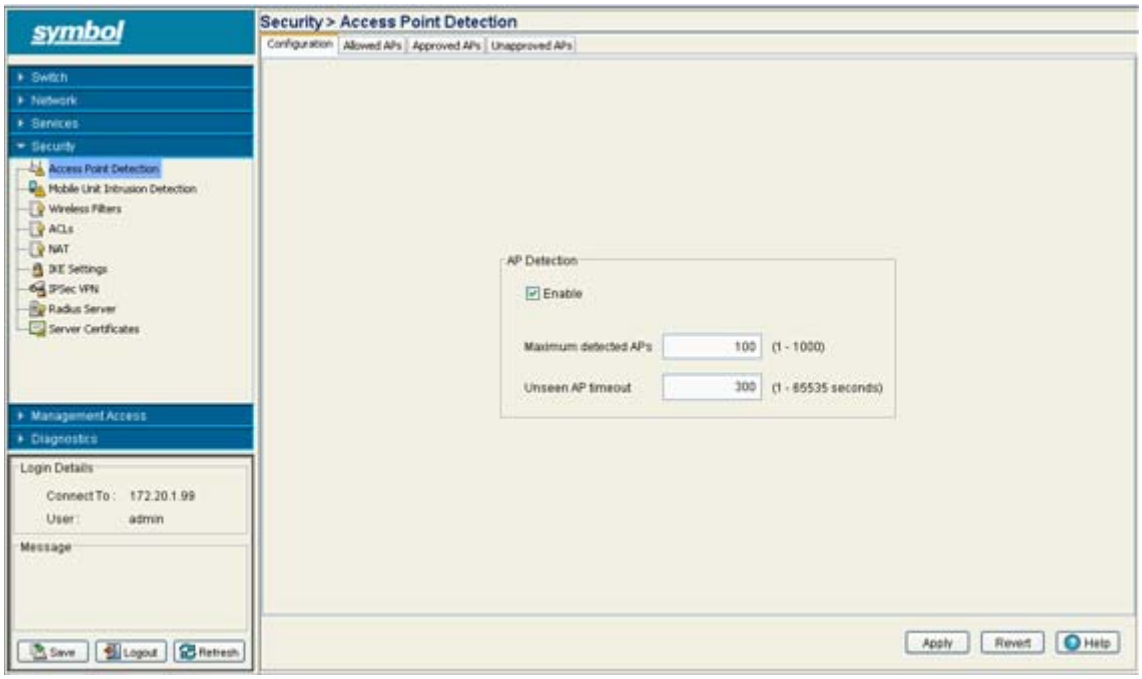
- *Enabling and Configuring AP Detection*
- *Configuring Allowed APs*
- *Configuring Approved APs*
- *Configuring Unapproved APs*

6.2.1 Enabling and Configuring AP Detection

Use the **Configuration** screen to enable the switch to detect potentially hostile devices, set the number of detected APs allowed and define the timeout and threshold values used.

To configure AP Detection:

1. Select **Security** > **Access Port Intrusion Detection** from the main menu.
2. Select the **Configuration** tab.



3. Refer to the **AP Detection** field to reference the following information:

Enable	Select the **Enable** checkbox to enable the switch to detect potentially hostile devices (the definition of which defined by you). Once detected, these devices can be added to a list of devices either approved or denied from interoperating within the switch managed network.
Maximum detected APs	Use the **Maximum detected APs** parameter to enter a maximum number of devices that can be detected as potentially hostile devices. The range is from 1-1000 devices, with a default of 100. Select a higher number if the timeout value is low, as devices will be removed from the list of devices "seen" on the network.

Unseen AP timeout Define a value (in seconds) the switch uses to remove devices that have not communicated with the switch. The range is from 1-65535 seconds, with a default of 300 seconds.

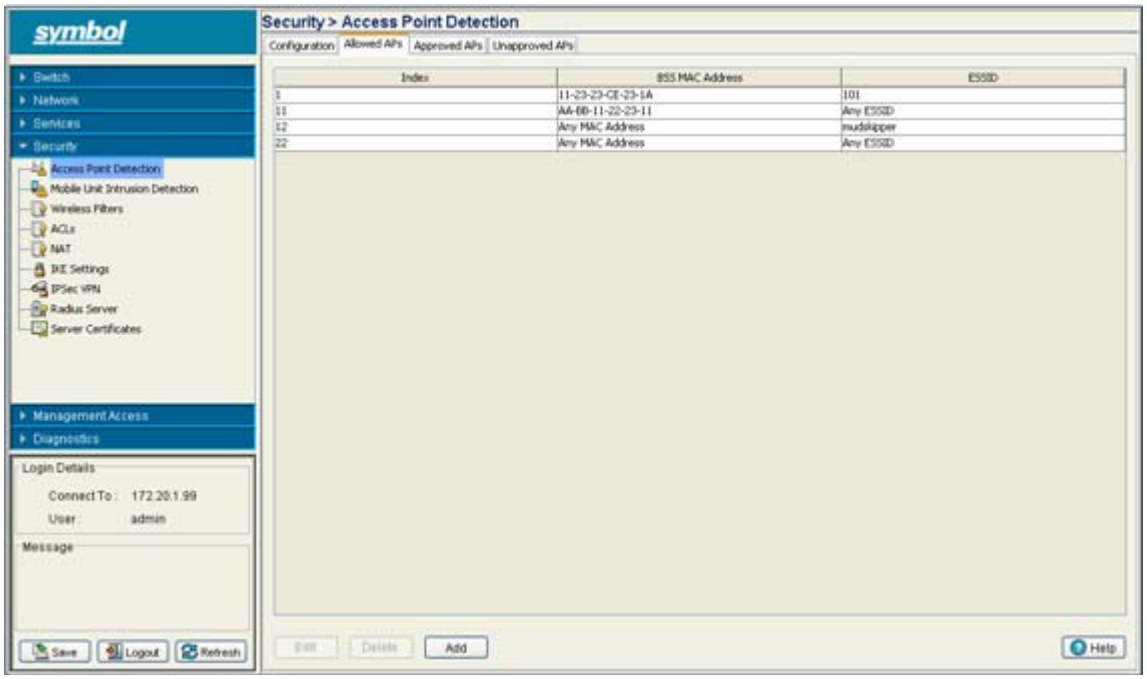
4. Click the **Apply** button to save the changes made to within the screen.
5. Click the **Revert** button to cancel any changes made within the screen and revert back to the last saved configuration.

6.2.2 Configuring Allowed APs

Use the **Allowed APs** tab to view the policies used for interpreting allowed devices within the switch managed network.

To view Allowed AP policy details:

1. Select **Security** > **Access Port Intrusion Detection** from the main tree menu.
2. Select the **Allowed APs** tab.



3. Refer to the **Allowed APs** table to reference the following information:

Index Displays the numerical identifier (index value) assigned to this particular set of Allowed AP parameters. Assign this value by clicking **Add** for a new set of devices address information or click the Edit button to revise the index. The Index can be used as reference to group specific devices numerically to a specific range of MAC or SSID addresses. This user cannot modify the index from this screen.

BSS MAC Address	Displays the MAC address of the Allowed AP(s). The MAC addresses displayed in the Allowed APs screen are defined by clicking the **Add** button and entering a specific MAC address or a by allowing all MAC addresses to be allowed. The list of MAC addresses allowed can be modified by highlighting an existing entry, clicking the **Edit** button and revising the properties of the MAC address.
ESSID	Displays the ESSIDs of the Allowed AP(s). The addresses displayed in the Allowed APs screen are defined by clicking the **Add** button and entering a specific MAC address or a by allowing all MAC addresses to be allowed. The list of MAC addresses allowed can be modified by highlighting an existing entry, clicking the **Edit** button and revising the properties of the MAC address.

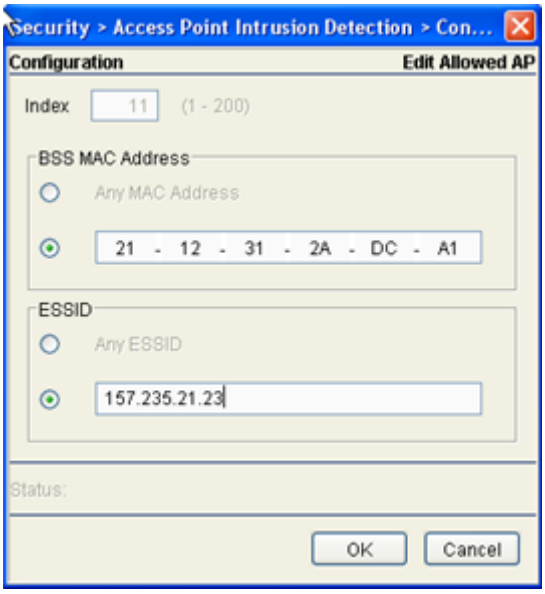
4. Use the **Filtering Option** to view the details displayed in the table.
5. Select an Allowed AP and click the **Edit** button to launch a screen used to modify the index and SSID of the AP. For more information, see *Editing Allowed APs on page 6-6*.
6. Select an Allowed AP and click the **Delete** button to remove the AP from list of Allowed APs.
7. Click the **Add** button to display a screen used to enter device information for a new AP to be added to the Allowed AP list. For more information, see *Adding a New AP on page 6-7*.

6.2.2.1 Editing Allowed APs

To modify the address range used to designate devices as Allowed APs.

1. Select an AP, whose configuration you wish to modify from the table.
2. Click the **Edit** button from within the **Access Port Intrusion Detection** screen.

   A **Edit Allowed APs Configuration** screen used to can edit the Allowed AP configuration.



   The **Index** displays a numerical index used to associate a numerical value with a group of addresses allowed to interoperate with the switch. This is a read only field and cannot be modified.

3. Refer to the **BSS MAC Address** field for the following information:

Any MAC Address / Specific MAC Address	Click the **Any MAC Address** radio button to allow any MAC address located on the network as an Allowed AP. This is not necessary if a specific MAC address is used with this particular index. Click the second radio button to enter a specific MAC address as an Allowed AP. Use this option if (for network security) you want to restrict the number of MAC Addresses used for this index to a single MAC address.

4. Refer to the **ESSID** field for the following:

Any ESSID / Specific ESSID	Click the **Any ESSID** radio button to allow any SSID located on the network as an Allowed AP. This may not be necessary if a specific ESSID was used with this particular index. Click the second radio button to enter a specific SSID as an Allowed AP. Use this option if (for network security) you want to restrict the number of device SSIDs saved for this index to a single SSID.

5. Refer to the **Status** field for the current state of the requests made from applet. This field displays error messages if something goes wrong in the transaction between the applet and the switch.
6. Click **OK** to use the changes to the running configuration and close the dialog.
7. Click **Cancel** to close the dialog without committing updates to the running configuration.

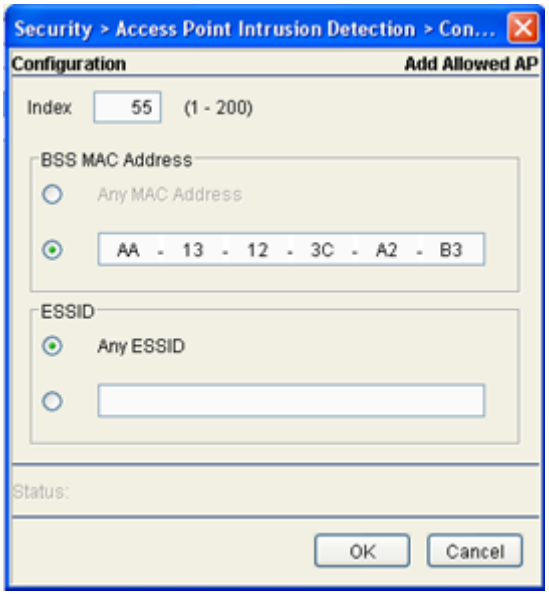
6.2.2.2 Adding a New AP

The option exists to add devices to a list of devices approved for operation with the switch. Adding a device entails defining an index (numerical identifier) for the Allowed device as well as specifying the address range of those devices interpreted as approved.

To add a device:

1. Click the **Add** button from within the **Access Port Intrusion Detection** screen.

The **Add Allowed APs Configuration** screen displays.



2. Use the **Index** parameter to assign a numerical index value to this particular list of devices.

   The index range is from 1-200. The Index can be used as reference value to group specific devices numerically to a specific range of allowed MAC or SSID addresses.

3. Refer to the **BSS MAC Address** field for the following:

Any MAC Address / Specific MAC Address	Click the **Any MAC Address** radio button to allow any MAC address located on the network as an Allowed AP. This may be an option when transmitting in a very secure environment wherein all devices are known to the switch. Click the second radio button to enter a specific MAC address as an Allowed AP. Use this option when transmitting in a less secure environment and (in the interest of security) devices are required to be added individually to the list of Allowed APs.

4. Refer to the **ESSID** field for the following:

Any ESSID / Specific ESSID	Click the **Any ESSID** radio button to allow any SSID located on the network as an Allowed AP. This may not be necessary if a specific ESSID was used with this particular index and the network segment (associated with this index) is now full of devices viewed as Allowed APs. Click the second radio button to enter a specific SSID as an Allowed AP. Use this option if (for network security) you want to restrict the number of device SSIDs for this index to a single SSID.

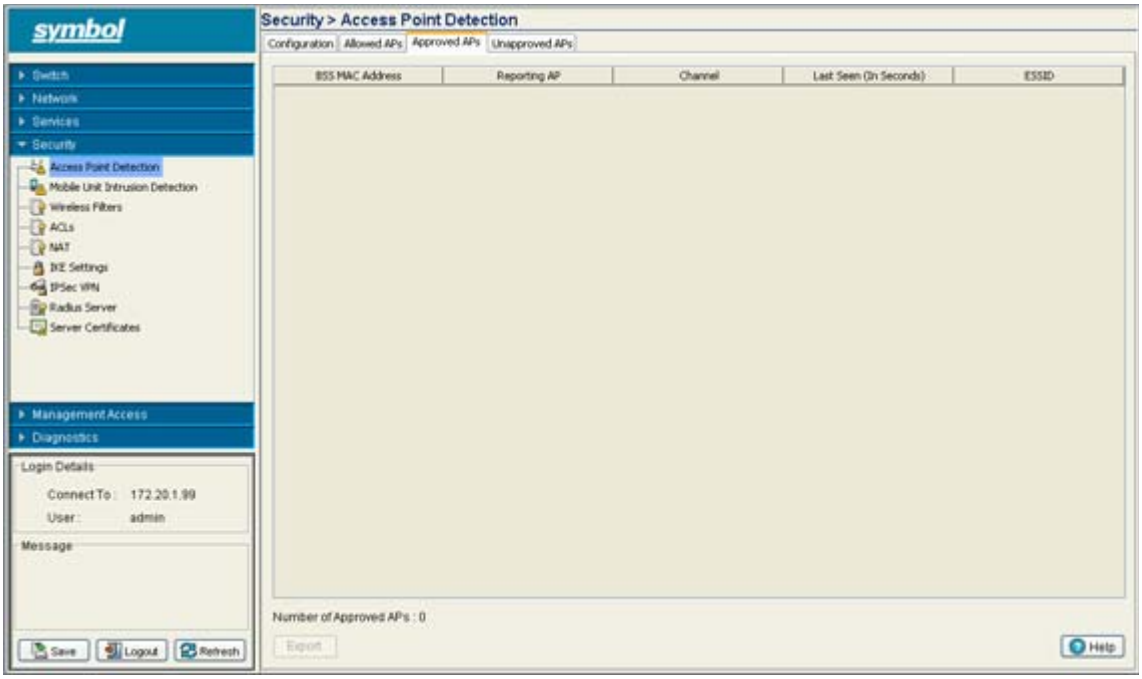
5. Refer to the **Status** field for the current state of the requests made from applet. This field displays error messages if something goes wrong in the transaction between the applet and the switch.
6. Click **OK** to use the changes to the running configuration and close the dialog.
7. Click **Cancel** to close the dialog without committing updates to the running configuration.

6.2.3 Configuring Approved APs

Use the Approved APs tab to review those APs detected and approved for operation within the switch managed network. There are no configuration activities required within the Approved APs tab.

To view Approved APs details:

1. Select **Security** > **Access Port Intrusion Detection** from the main menu tree.
2. Click the **Approved APs** tab.



3. The **Approved APs** tab displays the current read-only configuration for the uplink and downlink ports. The table within the screen displays the following information:

BSS MAC Address	Displays the MAC Address of each Approved AP (as defined using the Allowed APs **Add** and/or **Edit** functions). If looking for a specific Allowed AP MAC Address and it is not displayed, ensure the MAC Address has been configured as an Allowed AP by clicking the Allowed APs tab. Up to 1000 device MAC Addresses can be displayed.
Reporting AP	Displays the numerical value for the radio (802.11a, b or g) used with the specific device MAC Address and SSID listed for this Approved AP.
Channel	Displays the channel the Approved AP is currently transmitting on. Devices are required to be on the same channel to interoperate.
Last Seen (In Seconds)	Displays the time (in seconds) the Approved AP was last seen on the network.

ESSID	Displays the SSID of each Approved AP (as defined using the Allowed APs **Add** and/or **Edit** functions). If looking for a specific Allowed AP SSID and it is not displayed, ensure the SSID has been configured as an Allowed AP by clicking the Allowed APs tab and either adding the SSID to a new Allowed AP index or by selecting an existing index and clicking the Edit button to add the SSID to the list of Allowed SSIDs for that index.

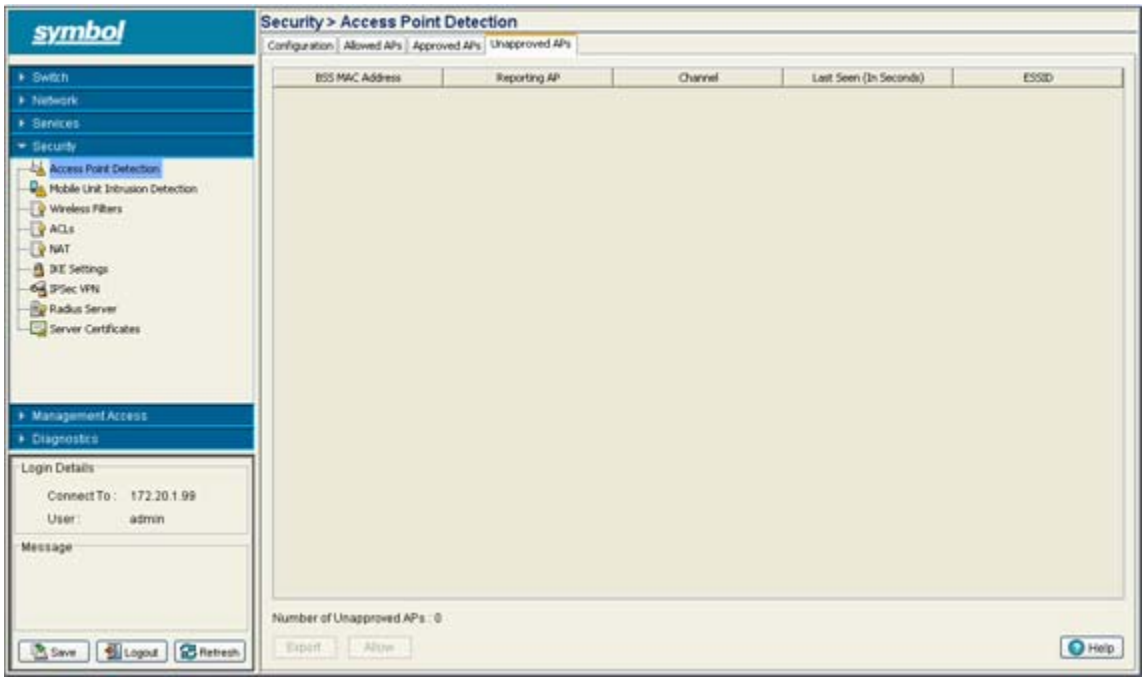
4. The number at the bottom of the screen defines the **Number of Approved APs** within the screen designated as approved for operation within the network.
5. Click on the **Export** button to export the contents of the table to a Comma Separated Values file (CSV).

6.2.4 Configuring Unapproved APs

Use the Unapproved APs tab to review those APs detected and restricted from operation within the switch managed network. There are no configuration activities required within the Unapproved APs tab.

To view Unapproved APs:

1. Select **Security** > **Access Port Intrusion Detection** from the main menu tree.
2. Click on the **Unapproved APs** tab.



3. The **Unapproved APs** tab displays the current read-only configuration for the uplink and downlink ports. The table displays the following information:

BSS MAC Address	Displays the MAC Address of each Unapproved AP. These MAC Addresses are devices observed on the network, but have yet to be added to the list of Approved APs and are therefore interpreted as a threat on the network. If a MAC Address displays on the list incorrectly, click the **Allowed APs** tab and either add the MAC Address to a new Allowed AP index or select an existing index and click the Edit button to add the MAC Address to the list of Allowed MAC Addresses for the index.
Reporting AP	Displays the numerical value for the radio (802.11a, b or g) used with the specific device MAC Address and SSID listed for this Unapproved AP.
Channel	Displays the channel the Unapproved AP is currently transmitting on. If this device is operating on a channel not frequently used within your network segment, then perhaps the device is correctly defined as an Unapproved AP.
Last Seen (In Seconds)	Displays the time (in seconds) the Unapproved AP was last seen on the network.
ESSID	Displays the SSID of each Unapproved AP. These SSIDs are device SSIDs observed on the network, but have yet to be added to the list of Approved APs and are therefore interpreted as a threat. If an SSID displays on the list incorrectly click the **Allowed APs** tab and either add the SSID to a new Allowed AP index or select an existing index and click the Edit button to add the SSID to the list of approved SSIDs for that index.

4. The **Number of Unapproved APs** is simply the sum of all of Unapproved Radio MAC Addresses detected.
5. If a Radio MAC address is listed incorrectly, highlight the Radio MAC Address and click the **Allow** button.

   Assign an Index and complete the required device address information to move the device into the list of Approved Radio MAC Addresses. The number of Unapproved APs updates accordingly as devices are added and removed.
6. Click on the **Export** button to export the contents of the table to a Comma Separated Values file (CSV).

6.3 Configuring MU Intrusion Detection

Unauthorized attempts to access the switch managed LAN by MUs is a significant threat to the network. The switch can protect against threats from MUs trying to find network vulnerabilities. Basic forms of this behavior can be monitored and reported.

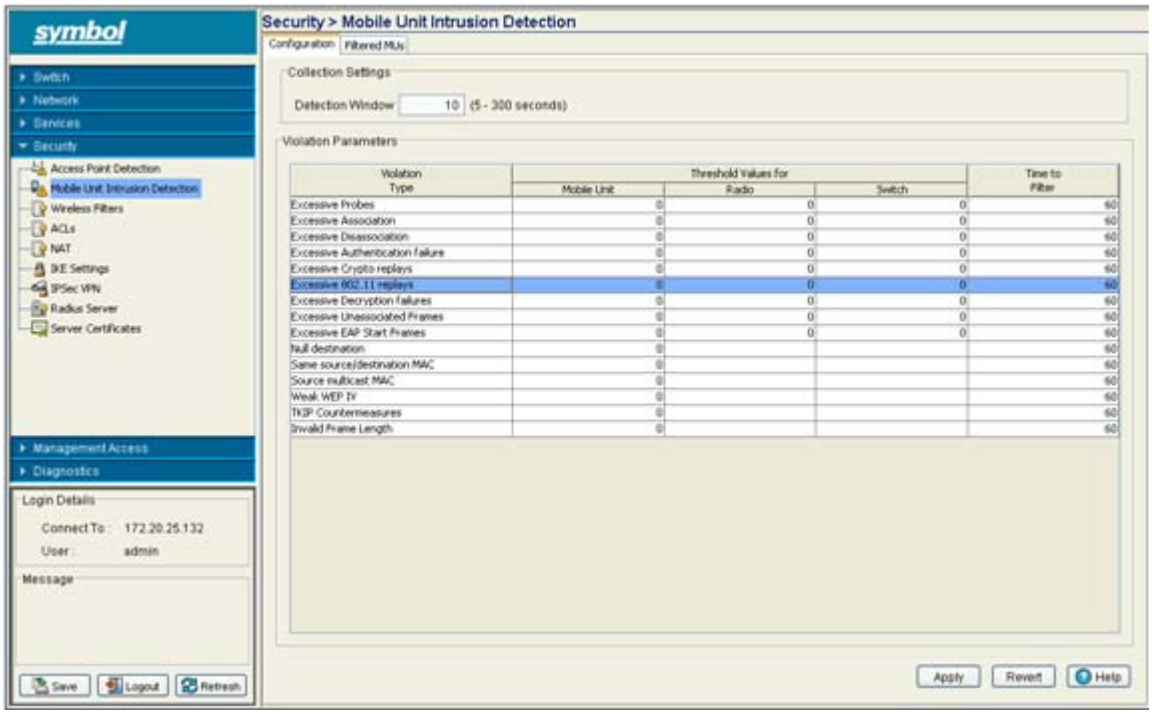
Use the **Mobile Unit Intrusion Detection** sub-menu to view and configure MU intrusion related information. The Mobile Unit Intrusion Detection screen consists of the following tabs:

- *Configuring MU Intrusion Detection*
- *Viewing Filtered MUs*

6.3.1 Configuring MU Intrusion Detection

To configure MU intrusion detection:

1. Select **Security** > **Mobile Unit Intrusion Detection** from the main tree menu.
2. Click the **Configuration** tab.



The MU Intrusion Detection tab consists of the following two fields:

- Collection Settings
- Violation Parameters

3. Within the **Collection Settings** field, set the **Detection Window** interval (in seconds) the switch uses to scan for MU violations. The available range is from 5 - 300 seconds.

4. Refer to the **Violation Parameters** field to define threshold values that trigger an alarm:

Violation Type	Displays the name of the violation for which threshold values are set in the mobile unit, radio and switch columns.
Mobile Unit	Set the MU threshold value for each violation type. If exceeded, the MU will be filtered and displayed within the Filtered MUs screen.
Radio	Set the radio threshold value for each violation type. If exceeded, the MU will be filtered and displayed within the Filtered MUs screen.
Switch	Set the switch's threshold value for each violation type. If exceeded, the offending MU will be filtered (from the switch) and displayed within the Filtered MUs screen.
Time to Filter	Set the Time to Filter interval (in seconds) the switch uses to filter out MUs that have been defined as committing a violation. Refer to *Viewing Filtered MUs on page 6-14* to review the contents of the MUs that have been filtered thus far.

CAUTION Setting mobile unit threshold values too low can jeopardize MU performance or break the MU's connection.

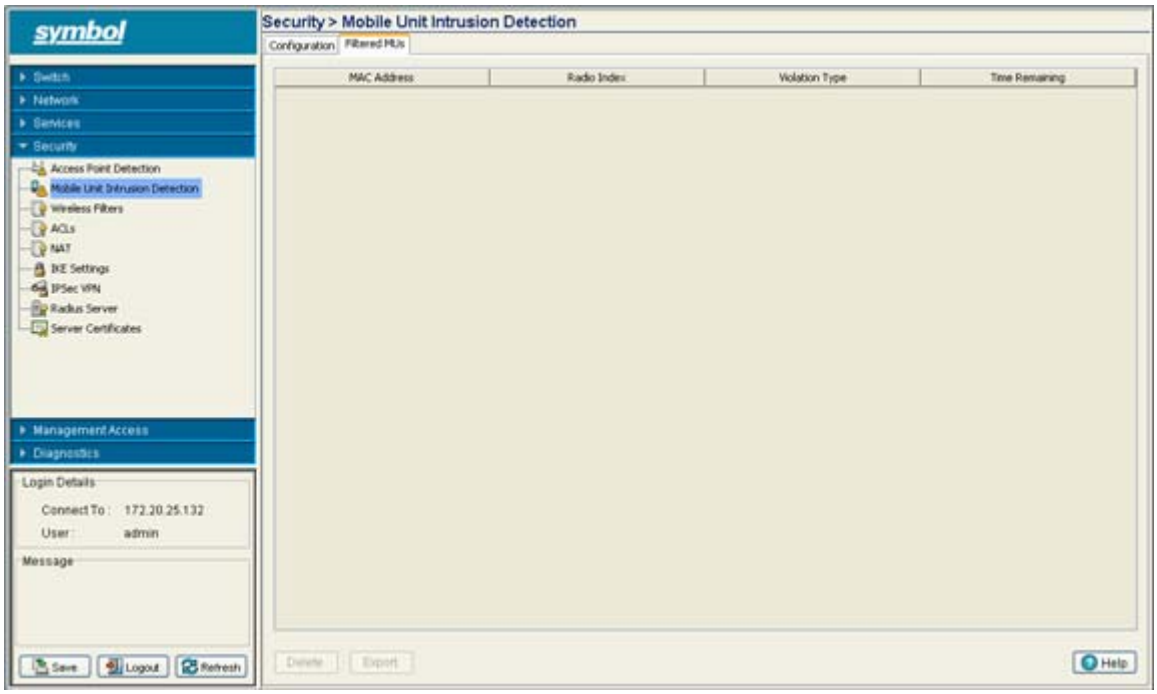
5. Click on **Apply** button to save the configuration.
6. Click on **Revert** to rollback to the previous configuration.

6.3.2 Viewing Filtered MUs

Periodically check the **Filtered MUs** tab to review those MUs that have been filtered by the switch for incurring a violation based on the settings defined within the **Configuration** tab. Each MU listed can be deleted from the list or its attributes exported to a user defined location.

To view status of those MUs filtered using the settings defined within the **Configuration** tab:

1. Select **Security > Mobile Unit Intrusion Detection** from the main tree menu.
2. Click on the **Filtered MUs** tab.



The Filtered MUs tab displays the following read-only information for detected MUs:

MAC Address	Displays the MU's MAC address. Defer to this address as the potentially hostile MU's identifier.
Radio Index	The radio Index displays the index of the detected MU. Use this information to discern whether the detected MU is known and whether is truly constitutes a threat.

Violation Type	Displays the reason the violation occurred for each detected MU. The following violation types are possible: • excessive probes • excessive associations • excessive disassocs • 802.11 replay failures • crypto replay failures • decryption failures • authentication failures • all 0's address • same source-dest address • multicast source address • use of weak WEP IV • TKIP countermeasures • excessive EAP/802.1x frames Use the Violation Type to discern whether the detested MU is truly a threat on the switch managed network (and must be removed) or can be interpreted as a non threat.
Time Remaining	Displays the time remaining before the next filter activity. Detected MUs are removed from the filtered list when the no longer violate the thresholds defined within the Configuration tab.

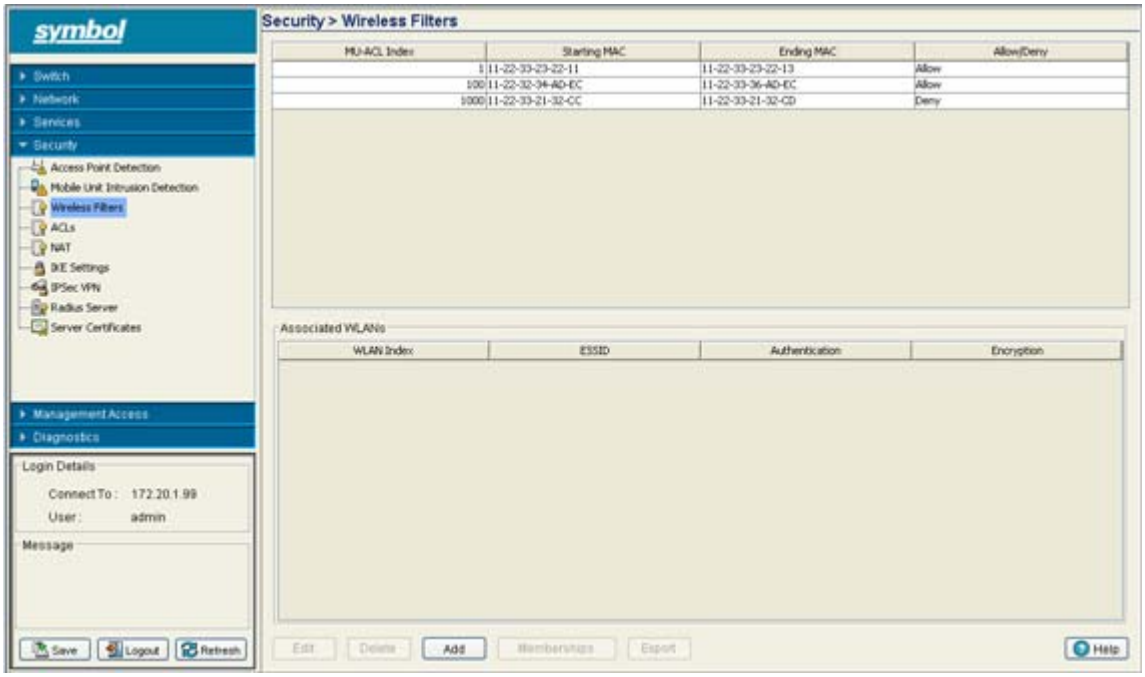
3. Select a detected MU and click the **Delete** button to remove it from the list of MUs you are tracking as potential threats within the switch managed network.

6.4 Configuring Wireless Filters

Use filters to either allow or deny a MAC address (or groups of MAC addresses) from associating with the switch. Refer to the **Wireless Filters** screen to review the properties of existing switch filters. A filter can be selected from those available and edited or deleted. Additionally, a new filter can be added if an existing filter does not adequately express the MU's address range required.

To display the Wireless Filters main page:

1. Select **Security > Wireless Filters** from the main menu tree.
2. The **Wireless Filters** tab is divided into 2 fields:
   - Filters
   - Associated WLANs



The **Filters** field contains the following read-only information:

MU-ACL Index	Displays a numerical identifier used to associate a particular ACL to a range of MAC addresses (or a single MAC address) that are either allowed or denied access to the switch managed network.
Starting MAC	Displays the beginning MAC Address (for this specific Index) either allowed or denied access to the switch managed network.
Ending MAC	Displays the ending MAC Address (for this specific Index) either allowed or denied access to the switch managed network.
Allow/Deny	States whether this particular ACL Index and MAC address range has been allowed or denied access to the switch managed network.

3. Refer to the **Associated WLANs** field for following

WLAN Index	Highlight an Index to display the name(s) of the WLANs currently associated with this particular Index. Click the **Membership** button to map available WLANs to this filter.
ESSID	Displays the SSID required by the devices comprising this WLAN.
Authentication	Displays the authentication scheme configured for the devices comprising this WLAN.
Encryption	Displays the encryption method configured for the devices comprising this WLAN.

4. If the properties of an existing filter are close to your needs but still require modification to better filter devices, select the **Edit** button. For more information see, *Editing a Wireless Filter on page 6-17*.
5. If an existing filter is now obsolete, select it from those listed and click the **Delete** button.
6. Click the **Add** button to create a new filter. For more information, see *Adding a new Wireless Filter on page 6-18*.
7. Click the **Memberships** button to display a screen wherein a selected index can be added to one or more existing WLANs. For more information see, *Associating an ACL with WLAN on page 6-19*
8. Click on the **Export** button to export the contents of the table to a Comma Separated Values file (CSV).

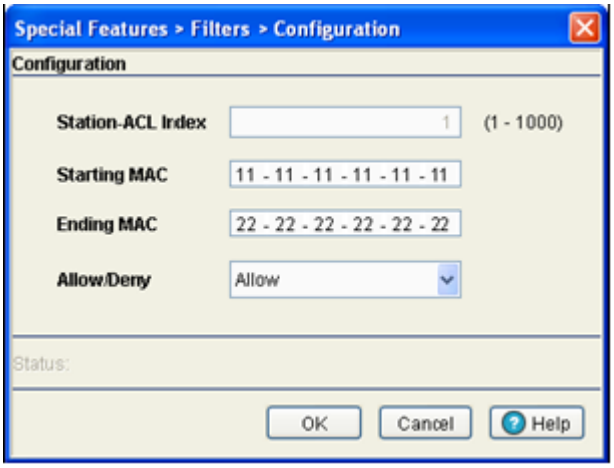
6.4.1 Editing a Wireless Filter

Use the **Edit** screen to modify the properties of an existing filter. This is recommended if an existing filter contains adequate device address information, but the allow/deny permissions need to be changed or if only minor changes are required to the starting and ending MAC addresses. If significant changes are required to a usable filter, consider creating a new one.

To edit an existing filter:

1. Select **Special Features> Filters** from the main menu tree.
2. Select one of the existing ACLs from the filters list.
3. Click the **Edit** button at the bottom of the screen to launch a new dialogue used for editing an ACL.

Within the screen the user can modify an ACL Index (numerical identifier) for the ACL, and edit the starting an ending MAC address range for the devices allowed or denied access to the switch managed network.



4. The **Station-ACL Index** is used as an identifier for a MAC Address range and allow/deny ACL designation. The available index range is 1 - 1000. However, the index is not editable, only its starting/ending MAC range and allow/deny designation. If a new index is needed, create a new filter.
5. Modify the existing **Starting MAC** for the target Index or leave the **Starting MAC** value as is and just modify the **Ending MAC** Address or **Allow**/**Deny** designation.
6. Modify the existing **Ending MAC** for the target Index. Enter the same Starting MAC address within the **Ending MAC** field to use only the **Starting MAC** address as either allowed or denied access to the switch managed network.
7. Use the drop-down menu to select **Allow** or **Deny**.

   This rule applies to the MUs within the specified Starting and Ending MAC Address range. For example, if the adoption rule is to Allow, access is granted for all MUs within the specified range.
8. Refer to the **Status** field for the current state of the requests made from applet. This field displays error messages if something goes wrong in the transaction between the applet and the switch.
9. Click **OK** to use the changes to the running configuration and close the dialog.
10. Click **Cancel** to close the dialog without committing updates to the running configuration.

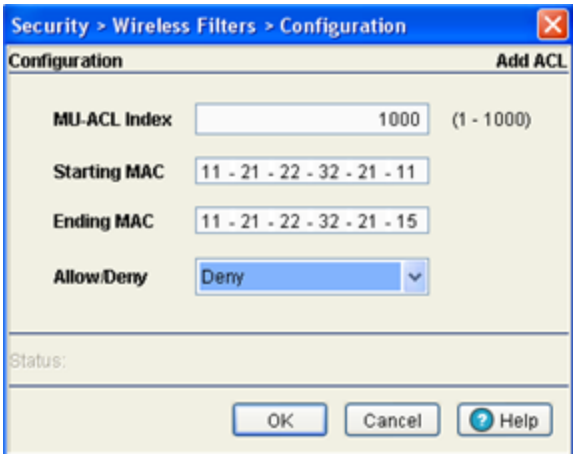
6.4.2 Adding a new Wireless Filter

Use the **Add** screen to create a new index and define a new address permission range. Once created, an allow or deny designation can be applied to the new filter ACL.

To create a new filter ACL:

1. Select **Security > Wireless Filters** from the main menu tree.
2. Click the **Add** button at the bottom of the screen to launch a new dialogue used for creating an ACL.

Define an Index (numerical identifier) for the ACL and starting an ending MAC address range for the devices allowed or denied access to the switch managed network.



3. Enter an Index numerical value (1 -1000) in the **MU-ACL Index** field.

   The MU-ACL Index is a numerical identifier used to associate a particular ACL to a range of MAC addresses (or a single MAC address) either allowed or denied access to the switch managed network. Enter a new Index to define a new MAC Address range and allow/deny ACL Index designation.

4. Enter the a hex value for the **Starting MAC** address.

   This is the beginning MAC address either allowed or denied access to the switch managed network.

5. Enter the a hex value for the **Ending MAC** address. Enter the same Starting MAC address within the **Ending MAC** field to use only the **Starting MAC** address as either allowed or denied access to the switch managed network.

6. Use the drop-down menu to select **Allow** or **Deny**.

   This rule applies to the MUs within the specified Starting and Ending MAC Address range. For example, if the adoption rule is to Allow, access is granted for all MUs within the specified range.

7. Refer to the **Status** field for the current state of the requests made from applet. This field displays error messages if something goes wrong in the transaction between the applet and the switch.

8. Click **OK** to use the changes to the running configuration and close the dialog.

9. Click **Cancel** to close the dialog without committing updates to the running configuration.

6.4.3 Associating an ACL with WLAN

Use the **Membership** screen to define a name for the ACL index and map the index to WLANs (1-32) requiring membership permission restrictions.

To associate a filter ACL index with a WLAN:

1. Select **Security> Wireless Filters** from the main menu tree.
2. Select one or more of the existing ACLs from the filters list.
3. Click the **Memberships** button.
4. Check the box below each WLAN you want associated with each ACL.

   Selectness a WLAN maps it the MAC address range and allow or deny designation assigned to it. Thus, be sure you are not restricting MU traffic for a WLAN that requires those MAC addresses to interact with the switch.

5. Refer to the **Status** field for the current state of the requests made from applet. This field displays error messages if something goes wrong in the transaction between the applet and the switch.
6. Click **OK** to use the changes to the running configuration and close the dialog.
7. Click **Cancel** to close the dialog without committing updates to the running configuration.

6.5 Configuring ACLs

An *Access Control List* (ACL) is a sequential collection of permit and deny conditions that apply to packets. When a packet is received on an interface, the switch compares the fields in the packet against any applied ACLs to verify the packet has the required permissions to be forwarded, based on the criteria specified in the access lists.

NOTE If a packet does not meet any of the criteria specified in the ACL, then the packet is dropped.

Use the **ACL** screen to view, add and configure Access Control configurations. Typically an ACL consists of series of entries called an *Access Control Entry* (ACE). Each ACE defines the access rights for a user in relationship to the switch. When access is attempted, the operating system uses the ACL to determine whether the user has switch access permissions. It consists of the following tabs:

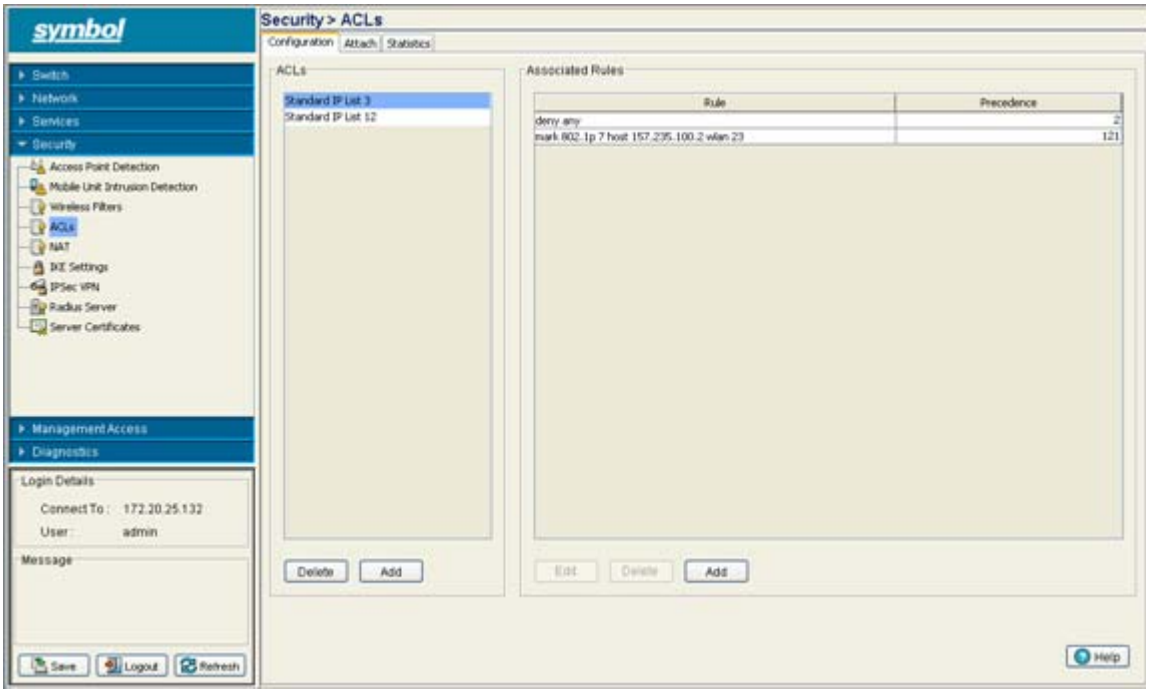
- *Configuring an ACL*
- *Attaching an ACL*
- *Reviewing ACL Statistics*

6.5.1 Configuring an ACL

Configure an ACL to enforce privilege separation and determine appropriate switch access permissions.

To configure an ACL:

1. Select **Security** > **ACLs** from the main tree menu.
2. Click the **Configuration** tab.
3. The Configuration tab consists of the following two fields:
   - ACLs
   - Associated Rules



   The **ACLs** field displays the list of ACLs currently associated with the switch. An ACL contains an ordered list of ACEs. Each ACE specifies a permit or deny designation and a set of conditions the packet must satisfy in order to match the ACE. Because the switch stops testing conditions after the first match, the order of conditions in the list is critical.

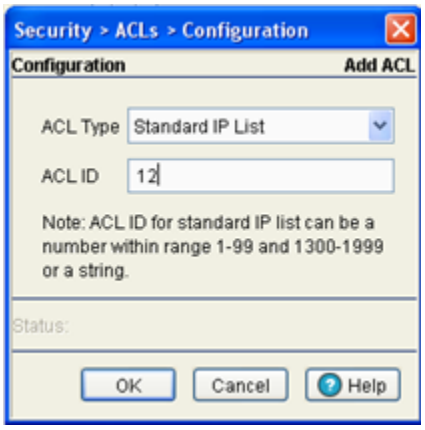
4. If an existing ACL no longer satisfies switch access control requirements, select it from amongst the existing ACLs and click the **Delete** button.
5. Use the **Add** button (within the ACLs field) to add an additional ACL. For more information, see *Adding a New ACL on page 6-22*.
6. Refer to the **Associated Rules** field to assess the rules and precedence associated with each ACL. If necessary, rules and can be added or existing rules modified. For more information, see *Adding a New ACL Rule on page 6-22*.

6.5.1.1 Adding a New ACL

When a packet is received by the switch, the switch compares the packet against the ACL to verify t the packet has the required permissions to be forwarded. Often, ACLs need to be added as client permissions change during switch operation.

To create a new ACL:

1. Select **Security** > **ACLs** from the main menu tree.
2. Click on the **Configuration** tab to view the list of ACLs currently associated with the switch.
3. Click on the **Add** button.



4. Select an **ACL Type** from the drop-down menu. The following options are available:
   - Standard IP List – Uses source IP addresses for matching operations
   - Extended IP List – Uses source and destination IP addresses and optional protocol type information for matching operations
   - MAC Extended List – Uses source and destination MAC addresses, VLAN ID and optional protocol type information.
5. Enter a numeric index name for the ACL in the **ACL ID** field.
6. Refer to the **Status** field for the current state of the requests made from applet. This field displays error messages if something goes wrong in the transaction between the applet and the switch.
7. Click **OK** to use the changes to the running configuration and close the dialog.
8. Click **Cancel** to close the dialog without committing updates to the running configuration.

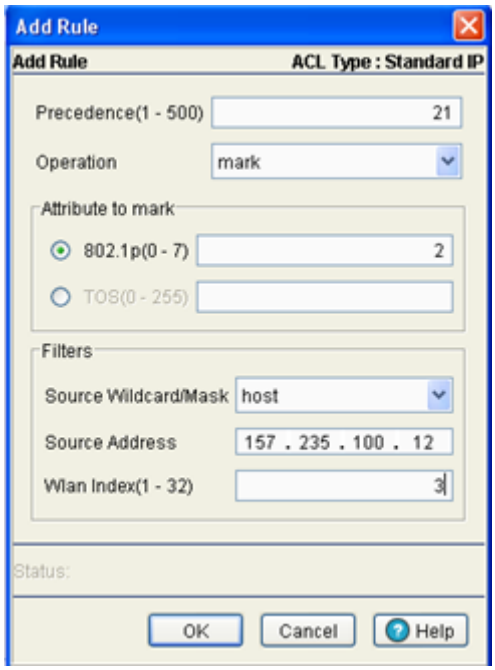
6.5.1.2 Adding a New ACL Rule

The switch supports the following ACL rule types:

- Router ACLs – Applied to VLAN (Layer 3) interfaces. One Router ACL can be applied in each direction on an interface. Router ACLs filter traffic based on Layer 3 parameters, source IP, destination IP protocol types and port numbers.
- Port ACLs – Applied to traffic entering a Layer 2 interface. The switch does not support Port ACLs in the outbound direction. Only switched packets are subjected to Port ACLs. Traffic filtering can be accomplished based on:
  - Layer 2 parameters - source MAC, destination MAC, Ethertype, VLAN-ID, 802.1p bits
  - Layer 3 parameters - source IP, destination IP, protocol, port.

To add a new rule:

1. Select **Security** > **ACLs** from the main menu tree.
2. Click the **Configuration** tab.
3. Click the **Add** button within the Associated Rules field.



4. Use the **Precedence** field to enter a precedence (priority) value between 1 and 500.

   The rules within an ACL will be applied to packets based on their precedence value. Rules with higher precedence are always applied first.

NOTE If adding an access control entry to an ACL using the switch SNMP interface, **Precedence** is a required parameter.

5. Use the **Operation** drop-down menu to define a permit, deny or mark designation for the ACL. If the action is to mark, the packet is tagged for priority.
6. If **mark** is selected from within the **Operations** drop-down menu, the **Attribute to mark** field becomes enabled. Select the **802.1p (0 - 7)** or **TOS(0 - 255)** checkbox and define the attribute receiving priority with this ACL mark designation.
7. From within the **Filters** field, select a **Source Wildcard/Mask** from the drop-down menu.

   The source is the source address of the network or host in dotted decimal format. The Source-mask is the network mask.
8. Use the **Source Address** field to enter the IP address from where the packets are sourced.
9. Define a **WLAN Index** (between 1 -32) to associate an existing WLAN with this ACL Rule.
10. Refer to the **Status** field for the current state of the requests made from applet. This field displays error messages if something goes wrong in the transaction between the applet and the switch.
11. Click **OK** to use the changes to the running configuration and close the dialog.
12. Click **Cancel** to close the dialog without committing updates to the running configuration.

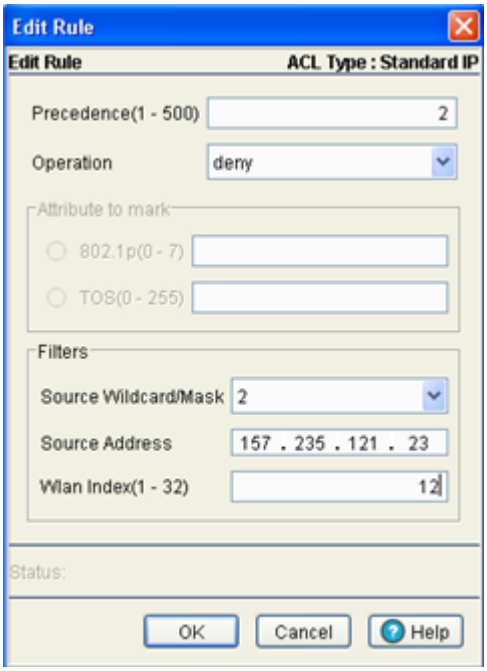
6.5.1.3 Editing an Existing Rule

As network and access permission requirements change, existing ACL rules need to be modified to be relevant with new client access requests to the switch.

To modify an existing ACL rule:

1. Select **Security > ACLs** from the main menu tree.
2. Click on the **Configuration** tab.
3. Select an ACL from the ACLs field.

   The rules associated with the selected ACL display in the Associated Rules section.
4. Click the **Edit** button within the Associated Rules field.



5. Use the **Precedence** field to modify the precedence (priority) value (if necessary) between 1 and 500.

   The rules within an ACL will be applied to packets based on their precedence value. Rules with higher precedence are always applied first.

NOTE If adding an access control entry to an ACL using the switch SNMP interface, **Precedence** is a required parameter.

6. Use the **Operation** drop-down menu (if necessary) to modify the permit, deny or mark designation for the ACL. If the action is to mark, the packet is tagged for priority.
7. If **mark** is selected from within the **Operations** drop-down menu, the **Attribute to mark** field becomes enabled. If necessary, select the **802.1p (0 - 7)** or **TOS(0 - 255)** checkbox and define the attribute receiving priority with this ACL mark designation.
8. From within the **Filters** field, modify (if necessary) the **Source Wildcard/Mask** from the drop-down menu.

   The source is the source address of the network or host in dotted decimal format. The Source-mask is the network mask.

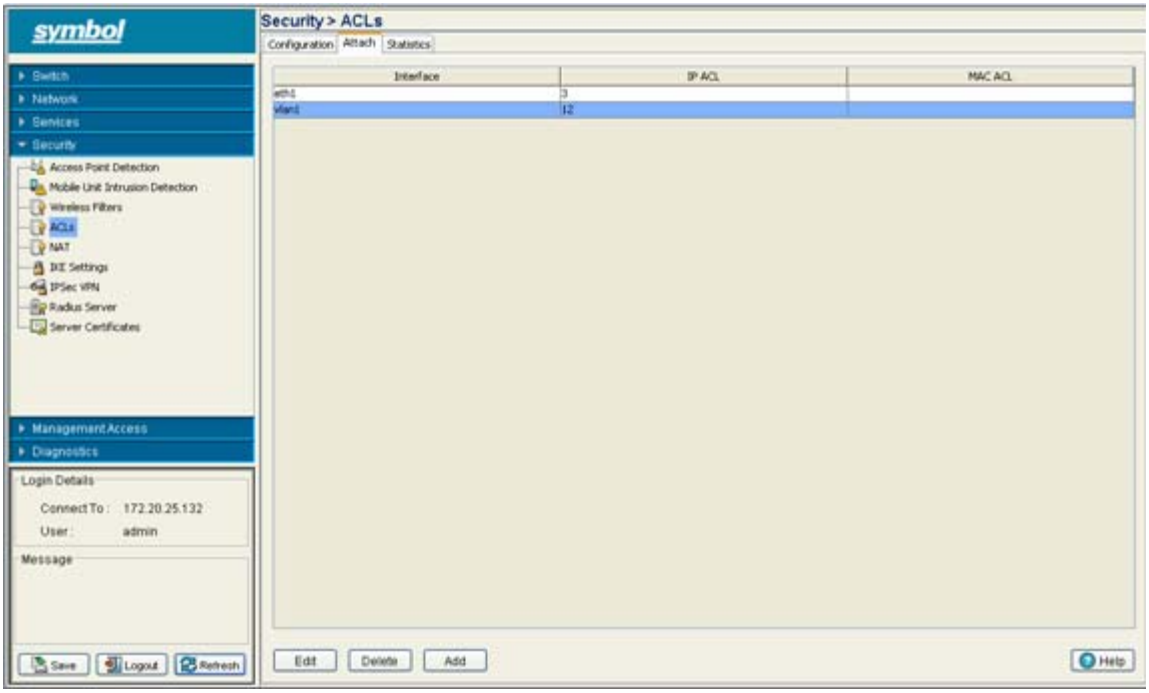
9. Use the **Source Address** field to edit (if necessary) the IP address from where the packets are sourced.
10. Optionally modify the **WLAN Index** (between 1 -32) to associate an existing WLAN with this ACL Rule.
11. Refer to the **Status** field for the current state of the requests made from applet. This field displays error messages if something goes wrong in the transaction between the applet and the switch.
12. Click **OK** to use the changes to the running configuration and close the dialog.
13. Click **Cancel** to close the dialog without committing updates to the running configuration.

6.5.2 Attaching an ACL

Use the **Attach** screen to view and assign the ACL to a physical interface or VLAN on the switch.

To attach an interface:

1. Select **Security** > **ACLs** from the main menu tree.
2. Click the **Attach** tab.



3. Refer to the following information as displayed within the Attach tab:

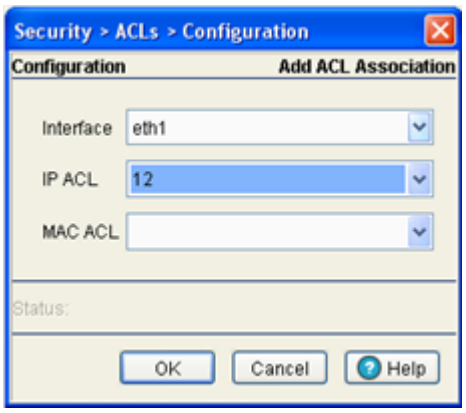
Interface	The interface to which the switch is configured. It can be one of the following: • Ethernet 1 • Ethernet 2 • VLAN 1
IP ACL	Displays the IP ACL configured as the inbound IP for the layer 2 or layer 3 interface.
MAC ACL	Displays the MAC ACL to be configured as the MAC IP for the layer 2 interface.

4. Select an interface and click on **Edit** to modify the ACL interface, IP ACL and MAC ACL values.
5. Select an interface and click the **Delete** button to delete the interface configuration from the switch.
6. Click on **Add** button to add an physical or VLAN interface to the switch. For more information, see *Adding a New ACL Configuration on page 6-26*.

6.5.2.1 Adding a New ACL Configuration

After creating an ACL, it can be applied to one or more interfaces. On a Layer 3 interface it can be applied in either an outbound or inbound direction, and only in inbound direction on a Layer 2 interface. To add an ACL interface to the switch:

1. Select **Security > ACLs** from the main menu tree.
2. Click on the **Attach** tab.
3. Click on the **Add** button.



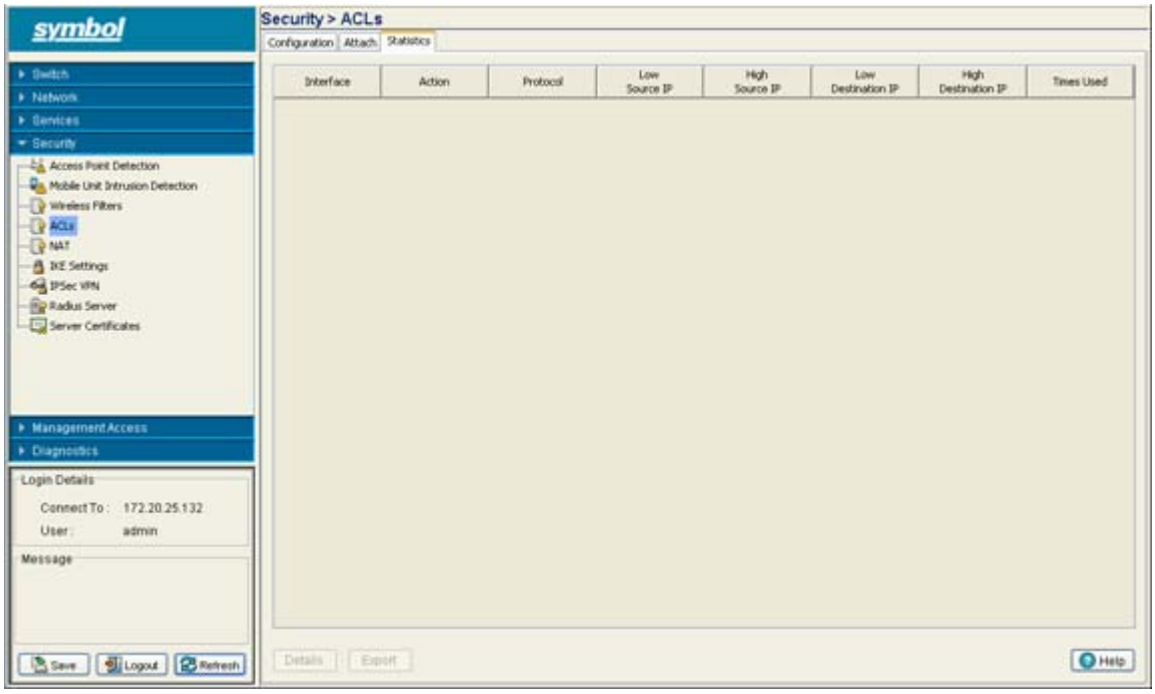
4. Use the **Interface** drop-down menu to select the interface to configure on the switch. Available options include – Ethernet 1, Ethernet 2 and VLAN 1.
5. Use the **IP ACL** drop-down menu to select an IP ACL used as the inbound IP for the layer 2 or layer 3 interface.
6. Use the **MAC ACL** drop-down menu to select an MAC ACL used as the MAC IP for the layer 2 interface.
7. Refer to the **Status** field for the current state of the requests made from applet. This field displays error messages if something goes wrong in the transaction between the applet and the switch.
8. Click **OK** to use the changes to the running configuration and close the dialog.
9. Click **Cancel** to close the dialog without committing updates to the running configuration.

6.5.3 Reviewing ACL Statistics

Use the **Statistics** screen to view set of statistics for those ACLs defined for use with the switch.

To review ACL statistics:

1. Select **Security** > **ACLs** from the main menu tree.
2. Click the **Statistics** tab.



3. Refer to the following information as displayed within the **Statistics** tab:

Interface	Displays the Ethernet 1, Ethernet 2 or VLAN 1 interface used to add the ACL association to the switch.
Action	Displays the permit, deny or mark designation for the ACL. If the action is to mark, the packet is tagged for priority.
Protocol	Displays the protocol used with the ACL. Options available to the switch include icmp, ip, tcp and udp.
Low Source IP	Displays the Low Source IP Address from where the packets are sourced.
High Source IP	Displays the High Source IP Address from where the packets are sourced.
Low Destination IP	Displays the Low Destination IP Address.
High Destination IP	Displays the High Destination IP Address.
Times Used	Displays the number of instances this ACL has been used. Periodically review this among ACLs to determine whether specific ACLs should be deleted or modified to make relevant.

4. Select an interface and click the **Delete** button to delete the ACL interface from the switch.
5. Click the **Export** to export the selected ACL attribute to a user specified location.

6.6 Configuring NAT Information

Network Address Translation NAT provides the translation of an Internet Protocol (IP) address within one network to a different, known IP address within another network. One network is designated the private network, while the other is the public. NAT provides a layer of security by translating private (local) network addresses to one or more public IP addresses. For example, when an administrator wants to allow individuals on the WAN side access to a particular FTP or web server that is located on one of the LAN subnets but does not want to permit any other access, NAT is the appropriate solution.

NAT operates on the switch to connect two networks together. An inside network is addressed with addresses requiring conversion into valid addresses before packets can be forwarded to an outside network. The translation process operates in parallel with packet routing.

NAT enables network administrators to move a Web or FTP Server to another host without having to troubleshoot broken links. Change the inbound mapping with the new inside local address to reflect the new host. Configure changes to your internal network seemlessly since the only external IP address either belongs to the switch or from a pool of global addresses.

The switch NAT configuration process is divided into the following activities:

- *Defining Dynamic NAT Translations*
- *Defining Static NAT Translations*
- *Configuring the NAT Interface*
- *Viewing NAT Status*

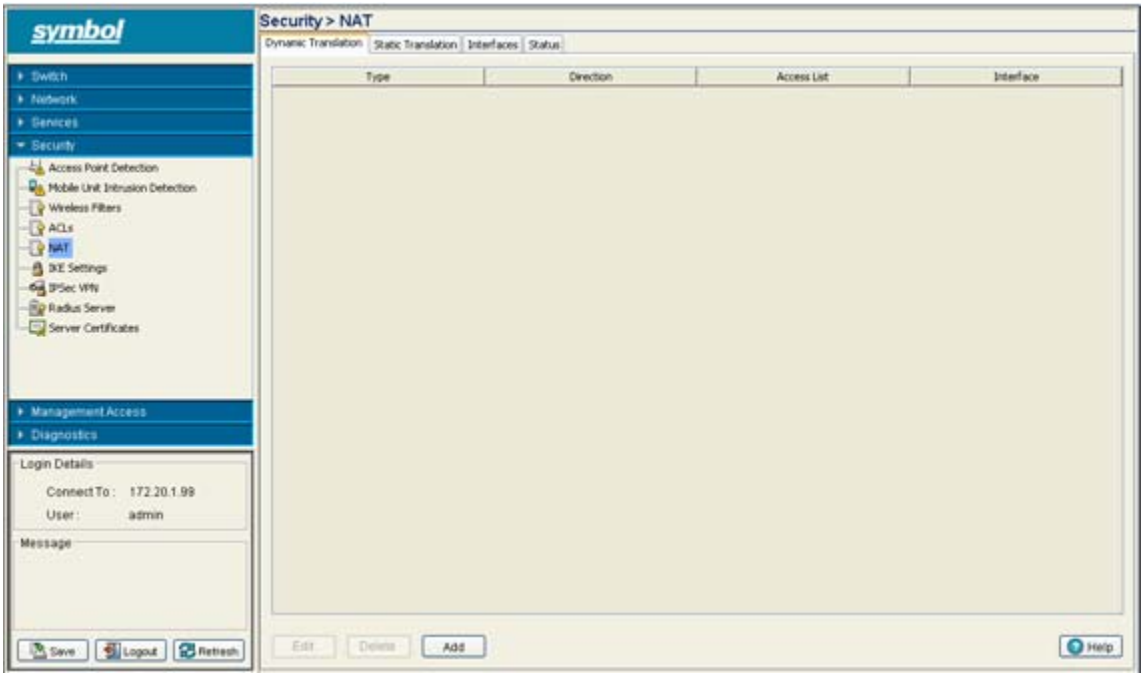
6.6.1 Defining Dynamic NAT Translations

The switch Dynamic NAT functionality creates active translation entries when a packet crosses from an IP NAT inside interface to an IP NAT outside interface, or vice versa. Dynamic NAT requires packets to be switched through the NAT router to generate translations in the switch's translation table.

Refer to the NAT screen's **Dynamic Translation** tab to view existing dynamic NAT configurations available to switch.

To view and add/edit a dynamic NAT configuration:

1. Select **Security** > **NAT** from the main menu tree.
2. Click on the **Dynamic Translation** tab.



3. Refer to the following information as displayed within the **Dynamic Translation** tab.

Type — Displays the NAT type as either:

- Inside - The set of networks that are subject to translation. These are the internal addresses you are trying to prevent from being exposed to the outside world.
- Outside - All other addresses. Usually these are valid addresses located on the Internet. Outside addresses pose no risk if exposed over a publicly accessible network.

Direction — Displays the Direction as either:

- Source - The inside network is transmitting data over the network its intended destination. On the way out, the source IP address is changed in the header and replaced by the (public) IP address.
- Destination - Packets passing through the NAT on the way back to the switch managed LAN are searched against to the records kept by the NAT engine. There the destination IP address is changed back to the specific internal private class IP address in order to reach the LAN over the switch managed network.

Access List — Defines a pool of addresses using start address, end address, and netmask. Packets from addresses matching those within the ACL displayed are translated using global addresses.

Interface — Displays the interface used with the NAT configuration.

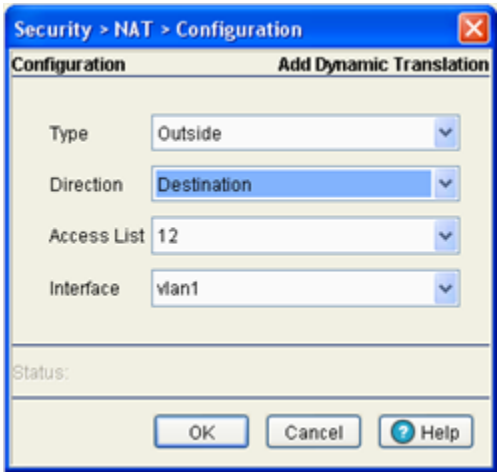
4. Select an existing NAT configuration and click the **Edit** button to display screen used to modify the settings of this existing NAT configuration. The fields within the Edit screen are similar to those displayed when adding a new NAT configuration.
5. Select an existing NAT configuration and click the **Delete** button to remove it from the list of available configurations displayed.
6. Click the **Add** button to display screen to create a new NAT configuration and add it to the list of available configurations. For more information, see *Adding a New Dynamic NAT Configuration on page 6-30*.

6.6.1.1 Adding a New Dynamic NAT Configuration

If the existing NAT configurations displayed with the Configuration prove unsuitable for translation, consider creating a new one.

To define a new NAT configuration:

1. Select **Security** > **NAT** from the main menu tree.
2. Click on the **Dynamic Translation** tab.
3. Click the **Add** button.



4. Define the NAT **Type** from the drop-down menu. Options include:
   - Inside - The set of networks that are subject to translation. These are the internal addresses you are trying to prevent from being exposed to the outside world.
   - Outside - All other addresses. Usually these are valid addresses located on the Internet. Outside addresses pose no risk if exposed over a publicly accessible network.
5. Define the NAT **Direction** from the drop-down menu. Options include:
   - Source - The inside network is transmitting data over the network its intended destination. On the way out, the source IP address is changed in the header and replaced by the (public) IP address.
   - Destination - Packets passing through the NAT on the way back to the switch managed LAN are searched against to the records kept by the NAT engine. There the destination IP address is changed back to the specific internal private class IP address in order to reach the LAN over the switch managed network.
6. Use the **Access List** drop-down menu to select the list of addresses to be used during the NAT translation process. These addresses (once translated) will not be exposed to the outside world when the translation address is used to interact with the remote destination.

7. Use the **Interface** drop-down menu to select the VLAN used as the communication medium between the source and destination points within the NAT configuration. Ensure the VLAN selected best represents the intended network traffic within the NAT supported configuration.
8. Refer to the **Status** field for the current state of the requests made from applet. This field displays error messages if something goes wrong in the transaction between the applet and the switch.
9. Click **OK** to use the changes to the running configuration and close the dialog.
10. Click **Cancel** to close the dialog without committing updates to the running configuration.

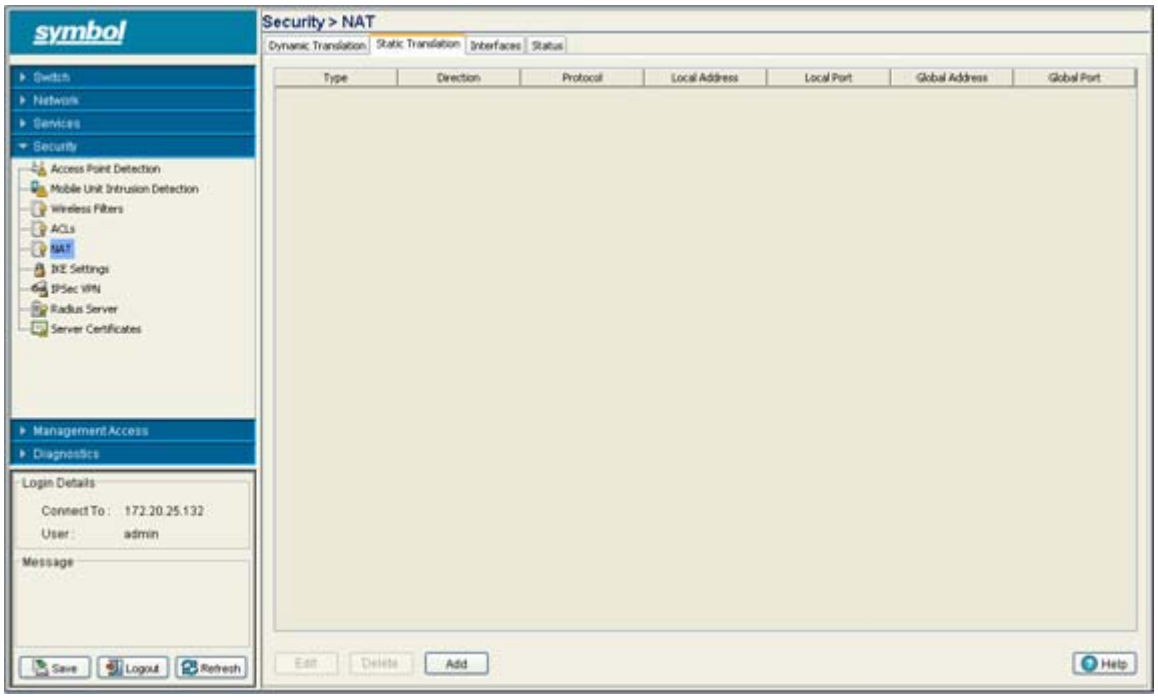
6.6.2 Defining Static NAT Translations

Static *Network Address Translation* (NAT) creates a permanent, one-to-one mapping between an address on an internal network and a perimeter or external network. To share a Web server on a perimeter interface with the Internet, use static address translation to map the actual address to a registered IP address. Static address translation hides the actual address of the server from users on insecure interfaces. Casual access by unauthorized users thus becomes much more difficult. Static NAT requires a dedicated address on the outside network for each host.

Refer to the NAT screen's **Static Translation** tab to view existing static NAT configurations available to switch.

To view and add/edit a dynamic NAT configuration:

1. Select **Security** > **NAT** from the main menu tree.
2. Click on the **Static Translation** tab.



3. Refer to the following information as displayed within the **Static Translation** tab.

Type	Displays the NAT type as either: • Inside - The set of networks that are subject to translation. These are the internal addresses you are trying to prevent from being exposed to the outside world. • Outside - All other addresses. Usually these are valid addresses located on the Internet. Outside addresses pose no risk if exposed over a publicly accessible network.
Direction	Displays the Direction as either: • Source - The inside network is transmitting data over the network its intended destination. On the way out, the source IP address is changed in the header and replaced by the (public) IP address. • Destination - Packets passing through the NAT on the way back to the switch managed LAN are searched against to the records kept by the NAT engine. There the destination IP address is changed back to the specific internal private class IP address in order to reach the LAN over the switch managed network.
Protocol	Displays the tcp or udp option selected for use with the static translation.
Local Address	Displays the Local Address used at the local (source) end of the static NAT configuration. This address (once translated) will not be exposed to the outside world when the translation address is used to interact with the remote destination.
Local Port	Displays the local (source) Port (1 - 65535) used to for the translation between the switch and its NAT destination.
Global Address	Displays the Global Address assigned to a host in the outside network. This should be interpreted as a secure address.
Global Port	Displays the Global Port used to for the translation between the switch and its NAT destination.

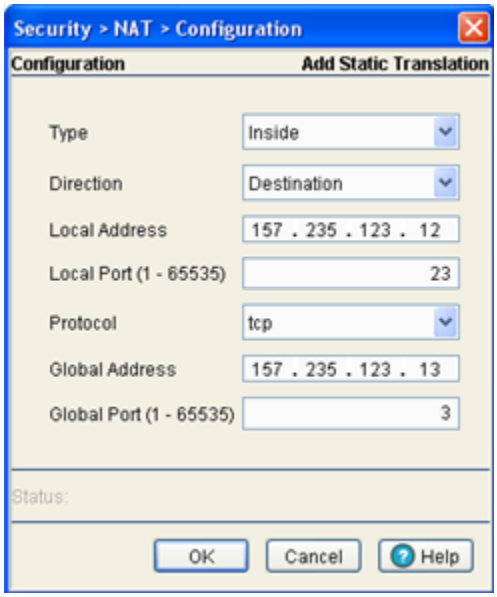
4. Select an existing NAT configuration and click the **Edit** button to display screen used to modify the settings of this existing NAT configuration. The fields within the Edit screen are similar to those displayed when adding a new NAT configuration.
5. Select an existing NAT configuration and click the **Delete** button to remove it from the list of available configurations displayed.
6. Click the **Add** button to display screen to create a new NAT configuration and add it to the list of available configurations. For more information, see *Adding a New Dynamic NAT Configuration on page 6-30*.

6.6.2.1 Adding a New Static NAT Configuration

If the existing NAT configurations displayed with the Configuration prove unsuitable for translation, consider creating a new one.

To define a new NAT configuration:

1. Select **Security** > **NAT** from the main menu tree.
2. Click on the **Static Translation** tab.
3. Click the **Add** button.



4. Define the NAT **Type** from the drop-down menu. Options include:
   - Inside - The set of networks that are subject to translation. These are the internal addresses you are trying to prevent from being exposed to the outside world.
   - Outside - All other addresses. Usually these are valid addresses located on the Internet. Outside addresses pose no risk if exposed over a publicly accessible network.
5. Define the NAT **Direction** from the drop-down menu. Options include:
   - Source - The inside network is transmitting data over the network its intended destination. On the way out, the source IP address is changed in the header and replaced by the (public) IP address.
   - Destination - Packets passing through the NAT on the way back to the switch managed LAN are searched against to the records kept by the NAT engine. There the destination IP address is changed back to the specific internal private class IP address in order to reach the LAN over the switch managed network.
6. Enter the **Local Address** used at the local (source) end of the NAT configuration. This address (once translated) will not be exposed to the outside world when the translation address is used to interact with the remote destination.
7. Enter the **Local Port (1 - 65535)** used to for the translation between the switch and its NAT destination.
8. Use the **Protocol** drop-down menu to select either **TCP** or **UDP** as the protocol
9. Enter the **Global Address** to assign to a host in the outside network. This should be interpreted as a secure address.
10. Displays the **Global Port** used to for the translation between the switch and its NAT destination.

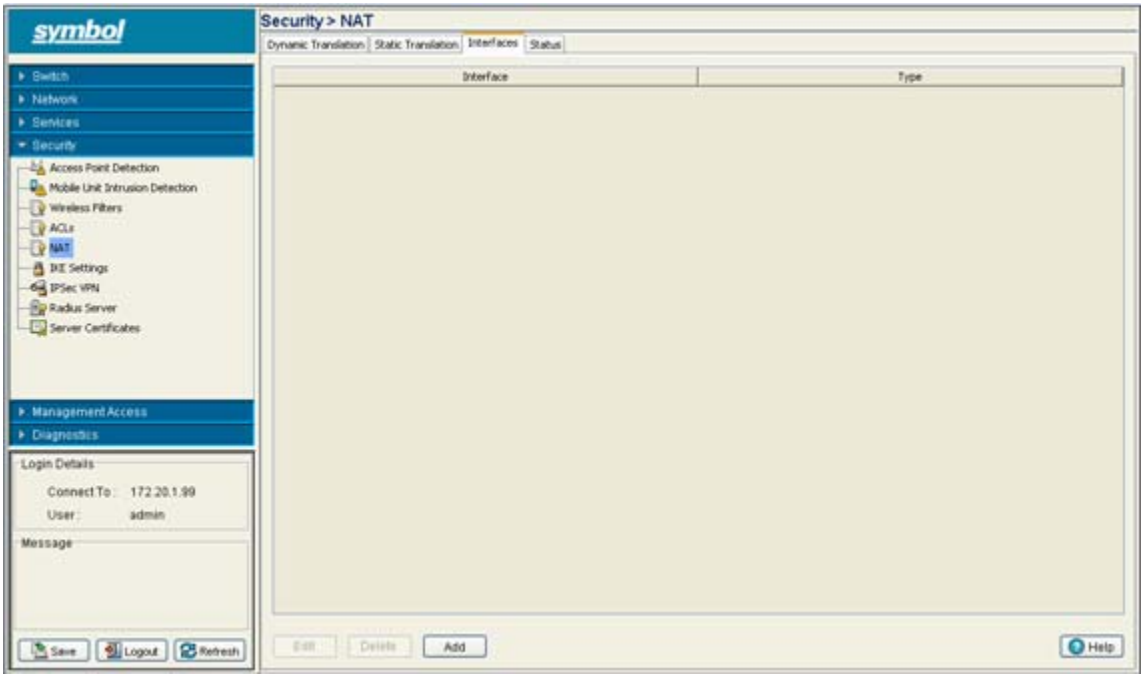
11. Refer to the **Status** field for the current state of the requests made from applet. This field displays error messages if something goes wrong in the transaction between the applet and the switch.
12. Click **OK** to use the changes to the running configuration and close the dialog.
13. Click **Cancel** to close the dialog without committing updates to the running configuration.

6.6.3 Configuring the NAT Interface

The NAT Interface is the VLAN used to route switch data traffic between the source and destination addresses locations within the switch-managed network. Any of default VLANs is available as the NAT interface in addition to any other VLANs you may have created for use with the switch. In addition to selecting the VLAN, specify the Inside or Outside NAT type.

To view and configure a NAT interface:

1. Select **Security** > **NAT** from the main menu tree.
2. Click on the **Interfaces** tab.



3. Refer to the following information as displayed within the **Interface** tab:

Interface	Displays the particular VLAN used as the inside or outside NAT type. All defined VLANs are available from the drop-down menu for use as the interface.

Type	Displays the NAT type as either: • Inside - The set of switch-managed networks subject to translation. These are the internal addresses you are trying to prevent from being exposed to the outside world. • Outside - All other addresses. Usually these are valid addresses located on the Internet. Outside addresses pose no risk if exposed over a publicly accessible network.

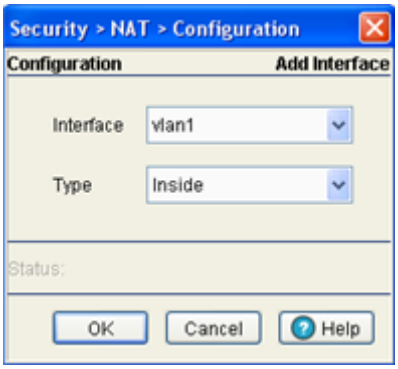
4. To Edit an existing interface, select it from the list of available interfaces and click the **Edit** button.

   An Edit Interface screen displays allowing the user to modify the VLAN and interface type (inside or outside) used.

5. If an interface is obsolete or of no use to the NAT translation process, select it and click the **Delete** button to remove it from the list of interfaces available

6. If modifying an existing interface is not a valid option, consider configuring a new interface. To define a new NAT interface:

   a. Click the **Add** button from within the Interfaces tab.



   b. Use the **Interface** drop-down menu to select the VLAN used as the communication medium between the switch managed network and its destination (within the insecure outside world).

   c. Use the **Type** drop-down menu to specific the Inside or Outside designation as follows:

      Inside - The set of switch-managed networks subject to translation. These are the internal addresses you are trying to prevent from being exposed to the outside world.

      Outside - All other addresses. Usually these are valid addresses located on the Internet. Outside addresses pose no risk if exposed over a publicly accessible network.

   d. Refer to the **Status** field for the current state of the requests made from applet. This field displays error messages if something goes wrong in the transaction between the applet and the switch.

   e. Click **OK** to use the changes to the running configuration and close the dialog.

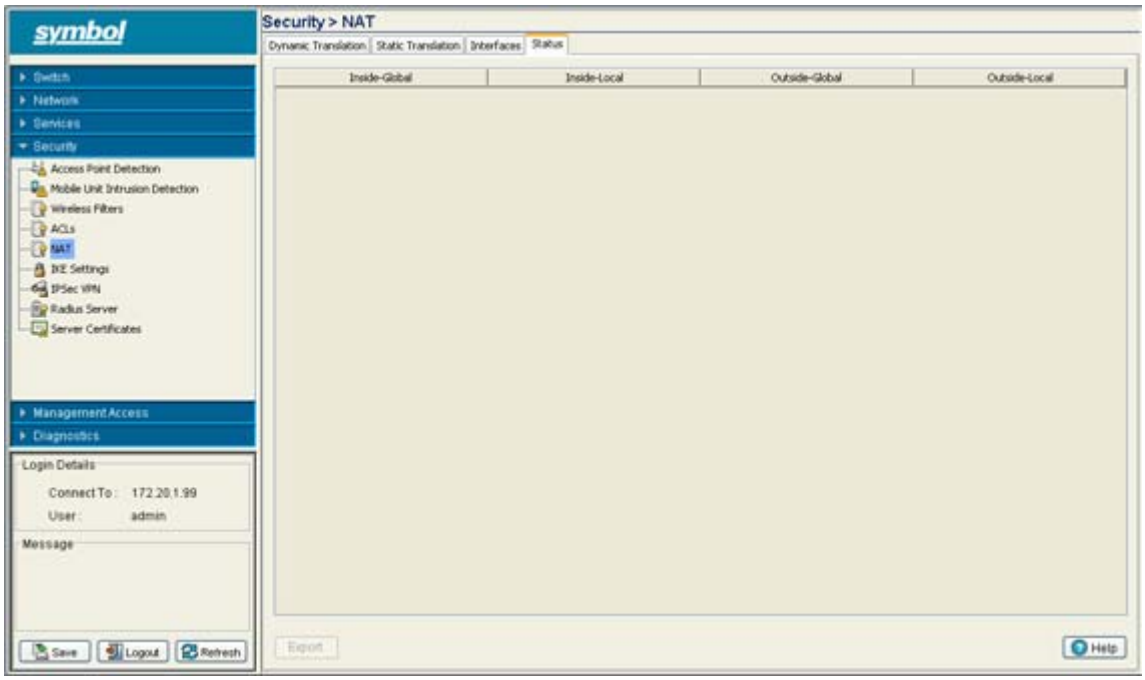
   f. Click **Cancel** to close the dialog without committing updates to the running configuration.

6.6.4 Viewing NAT Status

Use the **Status** tab to review the NAT translations configured thus far for the switch. The Status tab displays the inside and outside local and global IP addresses.

To view and configure a NAT interface:

1. Select **Security** > **NAT** from the main menu tree.
2. Click on the **Status** tab.



3. Refer to the following information to assess the validity and total NAT translation configurations available to the switch.

Inside-Global	Displays the internal global pool of addresses (allocated out of the switch's private address space but relevant to the outside) you are trying to prevent from being exposed to the outside world.
Inside Local	Displays the internal local pool of addresses (addresses internal to the switch) you are trying to prevent from being exposed to the outside world.
Outside-Global	The IP address of an outside host as it appears to the inside network.
Outside-Local	The configured IP address assigned to a host in the outside network.

4. Click on the **Export** button to export the contents of the table to a *Comma Separated Values* file (CSV).

6.7 Configuring IKE Settings

IKE (also known as ISAKMP) is the negotiation protocol enabling two hosts to agree on how to build an IPSec security association. To configure the security appliance for virtual private networks, set global IKE parameters that apply system wide and define IKE policies peers negotiate to establish a VPN tunnel.

IKE protocol is an IPSec standard protocol used to ensure security for VPN negotiation, and remote host or network access. IKE provides an automatic means of negotiation and authentication for communication between two or more parties. IKE manages IPSec keys automatically for the parties.

The switch IKE configuration process is decided into the following activities:

- *Defining the IKE Configuration*
- *Setting IKE Policies*
- *Viewing SA Statistics*

NOTE By default, the IKE feature is enabled on the WS5100 3.0 version switch. Symbol does not support disabling the IKE server.

6.7.1 Defining the IKE Configuration

Refer to the **Configuration** tab to enable (or disable) IKE and define the IKE identity (for exchanging identities) and aggressive mode. Aggressive mode enables you to configure *Internet Key Exchange* (IKE) pre-shared keys as Radius tunnel attributes for IP Security (IPSec) peers.

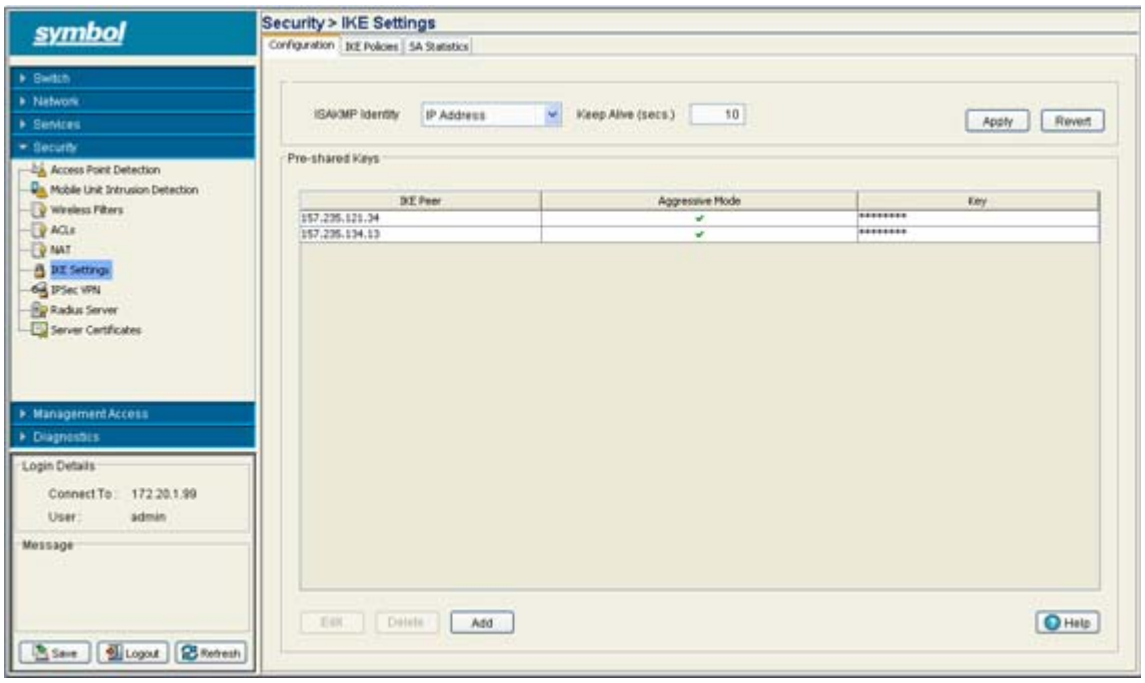
IKE pre-shared keys are simple to deploy, but do not scale well as the user base grows. Instead of keeping pre-shared keys on the switch, the aggressive mode scales pre-shared keys by storing and retrieving them from a server. Radius tunnel attributes are retrieved when a user tries to interact with the switch. The switch retrieves the pre-shared key from the server and the users initiate aggressive mode to the switch using the pre-shared key specified in the *Internet Security Association Key Management Policy* (ISAKMP) peer policy as a Radius tunnel attribute.

Use IKE to specify Radius tunnel attributes for an IPSec peer and initiate an IKE aggressive mode negotiation with the tunnel attributes. This feature is best implemented in a crypto hub scenario. Users initiate IKE aggressive mode negotiation with the switch using pre-shared keys specified as tunnel attributes and stored on the Radius server. This scenario is scalable since the keys are kept at a central repository (the Radius server) and more than one switch and application can use the information.

To view the current set of IKE configurations:

1. Select **Security** > **IKE Settings** from the main menu tree.

2. Click the **Configurations** tab.



3. Select the **Enable IKE** checkbox to use IKE.

   Enabling IKE invokes a negotiation protocol allowing two hosts to agree on how to build an IPSec security association. To configure the security appliance for virtual private networks, set global IKE parameters applying system wide. Create IKE policies as needed for peers to establish a VPN tunnel.

4. Use the **ISAKMP Identity** drop-down menu to select either a IP address, host name or domain name as the medium for exchanging identity information.

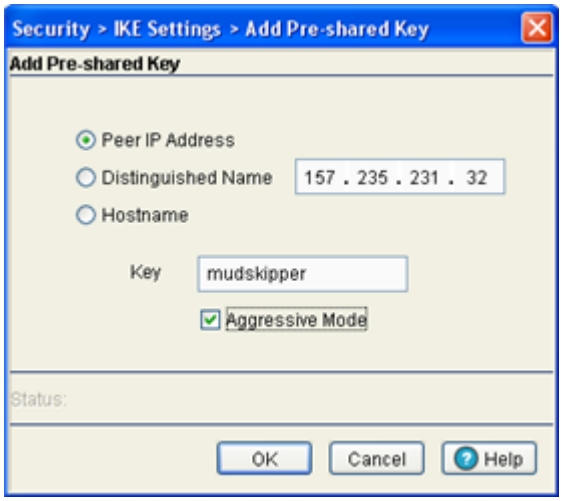
   During IKE negotiations, peers must identify themselves to one another. Use the selected identification method as the medium for device recognition.

5. Either enable or disable **Aggressive Mode** using the checkbox provided.
6. Click the **Apply** button to save the configuration.
7. Click the **Revert** to rollback to the previous configuration.
8. Refer to the Pre-shared Keys field to review the following information:

Peer IP Address	Use the Peer IP Address to associate an IP address with the specific tunnel used by a group of peers.
Aggressive Mode	Displays whether aggressive mode is enabled for this IP address and key string.
Key	Displays the string ID a remote peer uses to look up pre-shared keys.

9. Highlight an existing set of pre-shared Keys and click the **Edit** button to revise the existing peer IP address, key and aggressive mode designation.
10. Select an existing entry and click the **Delete** button to remove it within the table.

11. If the properties of an existing peer IP address, key and aggressive mode designation are no longer relevant and cannot be edited to be useful, click the **Add** button to create a new pre-shared key.



a. Select the **Peer IP Address checkbox** to associate an IP address with the specific tunnel used by a group of peers or, select the **Distinguished Name** checkbox to configure the switch to restrict access to those peers with the same distinguished name, or select the **Hostname** checkbox to allow shared-key messages between corresponding hostnames.

b. Define the **Key** (string ID) a remote peer uses to look up the pre-shared to interact securely with peers within the tunnel.

c. Select the **Aggressive Mode** checkbox if required. Aggressive mode enables you to configure *Internet Key Exchange* (IKE) pre-shared keys as Radius tunnel attributes for IP Security (IPSec) peers.

d. Refer to the **Status** field for the current state of the requests made from applet. This field displays error messages if something goes wrong in the transaction between the applet and the switch.

e. Click **OK** to use the changes to the running configuration and close the dialog.

f. Click **Cancel** to close the dialog without committing updates to the running configuration.

6.7.2 Setting IKE Policies

Each IKE negotiation is divided into two phases. Phase 1 creates the first tunnel (protecting later IKE negotiation messages) and phase 2 creates the tunnel protecting the data. To define the terms of the IKE negotiation, create one or more IKE policies, including the following:

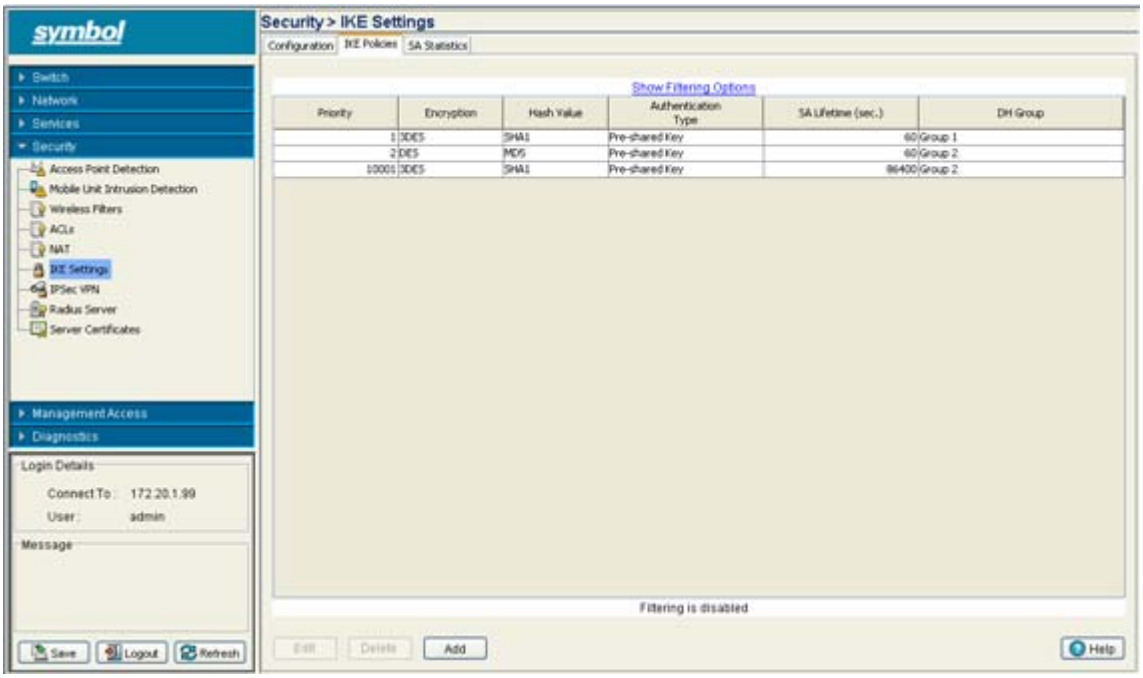
- A priority value (1 through 65,543, with 1 as highest priority permitted)
- An authentication scheme ensure the credentials of the peers
- An encryption scheme protecting the data
- A HMAC method ensuring the identity of the sender, and validating that the message has not been altered
- A Diffie-Hellman group establishing the strength of the of the encryption-key algorithm.
- A time limit for how long the encryption key is used before it is replaced.

If IKE policies are not defined, the switch uses the default policy (always set to the lowest priority) and contains the default values. When IKE negotiations start, the peer initiating the negotiation sends its policies to the remote peer. The remote peer searches for a match with its own policies using the defined priority scheme.

A IKE policies match when they have the same encryption, hash, authentication and Diffie-Hellman settings. The SA lifetime must also be less than or equal to the lifetime in the policy sent. If the lifetimes do not match, the shorter lifetime applies. If no match exists, IKE refuses negotiation.

To view the current set of IKE policies:

1. Select **Security** > **IKE Settings** from the main menu tree.
2. Click the **IKE Policies** tab.



3. Refer to the values displayed within the IKE Policies tab to determine if an existing policy requires revision, removal or a new policy requires creation.

Priority — Displays the priority for the IKE policy. The available range is from 1 to 65,543, with 1 being the highest priority value.

Encryption — Displays the encryption method protecting data transmitted between peers. Options include:

- DES. 56-bit DES-CBC is less secure but faster than the alternatives. The default value.
- 3DES - 168-bit Triple DES.
- AES - 128-bit AES.
- AES 192 - 192-bit AES.
- AES 256 - 256-bit AES.

Hash Value	Displays the hash algorithm used to ensure data integrity. The hash value validates a packet comes from its intended destination, and has not been modified in transit. Options include: • SHA - The default value. • MD5 - MD5 has a smaller digest and is somewhat faster than SHA-1.
Authentication Type	Displays the authentication scheme used to validate the identity of each peer. Pre-shared keys do not scale accurately with a growing network but are easier to maintain in a small network. Options include: • Pre-shared Key - Uses pre-shared keys. • RSA Signature- Uses a digital certificate with keys generated by the RSA signatures algorithm. • RSA Encr Nounces -
SA Lifetime	Displays an integer for the SA lifetime. The default is 60 seconds. With longer lifetimes, security defines future IPSec security associations quickly. Encryption strength is great enough to ensure security without using fast rekey times. Symbol recommends using the default value.
DH Group	Displays the Diffie-Hellman group identifier. IPSec peers use the defined value to derive a shared secret without transmitting it to one another.

4. Highlight an existing policy and click the **Edit** button to revise the policy's existing priority, encryption scheme, hash value, authentication scheme, SA lifetime and DH group.
5. Select an existing policy and click the **Delete** button to remove it from the table.
6. If the properties of an existing policy are no longer relevant and cannot be edited to be useful, click the **Add** button to define a new policy.

a. Configure a set of attributes for the new IKE policy:

Priority — Define the priority for the IKE policy. The available range is from 1 to 65,543, with 1 being the highest priority value.

Encryption — Set the encryption method used to protect the data transmitted between peers. Options include:

- DES. 56-bit DES-CBC is less secure but faster than the alternatives. The default value.
- 3DES - 168-bit Triple DES.
- AES - 128-bit AES.
- AES 192 - 192-bit AES.
- AES 256 - 256-bit AES.

Hash Value — Define the hash algorithm used to ensure data integrity. The hash value validates a packet comes from its intended destination, and has not been modified in transit. Options include:

- SHA - The default value.
- MD5 - MD5 has a smaller digest and is somewhat faster than SHA-1.

Authentication Type — Set the authentication scheme used to validate the identity of each peer. Pre-shared keys do not scale accurately with a growing network but are easier to maintain in a small network. Options include:

- Pre-shared Key - Uses pre-shared keys.
- RSA Signature- Uses a digital certificate with keys generated by the RSA signatures algorithm.
- RSA Encr Nounces -

SA Lifetime — Define an integer for the SA lifetime. The default is 60 seconds. With longer lifetimes, security defines future IPSec security associations quickly. Encryption strength is great enough to ensure security without using fast rekey times. Symbol recommends using the default value.

DH Group — Set the Diffie-Hellman group identifier. IPSec peers use the defined value to derive a shared secret without transmitting it to one another.

b. Refer to the **Status** field for the current state of the requests made from applet. This field displays error messages if something goes wrong in the transaction between the applet and the switch.

c. Click **OK** to use the changes to the running configuration and close the dialog.

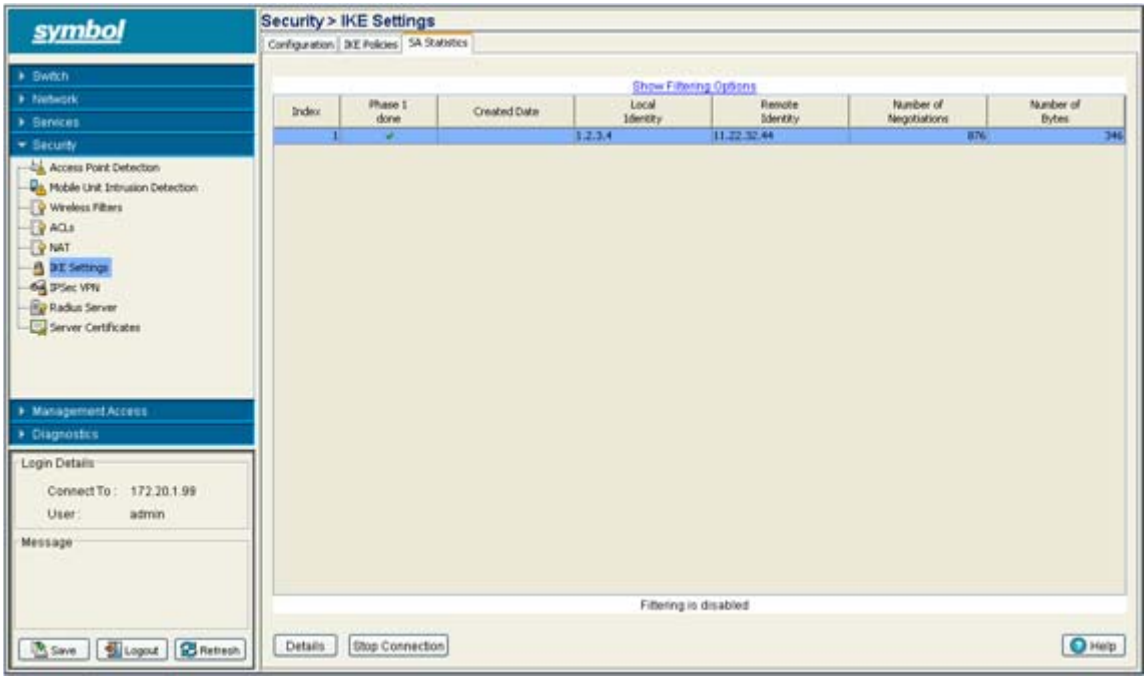
d. Click **Cancel** to close the dialog without committing updates to the running configuration.

6.7.3 Viewing SA Statistics

A *security association* (SA) is a description of how two peers employ a security technique to interoperate securely. IKE requires SAs to identify connection attributes. IKE can negotiate and establish its own SA. An IKE SA is used by IKE only, and is bi-directional.

To view SA statistics:

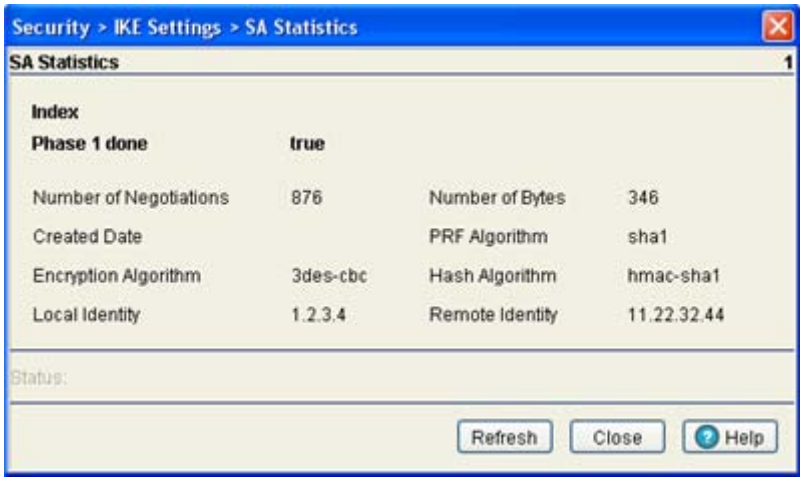
1. Select **Security** > **IKE Settings** from the main menu tree.
2. Click the **SA Statistics** tab.



3. Refer to the information displayed within SA Statistics tab to discern the following:

Index	Displays the alpha-numeric name (index) used to identify individual SAs.
Phase 1 done	Displays whether this index is completed with the phase 1 (authentication) credential exchange between peers
Created Date	Displays the exact date the SA was configured for each index displayed.
Local Identity	Specifies the address the local IKE peer use to identify itself to the remote peer.
Remote Identity	Specifies the address the remote IKE peer use to identify itself to a local peer.
Number of Negotiations	During IKE negotiations the peers must identify themselves to each other. This value is helpful in determining the network address information used to validate peers.
Number of Bytes	Displays the number of bytes passed between the peers for the specified index.

4. Select an index and click the **Details** button to display a more robust set of statistics for the selected index.



   Use this information to discern whether changes to an existing IKE configuration is warranted or if a new configuration is required.

5. Click the **Clear Statistics** button to begin a new data gathering activity by resetting all the data counters to zero.

6.8 Configuring IPSec VPN

Use IPSec *Virtual Private Network* (VPN) to define secure tunnels between two peers. Configure which packets are sensitive and should be sent through these secure tunnels, and what should be used to protect these sensitive packets. Once configured, an IPsec peer creates the appropriate secure tunnel and sends the packet through the tunnel to the remote peer.

IPSec tunnels are sets of *security associations* (SA) established between two peers. The security associations define which protocols and algorithms are applied to sensitive packets, and what keying material is used by the two peers. Security associations are unidirectional and established per security protocol.

To configure IPSec security associations, Symbol uses the Crypto Map entries. Crypto Map entries created for IPSec pull together the various parts used to set up IPSec security associations. Crypto Map entries include transform sets. A transform set is an acceptable combination of security protocols, algorithms and other settings to apply to IPSec protected traffic.

The *Internet Key Exchange* (IKE) protocol is a key management protocol standard which can be used in conjunction with the IPSec standard. IKE automatically negotiates IPSec security associations and enables IPSec secure communications without costly manual configuration. To support IPSec VPN functionality, the following configuration activities are required:

- Configure a DHCP Sever to give public IP address

  An IPSec client needs to have an IP address before it can connect to the VPN Server and create an IPSec tunnel. Thus, a DHCP Server needs to be configured on the interface to distribute public IP addresses to the IPSec clients.

- Configure a Crypto policy (IKE)

  IKE automatically negotiates IPSec security associations and enables IPSec secure communications without costly manual pre-configuration. IKE eliminates the need to manually specify all the IPSec security parameters in the crypto maps at both peers. Allows you to specify a lifetime for the IPSec

security association. Allows encryption keys to change during IPSec sessions. Permits *Certification Authority* (CA) support for a manageable, scalable IPSec implementation. Allows dynamic authentication of peers. If you do not want IKE to be used with your IPSec implementation, you can disable it for IPSec peers. You cannot have a mix of IKE-enabled and IKE-disabled peers within your IPSec network. Manually specify all the IPSec security associations in the crypto maps for all peers.

- Configure security associations parameters

  The use of manual security associations is a result of a prior arrangement between switch users and the IPSec peer. If IKE is not used for establishing security associations, there is no negotiation of security associations, so the configuration information in both systems must be the same for traffic to be processed successfully by IPSec.

- Define transform sets

  A transform set represents a combination of security protocols and algorithms. During the IPSec security association negotiation, peers agree to use a particular transform set for protecting data flow.

  With manually established security associations, there is no negotiation with the peer, so both sides must specify the same transform set. If you change a transform set definition, the change is only applied to crypto map entries that reference the transform set. The change is not applied to existing security associations, but is used in subsequent negotiations to establish new security associations.

- Create crypto map entries

  When IKE is used to establish security associations, the IPSec peers can negotiate the settings they use for the new security associations. Therefore, you can specify lists (such as lists of acceptable transforms) within the crypto map entry.

- Apply crypto map sets to Interfaces

  You must assign a crypto map set to each interface through which IPSec traffic flows. The security appliance supports IPSec on all interfaces. Assigning the crypto map set to an interface instructs the security appliance to evaluate all the traffic against the crypto map set and to use the specified policy during connection or SA negotiation. Assigning a crypto map to an interface also initializes run-time data structures, such as the SA database and the security policy database. Reassigning a modified crypto map to the interface resynchronizes the run-time data structures with the crypto map configuration. Also, adding new peers through the use of new sequence numbers and reassigning the crypto map does not tear down existing connections. With the WS5100 switch, a Crypto Map cannot get applied to more than one interface at a time.

- Monitor and maintain IPSec tunnels

  New configuration changes will only take effect when negotiating subsequent security associations. If you want the new settings to take immediate effect, you must clear the existing security associations so that they will be re-established with the changed configuration.

  For manually established security associations, clear and reinitialize the security associations or the changes will not take effect.

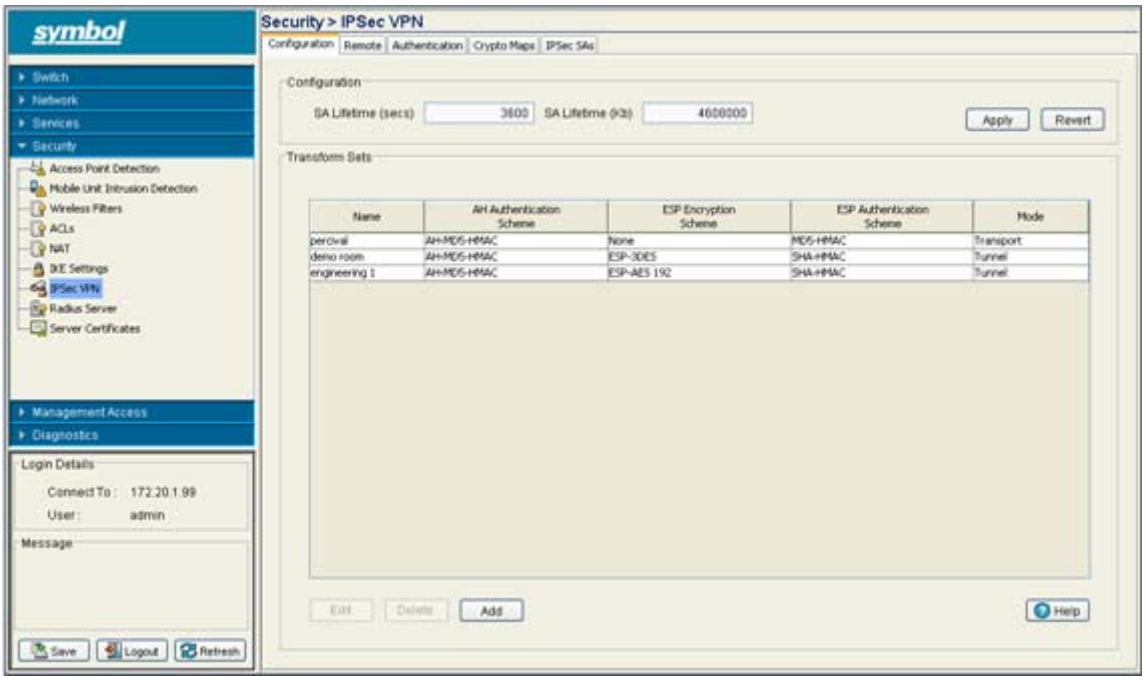
For more information on configuring IPSec VPN, refer to the following:

- *Defining the IPSec Configuration*
- *Defining the IPSec VPN Remote Configuration*
- *Configuring IPSEC VPN Authentication*
- *Configuring Crypto Maps*
- *Viewing IPSec Security Associations*

6.8.1 Defining the IPSec Configuration

Use the IPSec VPN Configuration screen to view the attributes of existing VPN tunnels and modify the security association lifetime and keep alive intervals used to maintain the routes between VPN peers. From the Configuration screen, transform sets can be created as existing sets modified or deleted.

1. Select **Security > IPSec VPN** from the main menu tree.
2. Click the **Configuration** tab.



3. Refer to the **Configuration** field to define the following information.

SA Lifetime (secs)	For IKE based security associations, define a SA Lifetime (in seconds) forcing the periodically expiration and re-negotiation of peer credentials. Thus, continually validating the peer relationship.
SA Lifetime (Kb)	Causes the security association to time out after the specified amount of traffic (in kilobytes) have passed through the IPSec tunnel using the security association.
Apply	Click **Apply** to save any updates you may have made to the screen.
Revert	Click the **Revert** button to disregard any changes you have made and revert back to the last saved configuration.

4. Refer to the **Transform Sets** field to view the following data:

Name	Displays a transform set identifier used to differentiate transform sets. The index is helpful when transform sets with similar attributes need to be revised or discarded.

AH Authentication Scheme	Displays the AH Transform Authentication scheme used with the index. Options include: • None - No AH authentication is used. • MD5-HMAC - AH with the MD5 (HMAC variant) authentication algorithm. • SHA-HMAC - AH with the SHA (HMAC variant) authentication algorithm.
ESP Encryption Scheme	Displays the ESP Encryption Transform used with the index. Options include: • None - No ESP encryption is used with the transform set. • DES - ESP with the 56-bit DES encryption algorithm. • 3DES - ESP with 3DES, ESP with AES. • AES - ESP with 3DES, ESP with AES.
ESP Authentication Scheme	Displays the ESP Authentication Transform used with the index. Options include: • None - No ESP authentication is used with the transform set. • MD5-HMAC - AH with the MD5 (HMAC variant) authentication algorithm. • SHA-HMAC - AH with the SHA (HMAC variant) authentication algorithm.
Mode	Displays the current mode used with the transform set. The mode is either tunnel or transport.

5. Select a IPSec VPN transform set (by its index) and click the **Edit** button to modify its properties. This i
6. s only recommended if the existing index is no longer relevant in its current state. For more information, see *Editing an Existing Transform Set on page 6-48*.
7. Select an index and click the **Delete** button to remove it from the table.
8. If none of the transform sets displayed appear useful, click on the Add button to create a new one. For more information, see *Adding a New Transform Set on page 6-48*.

6.8.1.1 Editing an Existing Transform Set

If the attributes of an existing transform set no longer lend themselves as useful, consider editing the transform set to be relevant with the needs of existing VPN peers.

To edit the attributes of an existing transform set:

1. Select **Security > IPSec VPN** from the main menu tree.
2. Click the **Configuration** tab.
3. Select an existing transform set and click the **Edit** button.
4. Revise the following information as required to render the existing transform set useful.

Name	The name is read-only and cannot be modified unless a new transform set is created.
AH Authentication Scheme	Modify (if necessary) the AH Transform Authentication scheme. Options include: • None - No AH authentication is used. • MD5-HMAC - AH with the MD5 (HMAC variant) authentication algorithm. • SHA-HMAC - AH with the SHA (HMAC variant) authentication algorithm.
ESP Encryption Scheme	Modify (if necessary) the ESP Encryption Transform scheme. Options include: • None - No ESP encryption is used with the transform set. • DES - ESP with the 56-bit DES encryption algorithm. • 3DES - ESP with 3DES, ESP with AES. • AES - ESP with 3DES, ESP with AES.
ESP Authentication Scheme	Modify (if necessary) the ESP Authentication Transform scheme. Options include: • None - No ESP authentication is used with the transform set. • MD5-HMAC - AH with the MD5 (HMAC variant) authentication algorithm. • SHA-HMAC - AH with the SHA (HMAC variant) authentication algorithm.
Mode	Modify (if necessary) the current mode used with the transform set. The mode is either Tunnel or Transport.

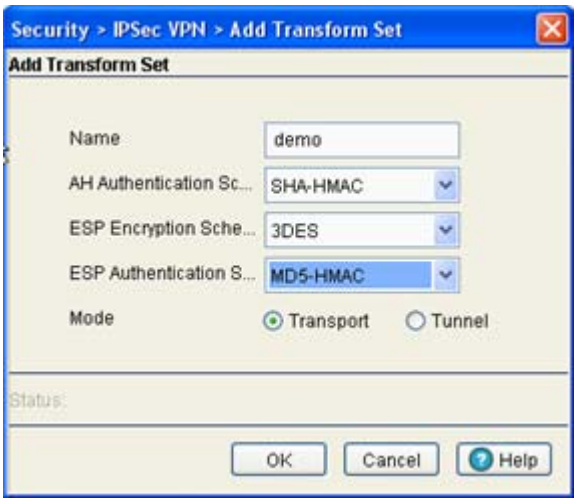
5. Refer to the **Status** field for the current state of the requests made from applet. This field displays error messages if something goes wrong in the transaction between the applet and the switch.
6. Click **OK** to use the changes to the running configuration and close the dialog.
7. Click **Cancel** to close the dialog without committing updates to the running configuration.

6.8.1.2 Adding a New Transform Set

If the attributes of an existing transform set no longer lend themselves as useful, and an existing transform set is not required, create a new transform set to meet the needs of your network.

To edit the attributes of an existing transform set:

1. Select **Security > IPSec VPN** from the main menu tree.
2. Click the **Configuration** tab.
3. Click the **Add** button.



4. Define the following information as required for the new transform set.

Name	Create a name describing this new transform set.
AH Authentication Scheme	Define the AH Transform Authentication scheme. Options include: • None - No AH authentication is used. • MD5-HMAC - AH with the MD5 (HMAC variant) authentication algorithm. • SHA-HMAC - AH with the SHA (HMAC variant) authentication algorithm.
ESP Encryption Scheme	Define the ESP Encryption Transform scheme. Options include: • None - No ESP encryption is used with the transform set. • DES - ESP with the 56-bit DES encryption algorithm. • 3DES - ESP with 3DES, ESP with AES. • AES - ESP with 3DES, ESP with AES.
ESP Authentication Scheme	Define the ESP Authentication Transform scheme. Options include: • None - No ESP authentication is used with the transform set. • MD5-HMAC - AH with the MD5 (HMAC variant) authentication algorithm. • SHA-HMAC - AH with the SHA (HMAC variant) authentication algorithm.
Mode	Define the current mode used with the transform set. The mode is either Tunnel or Transport.

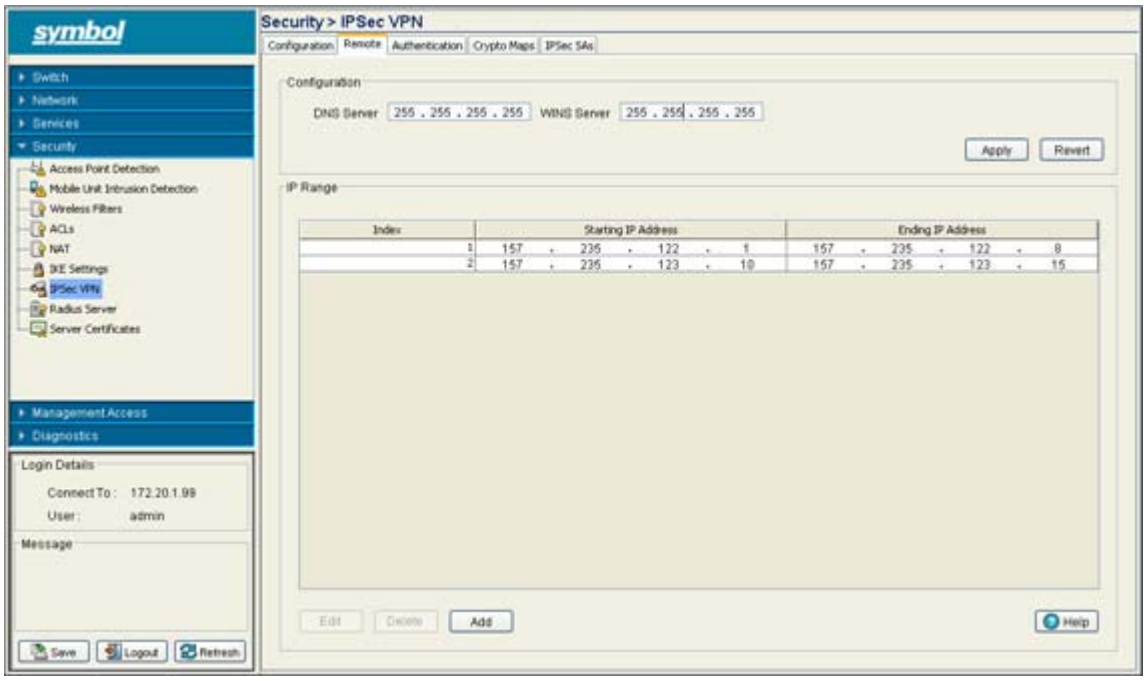
5. Refer to the **Status** field for the current state of the requests made from applet. This field displays error messages if something goes wrong in the transaction between the applet and the switch.
6. Click **OK** to use the changes to the running configuration and close the dialog.
7. Click **Cancel** to close the dialog without committing updates to the running configuration.

6.8.2 Defining the IPSec VPN Remote Configuration

Use the IPSec VPN Remote tab to configure the DNS and/or WINS Servers used to route packets to the remote end of the IPSec VPN tunnel. The Remote is also used for defining the IP address range used within the IPSec VPN tunnel and configuring the user authentication scheme for user permissions within the IPSec VPN tunnel.

To define the IPSEc VPN remote configuration:

1. Select **Security > IPSec VPN** from the main menu tree.
2. Click the **Remote** tab.



3. Refer to the **Configuration** field to define the following information.

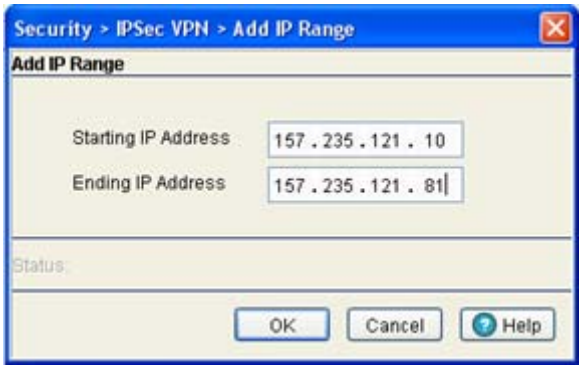
DNS Server	Enter the numerical IP address of the DNS Server used to route information to the remote destination of the IPSec VPN.
WINS Server	Enter the numerical IP address of the WINS Server used to route information to the remote destination of the IPSec VPN.
Apply	Click **Apply** to save any updates you may have made to the screen.
Revert	Click the **Revert** button to disregard any changes you have made and revert back to the last saved configuration.

4. Click the **IP Range** tab to view the following information.

Index	Enter the index assigned to the range of IP addresses displayed in the Starting and Ending IP Address ranges. This index is used to differentiate the index from others with similar IP addresses.
Starting IP Address	Enter the numerical IP address used as the starting address for the range defined. If the Ending IP address is left blank, then only the starting address is used for the remote destination.

Ending IP Address	Enter a numerical IP address to complete the range. If the Ending IP address is blank, then only the starting address is used as the destination address.

5. Click the **Edit** button (within the IP Range tab) to modify the range of existing IP addresses displayed.
6. Select an IP address range index and click the **Delete** button to remove this specific range from those available within the IP Range tab.
7. To add a new range of IP addresses, click the **Add** button (within the IP Range tab) and define the range in the fields provided. Click **OK** when completed to save the changes.



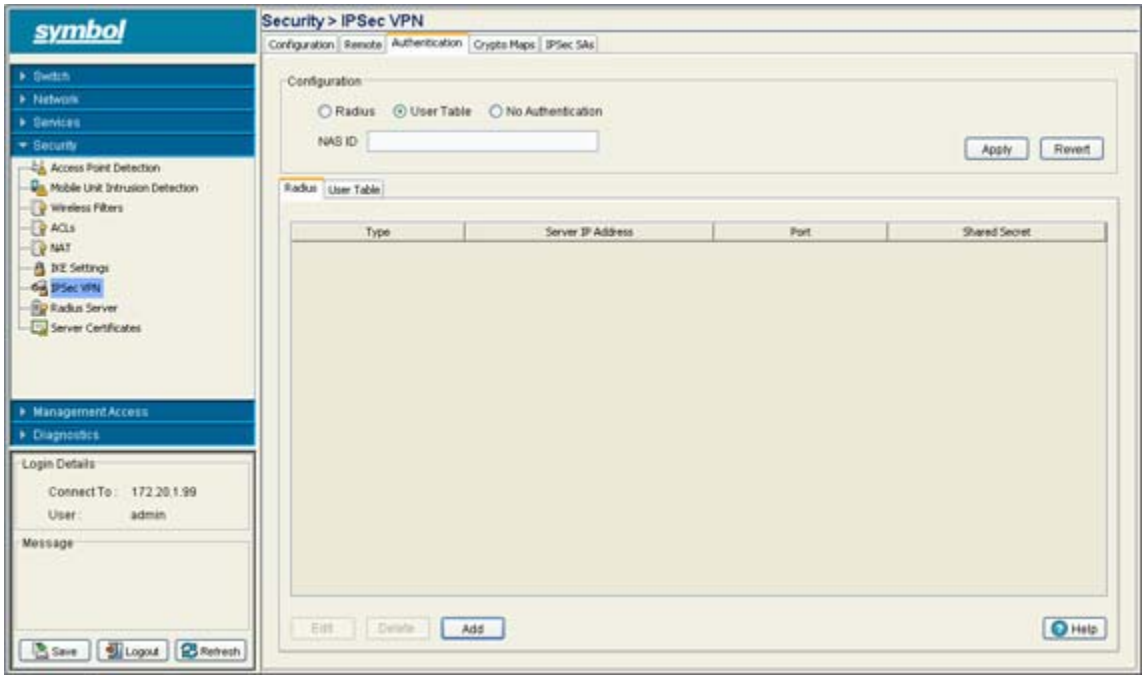
6.8.3 Configuring IPSEC VPN Authentication

If IKE is not used for establishing security associations, there is no negotiation of security associations, so the configuration information in both systems must be the same for traffic to be processed successfully by IPSec. Select the Authentication tab to define the credential verification mechanisms used with the IPSEC VPN configuration.

To define the IPSEc VPN authentication configuration:

1. Select **Security > IPSec VPN** from the main menu tree.

2. Click the **Authentication** tab.



3. Define whether the IPSec VPN user authentication is conducted using a Radius Server (by selecting the **Radius** radio button), by a user-defined set of names and password (by selecting the **User Table** radio button) or if no authentication is used for credential verification (by selecting the **No Authentication** radio button).
4. Enter a **NAS ID** for the NAS port.

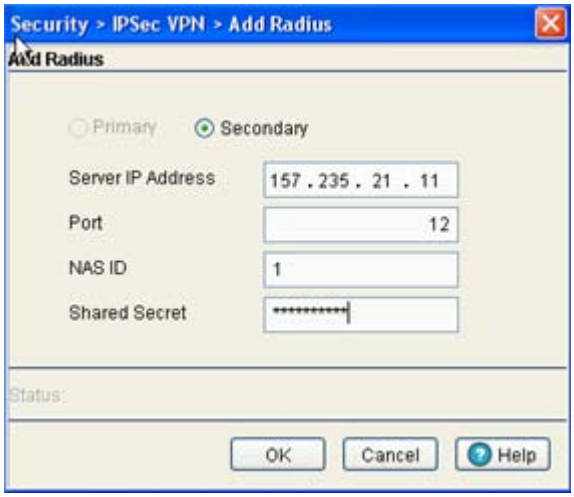
   The profile database on the Radius server consists of user profiles for each physical network access server (NAS) port connected. Every profile contains a profile matched to a username representing a physical port. When the switch authorizes users, it queries the user profile database using a username representative of the physical NAS port making the connection.
5. If the **Radius Server** radio button was selected, the following server information displays when the Radius tab is selected:

Type	Displays whether this target server is a primary or secondary Radius Server.
Server IP Address	Displays the IP address of the server acting as the data source for the Radius server.
Port	Displays the TCP/IP port number for the server acting as a data source for the Radius. The default port is 389.
Shared Secret	Displays a shared secret used for each host or subnet authenticating against the RADIUS server. The shared secret can be up to 7 characters in length.

6. Select an existing Radius Server and click the **Edit** button to modify its designation as a primary or secondary Radius Server, IP address, port, NAS ID and shared secret password.

   Symbol recommends only modifying an existing Radius Server when its current configuration is longer viable for providing user authentication. Otherwise, define a new Radius Server.

7. Select an existing server and click the **Delete** button to remove it from list of available Radius Servers for the remote VPN connection. Only delete a server if its configuration does not provide a valid authentication medium.
8. If you require a new Radius Server be configured, click the **Add** button.



Define this server's designation as a primary or secondary Radius Server, the server IP address, port, NAS ID and shared secret password. Click **OK** when completed to save the changes.

9. If **User Table** was selected from within the Configuration field, select the User Table tab to review the User Name and Passwords defined for use.
10. Click the **Add** button to display a screen used to add a new User and Password. Enter the User Name and Password and confirm. Click **OK** to save the changes.

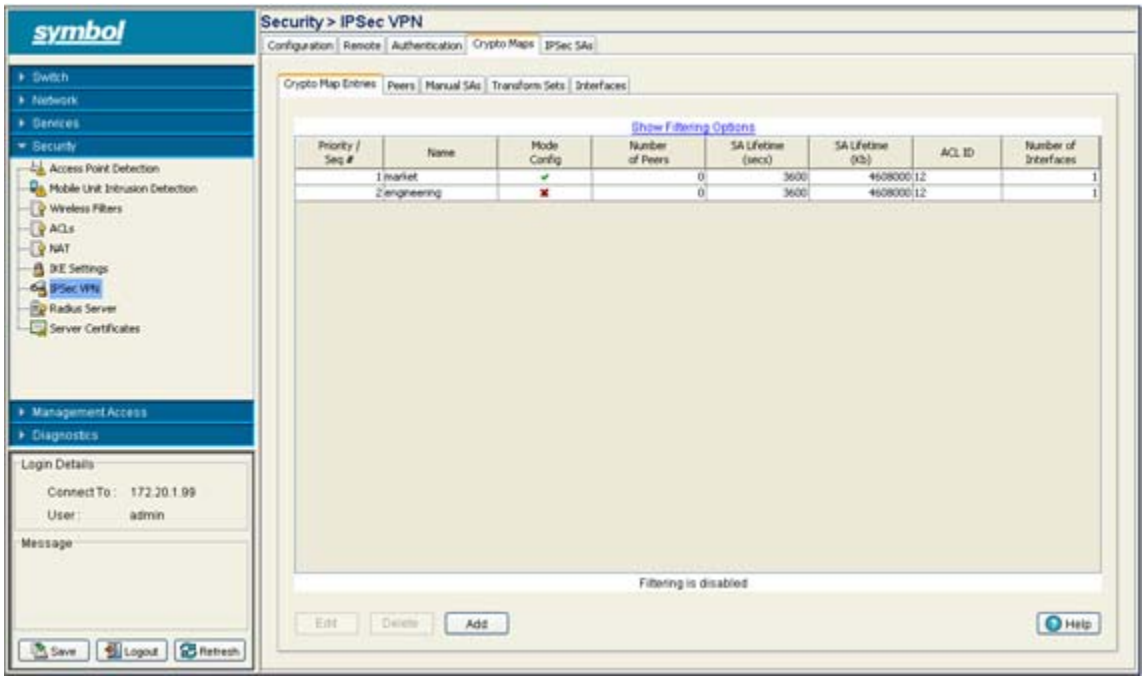
11. To change an existing user's password, select the user from within the User Table and click the **Change Password** button. Change and confirm the updated password.
12. If necessary, select an existing user and click the **Delete** button to remove that user from the list available within the User Table.

6.8.4 Configuring Crypto Maps

The Crypto Maps feature allows you to set restrictions preventing peers with specific credentials from accessing encrypted interfaces. If restricting access, specify a fewer number of crypto maps (referring to large identity sections) instead of specifying a large number of crypto maps (referring to small identity sections).

To define the Crypto Map configuration:

1. Select **Security > IPSec VPN** from the main menu tree.
2. Click the **Crypto Maps** tab.



The Crypto Maps screen is divided into 5 tabs, each serving a different function in the overall Crypto Map configuration. Refer to the following:

- *Crypto Map Entries*
- *Crypto Map Peers*
- *Crypto Map Manual SAs*
- *Crypto Map Transform Sets*
- *Crypto Map Interfaces*

6.8.4.1 Crypto Map Entries

To review, revise or add Crypto Map entries:

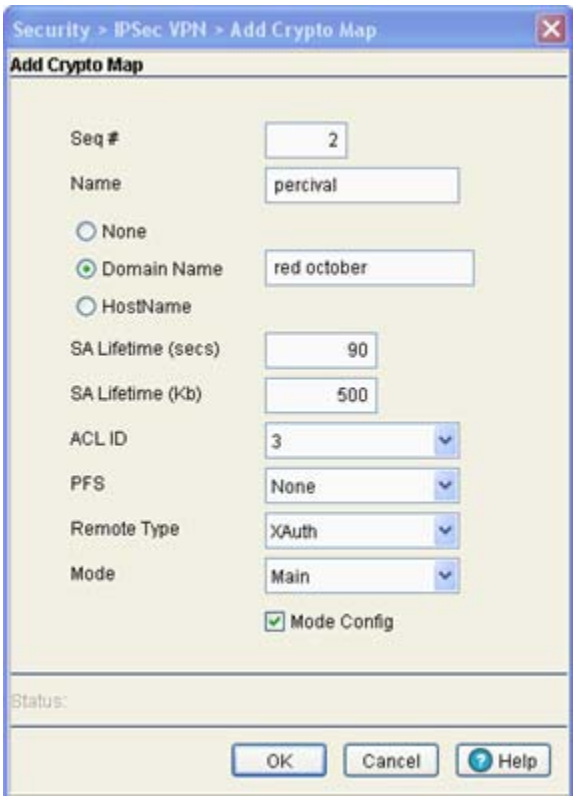
1. Select **Security** > **IPSec VPN** from the main menu tree.
2. Click the **Crypto Maps** tab and select **Crypto Map Entries.**
3. Review the following Crypto Map attributes to determine if an existing Crypto Map requires revision, deletion or if a new Crypto Map needs to be created.

Priority / Seq	Displays the numerical priority assigned to each Crypto Map.
Name	Displays the user-assigned name for this specific Crypto Map. This name can be modified using the **Edit** function or a new Crypto Map can be created by clicking the **Add** button.
Mode Config	This columns displays a green checkmark for the Crypto Map used with the current interface. A "X" is displayed next to other Crypto Maps not currently being used.
Number of Peers	Displays the number of peers used by each Crypto Map displayed.
SA Lifetime (secs)	Displays a SA Lifetime (in seconds) that forces the periodical expiration and re-negotiation of peer credentials. Thus, continually validating the peer relationship.
SA Lifetime (Kb)	Causes the security association to time out after the specified amount of traffic (in kilobytes) has passed through the IPSec tunnel using the security association.
ACL ID	Displays the name of the *Access Control List* (ACL) ID used for each Crypto Map.
Number of Interfaces	Displays the number of interfaces each specific Crypto Map is used with.

4. Select an existing Crypto Map and click the **Edit** button to modify the Crypto Map's attributes. If an entire Crypto Map requires revision, consider deleting the Crypto Map and creating a new one using the **Add** function.

   Refer to the definitions supplied for the **Add Crypto Map** screen (on the next page) to ascertain the requirements for editing a Crypto Map.
5. Select an existing Crypto Map and click the **Delete** button to remove it from the list of available Crypto Maps within the screen.

6. Click the **Add** button to define the attributes of a new Crypto Map.



   a. Assign a **Seq #** (sequence number) distinguishes one from the other. The sequence number determines its priority among the other Crypto Maps. The lower the number, the higher the priority.

   b. Assign the Crypto Map a **Name** to differentiate from others with similar configurations.

   c. Use the **None**, **Domain Name** or **Host Name** radio buttons to select and enter the fully qualified domain or host name of the host exchanging identity information.

   d. Define a **SA Lifetime (secs)** to define an interval (in seconds) that (when expired) forces a new association negotiation.

   e. Define a **SA Lifetime (Kb)** to time out the security association after the specified amount of traffic (in kilobytes) has passed through the IPSec tunnel using the security association.

   f. Use the **ACL ID** drop-down menu to permit a Crypto Map data flow using the permissions within the selected ACL.

   g. Use the **PFS** drop-down menu to specify a group to require *perfect forward secrecy* (PFS) in requests received from the peer.

   h. Use the **Remote Type** drop-down menu to specify a remote type of either **XAuth** or **L2TP**.

   i. Use the **Mode** drop-down menu to specify a mode of **Main** or **Aggressive**. Aggressive mode enables you to configure pre-shared keys as Radius tunnel attributes for IP Security (IPSec) peers.

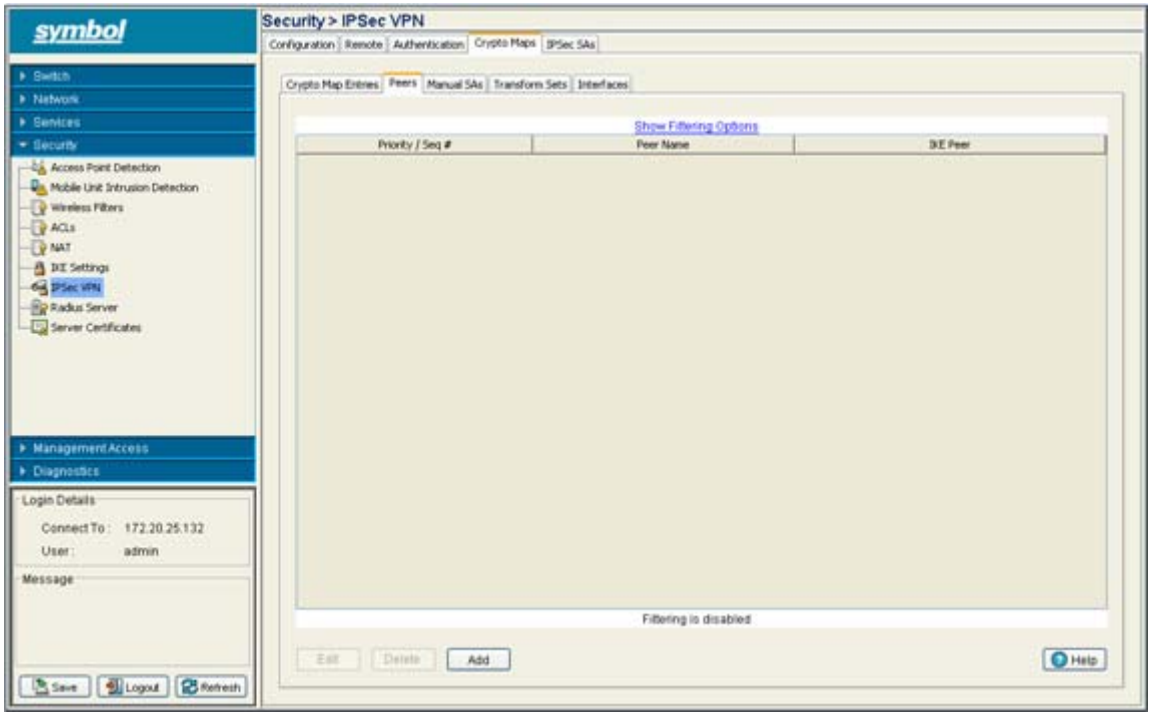
   j. Optionally select the **Mode Config** checkbox to allow the new Crypto Map to be implemented using the aggressive mode if selected from the Mode drop-down menu.

7. Click **OK** to save the new Crypto Map and display it within the Crypto Map tab.

6.8.4.2 Crypto Map Peers

To review, revise or add Crypto Map peers:

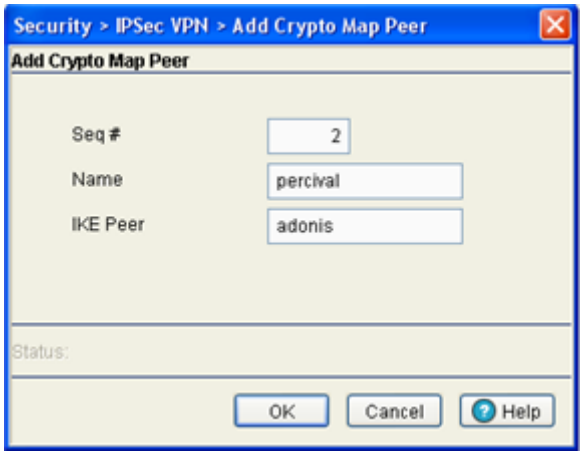
1. Select **Security** > **IPSec VPN** from the main menu tree.
2. Click the **Crypto Maps** tab and select **Peers.**



3. Refer to the read-only information displayed within the **Peers** tab to determine whether a peer configuration (among those listed) requires modification or a new peer requires creation.

Priority / Seq #	Displays each peer's Seq # (sequence number) in order to distinguish one from the other. The sequence number determines its priority among Crypto Maps. The lower the number, the higher the priority.
Peer Name	Displays the name assigned to the peer to differentiate it from others with similar configurations.
IKE Peer	Displays the IKE peer used with the Crypto Map to build an IPSec security association.

4. If a Crypto Map Seq # or IKE peer requires revision, select it from amongst those displayed and click the **Edit** button to revise its configuration.
5. Select an existing Crypto Map and click the **Delete** button to remove from the list of those available to the switch.
6. If a new peer requires creation click the **Add** button.



a. Define the **Seq #** for the new peer. The sequence number determines its priority among Crypto Maps. The lower the number, the higher the priority.

b. Provide a unique **Name** for the new Crypto Map peer to differentiate it from others with similar configurations.

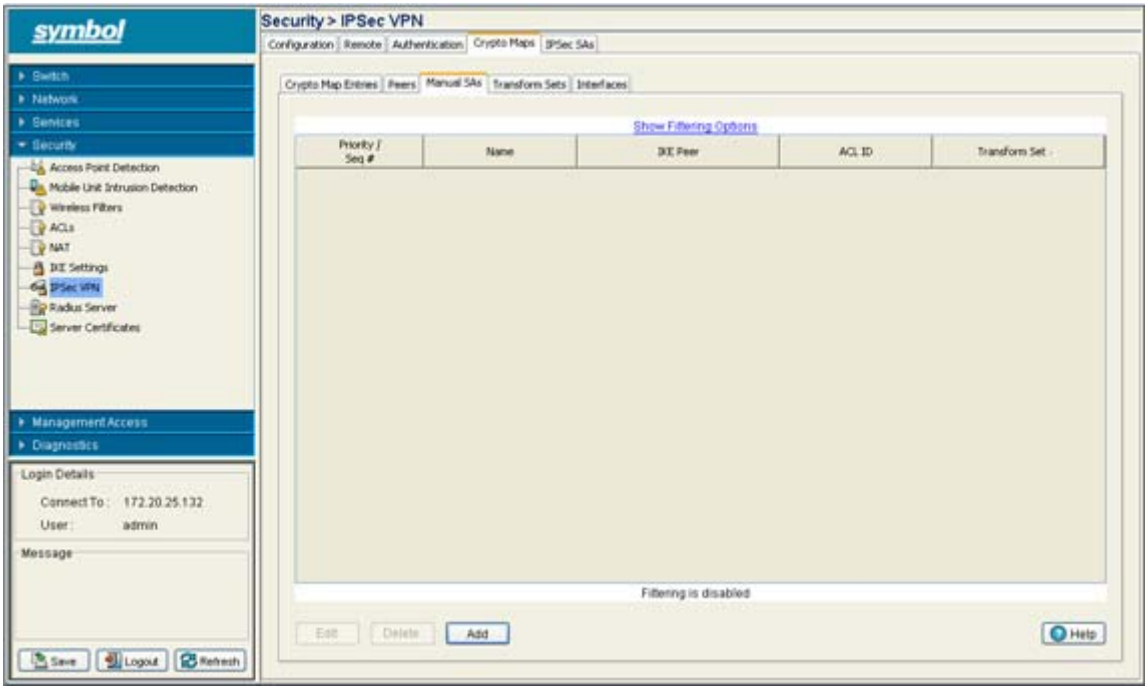
c. Enter the name of the **IKE Peer** used with the Crypto Map to build an IPSec security association.

7. Click **OK** when completed to save the configuration of the new Crypto Map peer.

6.8.4.3 Crypto Map Manual SAs

To review, revise or add a Crypto Map using a manually defined security association:

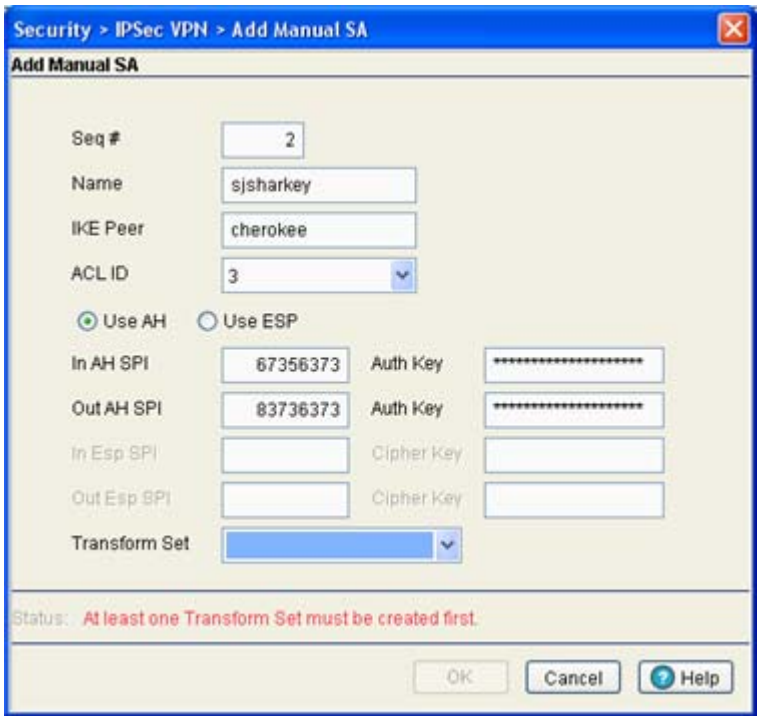
1. Select **Security** > **IPSec VPN** from the main menu tree.
2. Click the **Crypto Maps** tab and select **Manual SAs.**



3. Refer to the read-only information displayed within the **Manual SAs** tab to determine whether a Crypto Map with a manually defined security association requires modification or a new one requires creation.

Priority / Seq #	Displays the Seq # (sequence number) used to determine priority. The lower the number, the higher the priority.
Name	Displays the name assigned to the security association.
IKE Peer	Displays the IKE peer used with the Crypto Map to build an IPSec security association.
ACL ID	Displays the ACL ID the Crypto Map's data flow is using to establish access permissions.
Transform Set	Displays the transform set representing a combination of security protocols and algorithms. During the IPSec security association negotiation, peers agree to use a particular transform set for protecting the data flow.

4. If a Crypto Map with a manual security association requires revision, select it from amongst those displayed and click the **Edit** button to revise its Seq #, IKE Peer, ACL ID and security protocol.
5. Select an existing table entry and click the **Delete** button to remove from the list of those available to the switch.
6. If a new Crypto Map manual security association requires creation, click the **Add** button.



   a. Define the **Seq #**. The sequence number determines priority among Crypto Maps. The lower the number, the higher the priority.
   b. Provide a unique **Name** for this Crypto Map with the manual security association to differentiate it from others with similar configurations.
   c. Enter the name of the **IKE Peer** used to build an IPSec security association.

d. Use the **ACL ID** drop-down menu to permit a Crypto Map data flow using the permissions within the selected ACL.

e. Select either the **AH** or **ESP** radio button to define whether the Crypto Map's manual security association is an *AH Transform Authentication* scheme or an *ESP Encryption Transform* scheme. The AH SPI *or* ESP SPI fields and key fields become enabled depending on which radio button is selected.

f. Define the **In AH SPI** and **Auth Keys** *or* **In Esp** and **Cipher Keys** depending on which option has been selected.

g. Use the **Transform Set** drop-down menu to select the transform set representing a combination of security protocols and algorithms. During the IPSec security association negotiation, peers agree to use the transform set for protecting the data flow. A new manual security association cannot be generated without the selection of a transform set.

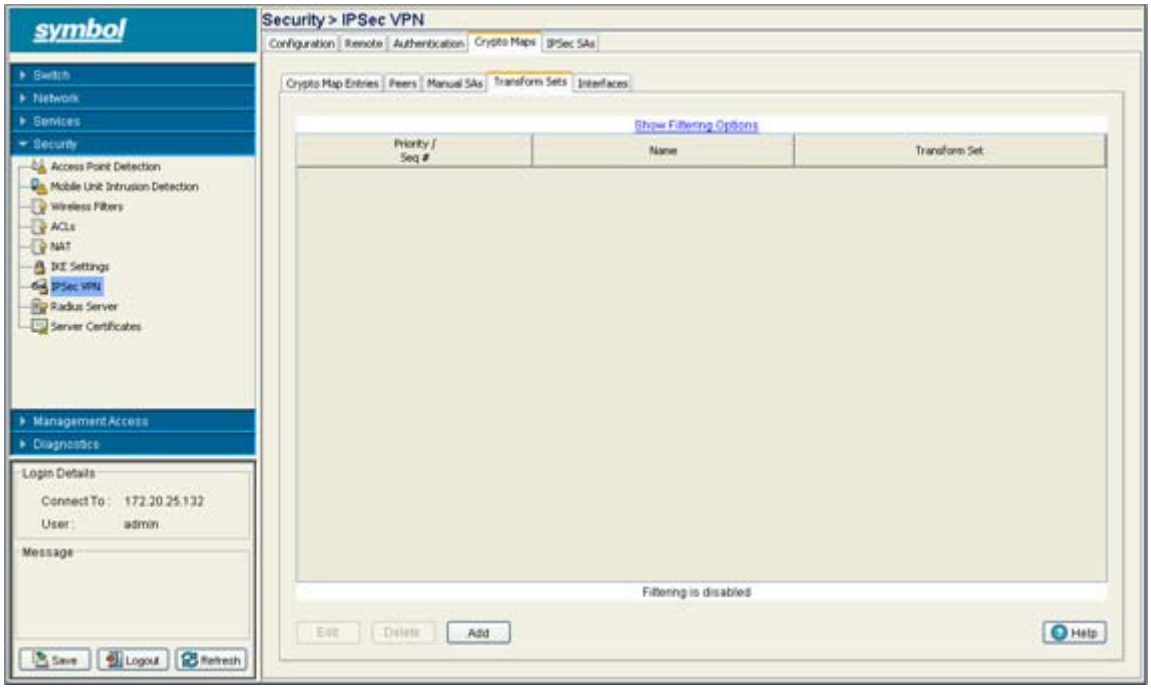
7. Click **OK** when completed to save the configuration of the Crypto Map security association.

6.8.4.4 Crypto Map Transform Sets

A transform set is a combination of security protocols and algorithms that define how the security appliance protects data.

To review, revise or add a Crypto Map transform set:

1. Select **Security** > **IPSec VPN** from the main menu tree.
2. Click the **Crypto Maps** tab and select **Transform Sets.**

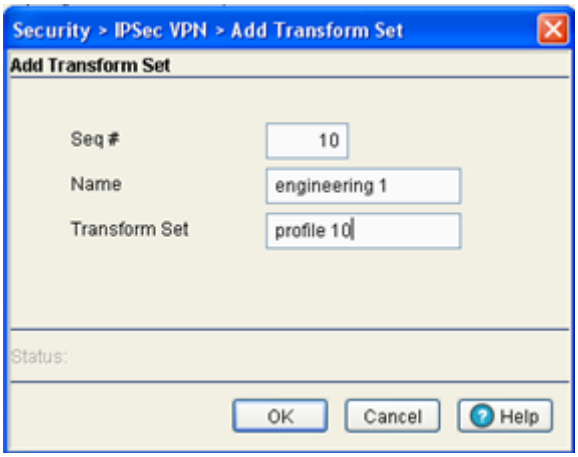


3. Refer to the read-only information displayed within the **Transform Set** tab to determine whether a Crypto Map transform set requires modification or a new one requires creation.

Priority / Seq #	Displays the Seq # (sequence number) used to determine priority. The lower the number, the higher the priority.
Name	Displays the name assigned Crypto Map using the transform set.

Transform Set	Displays the transform set representing a combination of security protocols and algorithms. During the IPSec security association negotiation, peers agree to use the transform set for protecting the data flow.

4. Select an existing Crypto Map and click the **Edit** button to revise its Seq #, Name and Transform Set.
5. Select an existing entry from the table and click the **Delete** button to remove from list.
6. If a new Crypto Map transform set requires creation, click the **Add** button.



   a. Define the **Seq #**. The sequence number determines priority among Crypto Maps. The lower the number, the higher the priority.
   b. Provide a unique **Name** to differentiate this configuration from others with a similar configuration.
   c. Enter the name of the **Transform set** used with the Crypto Map.
7. Click **OK** when completed to save the configuration of the Crypto Map transform set.

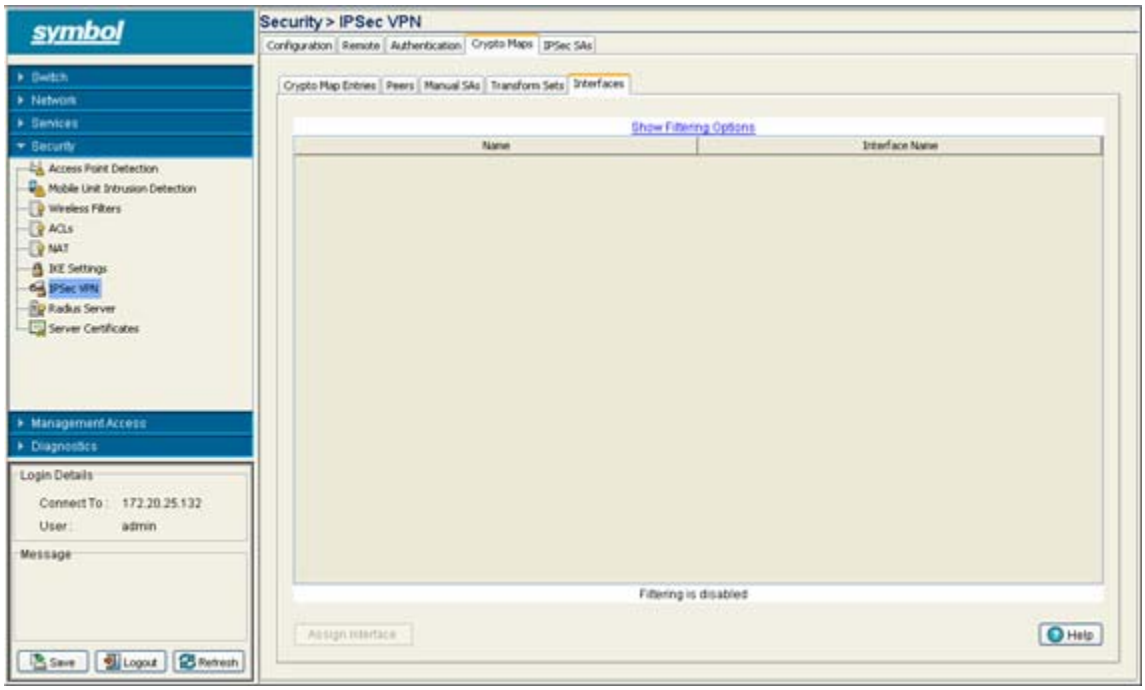
6.8.4.5 Crypto Map Interfaces

To review the interfaces currently available to the Crypto Maps or assign an interface:

NOTE With the WS5100 Series Switch, a Crypto Map cannot get applied to more than one interface at a time.

1. Select **Security** > **IPSec VPN** from the main menu tree.

2. Click the **Crypto Maps** tab and select **Interfaces.**



3. Refer to the following read-only information displayed within the **Interfaces** tab.

Name	Displays the name of the Crypto Maps available for interface.
Interface Name	Displays the name of the interface through which IPSec traffic will flow. Applying the crypto map set to an interface instructs the switch to evaluate all the interface's traffic against the crypto map set and to use the specified policy during connection or security association negotiation on behalf of traffic to be protected by crypto (either CET or IPSec).

4. Click the **Assign Interface** button to assign a crypto map to each interface through which IPSec traffic flows.

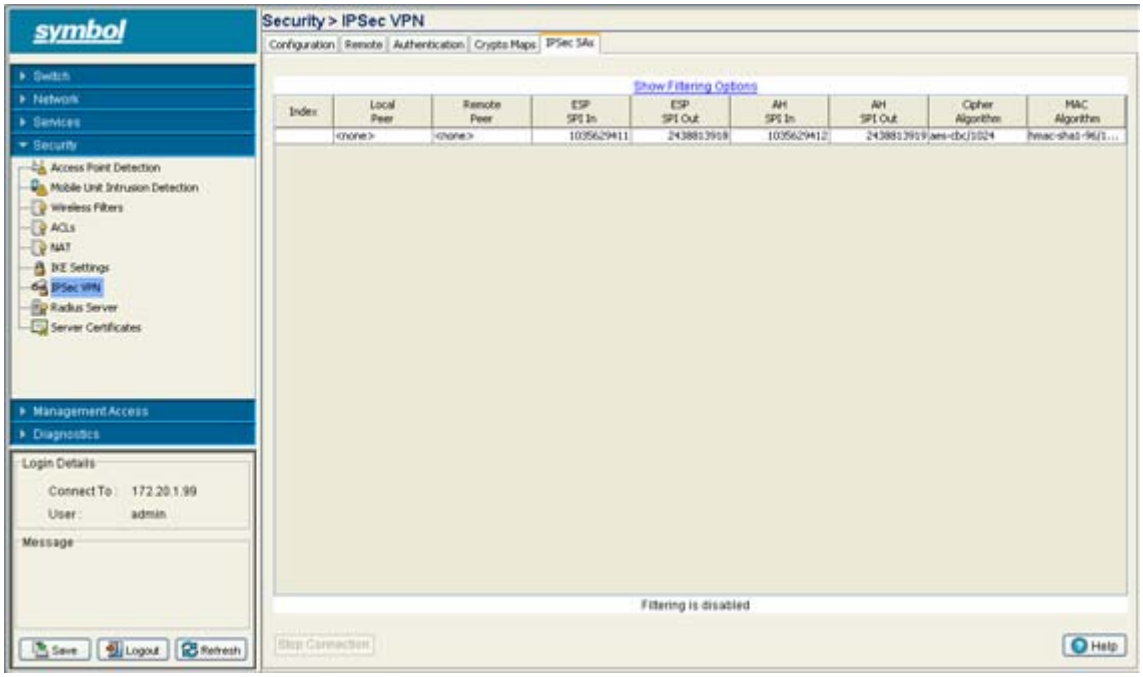
   The security appliance supports IPSec on all interfaces. Assigning the crypto map set to an interface instructs the security appliance to evaluate all the traffic against the crypto map set and to use the specified policy during connection or SA negotiation. Assigning a crypto map to an interface also initializes run-time data structures, such as the SA database and the security policy database. Reassigning a modified crypto map to the interface resynchronizes the run-time data structures with the crypto map configuration. Also, adding new peers through the use of new sequence numbers and reassigning the crypto map does not tear down existing connections.

6.8.5 Viewing IPSec Security Associations

Refer to the **IPSec SAs** tab to review the various *security associations* (SAs) between the local and remote peers comprising an IPSec VPN connection. The IPSec SA tab also displays the authentication and encryption schemes used between the VPN peers as well other device address information.

To display IPSec VPN security associations:

1. Select **Security > IPSec VPN** from the main menu tree.
2. Click the **IPSec SAs** tab.



3. Refer to the following security association data:

Index	Displays the numerical (if defined) for the security association. Use the index to differentiate the index from others with similar configurations.
Local Peer	Displays the name of the local peer at the near side of the VPN connection.
Remote Peer	Displays the name of the remote peer at the far side of the VPN connection.
ESP SPI In	SPI specified in the *Encapsulating Security Payload* (ESP) inbound header.
ESP SPI Out	SPI specified in the *Encapsulating Security Payload* (ESP) outbound header.
AH SPI In	Displays the inbound *Authentication Header* (AH).
AH SPI Out	Displays the outbound *Authentication Header* (AH).
Cipher Algorithm	Displays the algorithm used with the ESP cipher.
MAC Algorithm	Displays the algorithm used with the security association.

4. If necessary, select a security association from those displayed and click the **Delete** button to remove it.

6.9 Configuring the Radius Server

Remote Authentication Dial-In User Service (Radius) is a client/server protocol and software enabling remote access servers to communicate with the switch to authenticate users and authorize their access to the switch managed network.

Radius enables centralized management of switch authentication data (usernames and passwords). When a MU attempts to associate to the Radius supported switch, the switch sends the authentication request to the Radius server. The communication between the switch and server are authenticated and encrypted through the use of a shared secret password (not transmitted over the network).

The Radius server stores the authentication data locally, but it can also store authentication data in an external database. A Radius server as the centralized authentication server makes is an excellent choice for performing accounting. Radius can significantly increase security by centralizing password management.

NOTE The switch can be configured to use its own local Radius server or an external Radius server you define and configure within the switch managed network.

CAUTION When restarting or rebooting the switch, the Radius server will also be restarted regardless of its state before the reboot.

Setting up Radius on the switch entails the following:

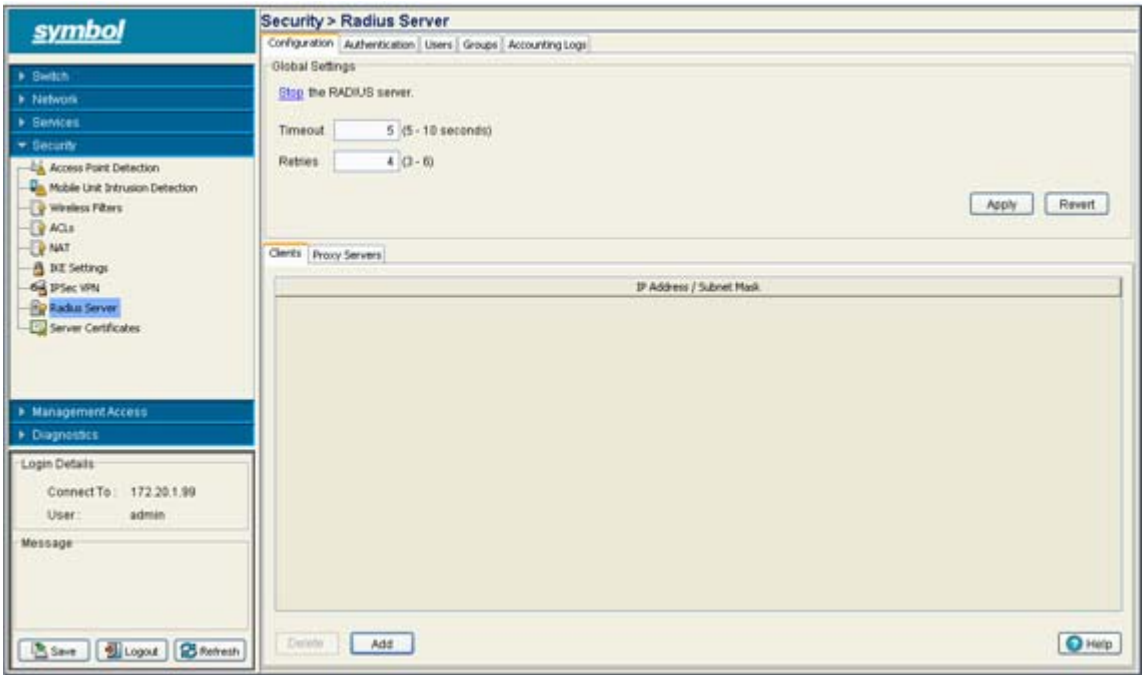
- *Defining the Radius Configuration*
- *Configuring Radius Authentication and Accounting*
- *Configuring Radius Users*
- *Configuring Radius User Groups*
- *Viewing Radius Accounting Logs*

NOTE For hotspot deployment, Symbol recommends using the switch's onboard Radius server and built-in user database. This is the easiest setup option and offers a high degree of security and accountability. For information on configuring the Radius server, see *Configuring the Radius Server on page 6-64*.

6.9.1 Defining the Radius Configuration

To configure Radius support on the switch:

1. Select **Security** > **Radius Server** from the main menu.
2. Ensure the **Configuration** tab is selected.



3. Click the Start **the RADIUS server** link to use the switch's own Radius server to authenticate users accessing the switch managed network.
4. Set a **Timeout** value (between 1 and 65535 seconds) to define how long the switch waits for a reply to a Radius request before retransmitting the request.

   Ensure the value is set long enough to compensate for the heaviest periods of data traffic within the switch managed network.
5. Set a **Retires** value (between 1 and 65535) to define the number of times the switch transmits each Radius request to the server before giving up.
6. Click the **Apply** button to save the changes made to within the Global Settings field.
7. Click the **Revert** button to cancel any changes made within the Global Settings field and revert back to the last saved configuration.

NOTE The appearance of the bottom portion of the Configuration tab differs depending on whether **Clients** or **Proxy Servers** is selected. Select the Clients tab to display the IP Address and Subnet Mask of existing Radius clients. Existing clients can be modified or new clients added. For more information, see *Radius Client Configuration on page 6-66*. Select the Proxy Servers tab to display the ID suffix, IP Address and Port Number of existing Radius proxy servers. Existing servers can be modified or new proxy servers added. For more information, see *Radius Proxy Server Configuration on page 6-66*.

6.9.1.1 Radius Client Configuration

A Radius client implements a client/server mechanism enabling the switch to communicate with a central server to authenticate users and authorize their access to the switch managed network. A Radius client is often an embedded device since it alleviates the need to store detailed user information locally.

To configure Radius client support:

1. Select **Security** > **Radius Server** from the main menu.
2. Ensure the **Configuration** tab is selected.
3. Select the **Clients** tab from the bottom portion of the Configuration tab.

   The Clients tab displays the IP address and subnet mask of the switch's existing Radius clients.
4. To edit an existing Radius client configuration, select it from the table and click the **Edit** button.

   The Edit screen displays the Radius client's existing IP address, subnet mask and shared secret password used for credential verification. Modify these settings as required.
5. To remove an existing Radius client configuration from the table of configurations available to the switch, select the configuration and click the **Delete** button.
6. To create a new Radius client configuration, click the **Add** button at the bottom of the screen.

   a. Specify the **IP Address/Mask** of the subnet or host authenticating with the Radius client.
   b. Specify a Radius **Shared Secret** for authenticating the RADIUS client.

      Shared secrets are used to verify Radius messages (with the exception of the Access-Request message) are sent by a Radius -enabled device configured with the same shared secret. The shared secret is a case-sensitive string that can include letters, numbers, or symbols. Make the shared secret at least 22 characters long to protect the Radius server from brute-force attacks.
   c. Refer to the **Status** field for the current state of the requests made from applet. This field displays error messages if something goes wrong in the transaction between the applet and the switch.
   d. Click **OK** to use the changes to the running configuration and close the dialog.
   e. Click **Cancel** to close the dialog without committing updates to the running configuration

6.9.1.2 Radius Proxy Server Configuration

The switch can be configured to receive accounting requests from a Radius proxy server. A user's access request is sent to a proxy server if it cannot be authenticated by a local server. The proxy server forwards the access request to a proxy server that can authenticate the user. The proxy server checks the information in the user access request and either accepts or rejects the request. If the proxy target server accepts the request, it returns configuration information specifying the type of connection service required to authenticate the user.

To configure Radius proxy server support:

1. Select **Security** > **Radius Server** from the main menu.
2. Ensure the **Configuration** tab is selected.
3. Select the **Proxy Servers** tab from the bottom portion of the Configuration tab.

   The Proxy Servers tab displays the user ID suffix (index), IP address and port number of the switch's existing proxy server configurations.
4. To edit an existing Radius proxy server configuration, select it from the table and click the **Edit** button.

   The Edit screen displays the Radius proxy server's existing ID suffix (index), IP address, port number and shared secret password used for credential verification. Modify these settings as required.
5. To remove an existing Radius proxy server configuration from the table of configurations available to the switch, select the configuration and click the **Delete** button.
6. To create a new Radius proxy server configuration, click the **Add** button at the bottom of the screen.

   a. Create a new **User ID Suffix** serving as an abbreviation for the configuration to differentiate it from other configurations with similar attributes.
   b. Specify the **IP Address** of the new Radius proxy server.
   c. Enter the TCP/IP port number for the server that will be acting as a data source for the proxy server.
   d. Specify a Radius **Shared Secret** for authenticating the RADIUS client.

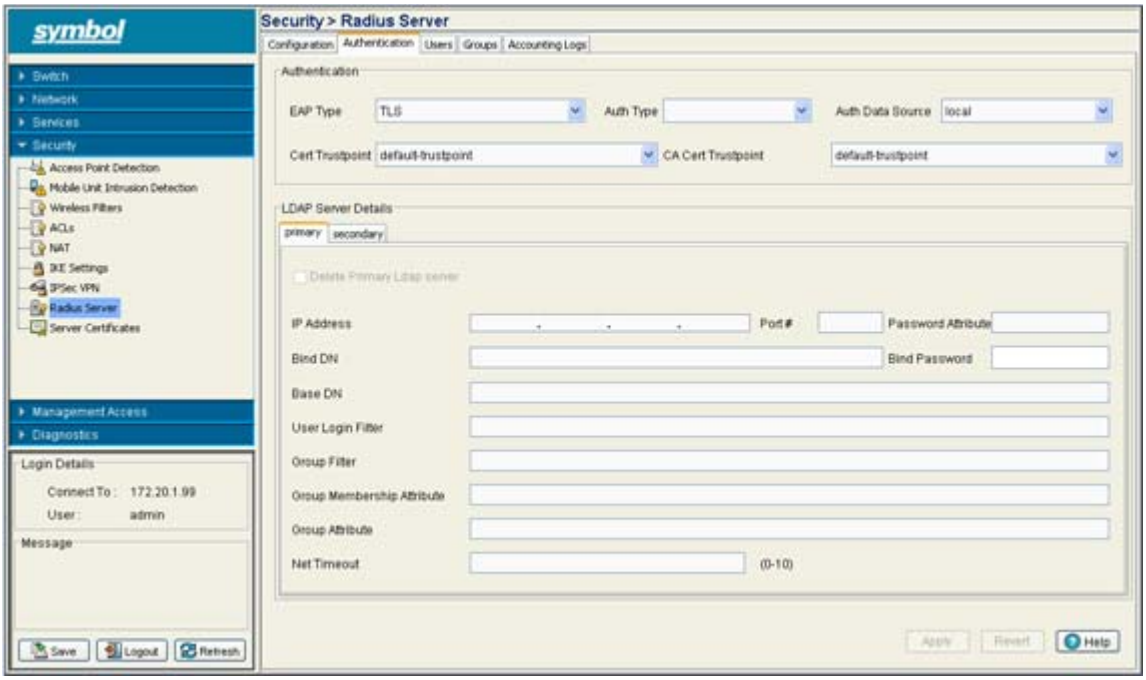
      Shared secrets are used to verify Radius messages (with the exception of the Access-Request message) are sent by a Radius -enabled device configured with the same shared secret. The shared secret is a case-sensitive string that can include letters, numbers, or symbols. Make the shared secret at least 22 characters long to protect the Radius server from brute-force attacks.
   e. Refer to the **Status** field for the current state of the requests made from applet. This field displays error messages if something goes wrong in the transaction between the applet and the switch.
   f. Click **OK** to use the changes to the running configuration and close the dialog.
   g. Click **Cancel** to close the dialog without committing updates to the running configuration

6.9.2 Configuring Radius Authentication and Accounting

Deploy one or more Radius servers to manage security and retrieve accounting information within the switch managed network. Radius accounting supplies administrators with user data as Radius sessions are implemented and terminated.

To define the Radius authentication and accounting configuration:

1. Select **Security** > **Radius Server** from the main menu.
2. Select the **Authentication** tab.



3. Refer to the **Authentication** field to define the following Radius authentication information:

EAP Type Specify the EAP type for the RADIUS server.

- PEAP uses a TLS layer on top of EAP as a carrier for other EAP modules. PEAP is an ideal choice for networks using legacy EAP authentication methods.
- TTLS is similar to EAP-TLS, but the client authentication portion of the protocol is not performed until after a secure transport tunnel has been established. This allows EAP-TTLS to protect legacy authentication methods used by some RADIUS servers.

Auth Type

If PEAP is selected as the EAP type, specify a Auth Type for PEAP to use from the drop-down menu. The options are GTC and MSCHAP-V2.

- EAP *Generic Token Card* (GTC) is a challenge handshake authentication protocol that uses a hardware token card to provide the response string.
- Microsoft CHAP (MSCHAP-V2) is an encrypted authentication method based on Microsoft's challenge/response authentication protocol.

If TTLS is selected as the EAP type, specify a Default Auth Type for TTLS to use from the drop-down menu. The options are MD5, PAP and MSCHAP-V2.

- Message Digest 5 (MD5) is a secure hash function which converts a long data stream into a fixed size digest.
- *Password Authentication Protocol* (PAP) is a protocol where the user sends an identifier and password pair to the server. This information is sent unencrypted.
- Microsoft CHAP (MSCHAP-V2) is an encrypted authentication method based on Microsoft's challenge/response authentication protocol.

Auth Data Source

Use **Auth Data Source** drop-down menu to select the data source for the local RADIUS server.

- If **Local** is selected, the switch's internal user database serves as the data source for user authentication. Refer to the **Users** and **Groups** tabs to define user and group permissions for the switch's local Radius server.
- If **LDAP** is selected, the switch uses the data within an LDAP server.

Cert Trustpoint

Click the **View/Change** button to specify the trustpoint from which the Radius server automatically grants certificate enrollment requests. A trustpoint is a representation of a CA or identity pair. A trustpoint contains the identity of the CA, CA-specific configuration parameters, and an association with one enrolled identity certificate.

CA Cert Trustpoint

Click the **View/Change** button to specify the CA certificate trustpoint from which the Radius server automatically grants certificate enrollment requests. A trustpoint is a representation of a CA or identity pair. A trustpoint contains the identity of the CA, CA-specific configuration parameters, and an association with one enrolled identity certificate.

NOTE For information on configuring certificates for use with the switch, see *Creating Server Certificates on page 6-77*.

4. Refer to the **LDAP Server Details** field to define the attributes of the primary and secondary Radius LDAP servers providing accounting services to the switch.

IP Address	Enter the IP address of the external LDAP server acting as the data source for the RADIUS server. This server must be accessible from an active subnet on the switch.
Port	Enter the TCP/IP port number for the LDAP server acting as the data source.
Password Attribute	Enter the password attribute used by the LDAP server for authentication.
Bind DN	Specify the distinguished name to bind with the LDAP server.
Bind Password	Enter a valid password for the LDAP server.
Base DN	Specify a distinguished name that establishes the base object for the search. The base object is the point in the LDAP tree at which to start searching.
User Login Filter	Enter the login used by the LDAP server for authentication. In most cases, the default value in this field should work.
Group Filter	Specify the group filters used by your LDAP server.
Group Membership Attribute	Specify the Group Member Attribute to be sent to the LDAP server when authenticating the users.
Group Attribute	Specify the group attribute used by the LDAP server.
Net Timeout	Enter a timeout value the system uses to terminate the connection to the Radius Server if no activity is detected.

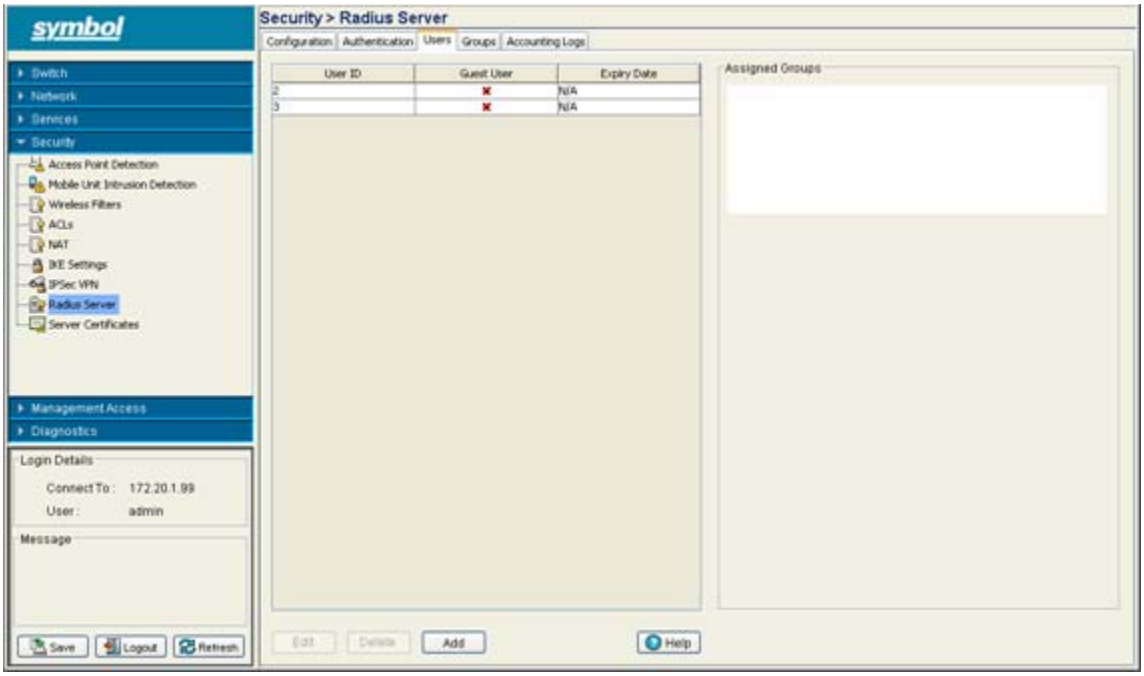
5. Click the **Apply** button to save the changes made to within the screen.
6. Click the **Revert** button to cancel any changes made within the screen and revert back to the last saved configuration.

6.9.3 Configuring Radius Users

Refer to the **Users** tab to view the current set of users and assigned groups for the Radius server. The Users tab is used when **Local** is selected as the Auth Data Source within the **Authentication & Accounting** tab. The user information is ignored if an LDAP server is used for user authentication.

To define the Radius user permissions for switch access:

1. Select **Security** > **Radius Server** from the main menu.
2. Select the **Users** tab.



3. Refer to the following user information to assess whether an existing user can be used with the local Radius server as is, requires modification or if a new user is required.

User ID	Displays the username for this specific user. The name assigned should reflect the user's identity and perhaps their status within the switch managed network (guest versus secure user).
Guest User	Displays whether a specific user has been defined as a guest user (with a red X) or has been configured as permanent user. Guest users have temporary Radius server access.
Expiry Date	If the user has been assigned guest privileges, then they were also assigned a date when their Radius privileges expire.

4. Refer to the **Assigned Groups** field to view the memberships for the existing users displayed within the Users tab.

   If the group assignment is insufficient, use the **Edit** or **Add** functions to modify/create users or modify their existing group assignments.

5. To modify the attributes of an existing user, select the user from the list of users displayed and click the **Edit** button.

Modify the existing user's guest designation, password, expiry date and group assignments as required to reflect the user's current local Radius authentication requirements.

6. If an existing user is no longer needed, select the user from those displayed and click the **Delete** button to permanently remove the user from the list available.
7. To create a new user for use with the local Radius server, click the **Add** button and provide the following information.

CAUTION Radius user passwords will be stored in the running configuration file in clear text.

User ID	Define a unique user ID that differentiates this user from others with similar attributes.
Guest User	Select the Guest User checkbox to assign this particular user only temporary access to the local Radius server, thus restricting their authentication period to a user defined interval.
Password	Enter the password used to add the user to the list of approved users displayed within the Users tab.
Confirm Password	Re-enter (confirm) the password used to add the user to the list of approved users displayed within the Users tab.
Current Switch Time	Displays the read only switch time. This is the switch time used for the expiry data and time.
Expiry Date & Time	Define the date and time (in dd:MM:yyyy-hh:mm) format to timeout users defined with temporary permissions.
Available Groups	Use the Available Groups **Add ->** and **Remove <-** functions to map groups (for inclusion) for this specific user.
Configured Group	Select the **Configured Group** checkbox to

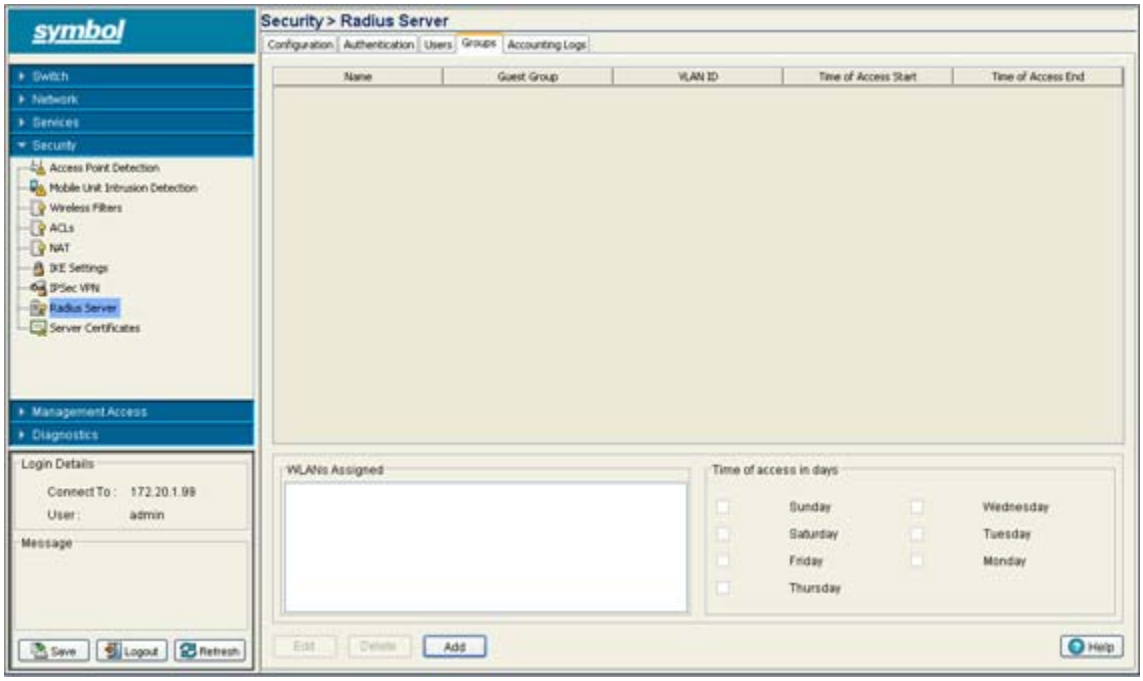
a. Refer to the **Status** field for the current state of the requests made from applet. This field displays error messages if something goes wrong in the transaction between the applet and the switch.
b. Click **OK** to use the changes to the running configuration and close the dialog.
c. Click **Cancel** to close the dialog without committing updates to the running configuration

6.9.4 Configuring Radius User Groups

The **Groups** tab displays a list of all groups in the local Radius server's database. The groups are listed in the order added. The existing configuration fro each group is displayed to provide the administrator then option of using a group as is, modifying an existing group's properties or creating a new group.

To assess the configuration of existing user groups:

1. Select **Security** > **Radius Server** from the main menu.
2. Select the **Groups** tab.



3. Refer to the displayed user groups to assess the following read-only attributes for each group listed:

Name	Displays the unique name assigned to each group. The group name should be indicative of the user population within and their shared activity within the switch managed network.
Guest Group	Displays whether a specific group has been defined as a guest group (with a red X) or has been configured as permanent group. Guest users have temporary Radius server access.
VLAN ID	Display the VLAN ID(s) used by each group listed. The VLAN ID is representative of the shared SSID each group member (user) employs to interoperate with one another within the switch managed network (once authenticated by the local Radius server).
Time of Access Start	Displays the time each group was (will be) authenticated to interoperate within the switch managed network. Each user within the group will be authenticated with the local Radius server. Those group members successfully authenticated are allowed access to the switch managed network using the restrictions defined for the group.

Time of Access End	Displays the time each group's user base will loose access privileges within the switch managed network. After this time, users within this group will not be authenticated by the local Radius server. However, if a user is part of a different group that has not exceeded their access end interval, then the user may still interoperate with the switch (remain authenticated) as part of that group.

4. Refer to the **WLANs Assigned** area of the Groups tab to review which switch WLANs are available for use with configured groups.
5. Refer to the **Time of access in days** field to assess the intervals (which days) the group has been assigned access to the switch managed network (after each user has been authenticated).

   This value is read-only within the Groups tab. Click **Edit** to modify the access assignments of an existing group or click **Add** to create a new group with unique access assignments.
6. To modify the attributes of an existing group, select the group from the list of groups displayed and click the **Edit** button.

   Modify the existing group's guest designation, VLAN ID, access period and WLAN assignment.
7. If an existing group is no longer needed (perhaps obsolete in function), select the group from those displayed and click the **Delete** button to permanently remove the group from the list of available groups.
8. To create a new group, click the **Add** button and provide the following information.

Name	Define a unique group name that differentiates this new group from others with similar attributes.
Guest Group	Select the **Guest Group** checkbox to assign this particular group (and the users within) only temporary access to the local Radius server, thus restricting their authentication period to a user defined access interval.
VLAN ID	Define the VLAN ID for the new group. The VLAN ID is representative of the shared SSID each group member (user) employs to interoperate with one another within the switch managed network (once authenticated by the local Radius server).
Time of Access Start	Set the time the group is authenticated to interoperate within the switch managed network. Each user within the group will be authenticated with the local Radius server. Those group members successfully authenticated are allowed access to the switch managed network using the restrictions defined for the group.
Time of Access End	Set the time each group's user base will loose access privileges within the switch managed network. After this time, users within this group will not be authenticated by the local Radius server. However, if a user is part of a different group that has not exceeded their access end interval, then the user may still interoperate with the switch (remain authenticated) as part of that group.

Available WLANs	Use the Available WLANs **Add ->** and **Remove <-** functions to move WLANs for this new group from the available list to the configured list. Once on the configured list (and the changes applied), the members of this group can interoperate with the switch on these WLANs (once authenticated by the local Radius server).
Configured WLANs	The Configured WLANs columns displays the WLANs this new group can operate within (once users are configured). Use the **Add ->** and **Remove <-** functions to move WLANs from the available list to the configured list.
Time of access in days	Select the checkboxes corresponding to the days of the week you would like this new group to have access to the switch managed network using the WLANs configured. Of course, the user base within the group still needs to be authenticated by the local Radius server first.

a. Refer to the **Status** field for the current state of the requests made from applet. This field displays error messages if something goes wrong in the transaction between the applet and the switch.

b. Click **OK** to use the changes to the running configuration and close the dialog.

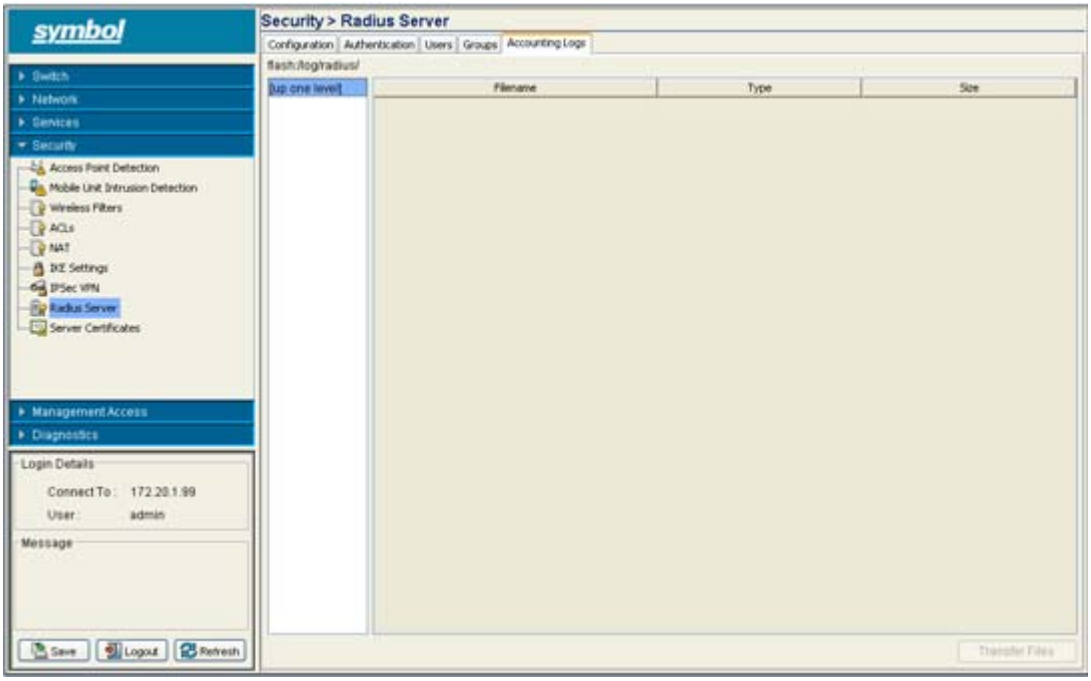
c. Click **Cancel** to close the dialog without committing updates to the running configuration.

6.9.5 Viewing Radius Accounting Logs

Accounting logs contain information about the use of remote access services by users.

To display the Radius accounting logs:

1. Select **Security** > **Radius Server** from the main menu.
2. Select the **Accounting Logs** tab.



3. Refer to the following information as displayed within the **Accounting Logs** tab.

Filename	Displays the name of each accounting log file. Use this information to differentiate files with similar attributes.
Type	Displays the type of file each file is.
Size	Display the size of the file.

4. Click the **Purge Records** button to clear the statistics displayed and refresh the data counters to zero to begin a new data collection activity.

6.10 Creating Server Certificates

Use the **Server Certificates** screen to view existing self-signed certificate values. The values displayed are read-only. The Server Certificates screen also allows an administrator to:

- create a certificate request
- send it to a Certificate Authority (CA)
- import the certificate.
- create a self signed certificate
- upload an external certificate
- delete a server certificate and/or root certificate of a trustpoint
- create a new key
- upload/download keys to and from the switch to and from a server or local disk
- delete all the keys in the switch.

Server Certificates are issued to Web Servers and used to authenticate Web Servers to Web browsers while establishing a *Secure Socket Layer* (SSL) connection.

The **Server Certificates** screen contains the following two tabs:

- *Using Trustpoints to Configure Certificates*
- *Configuring Trustpoint Associated Keys*

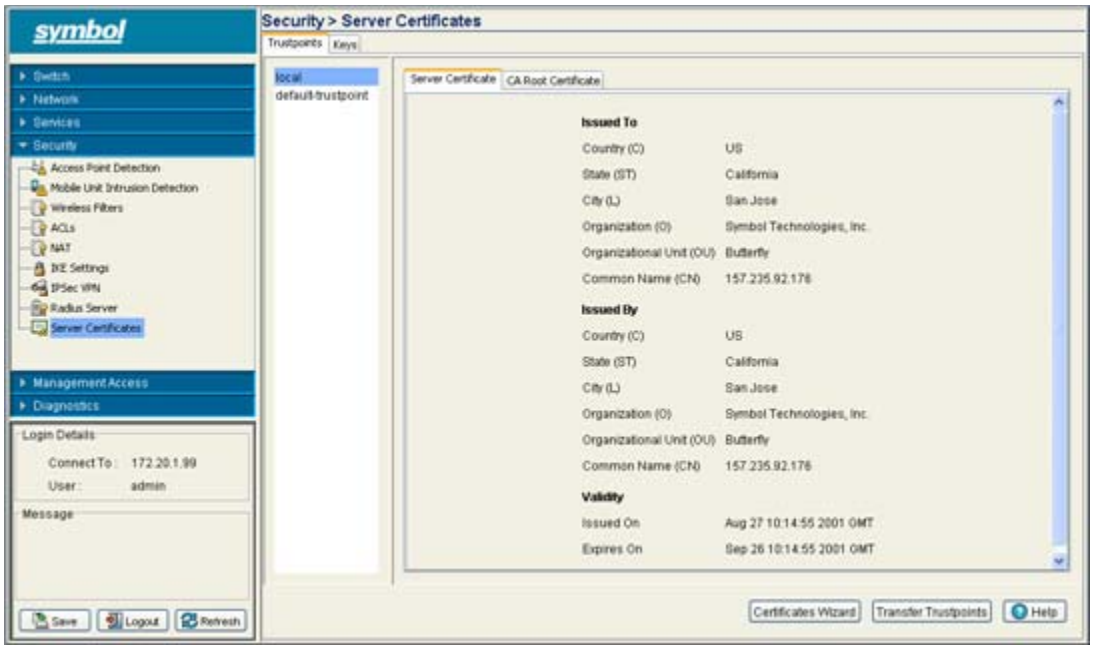
6.10.1 Using Trustpoints to Configure Certificates

Each certificate is digitally signed by a trustpoint. The trustpoint signing the certificate can be a certificate authority, corporation or an individual. A trustpoint represents a CA/identity pair and contains the identity of the CA, CA-specific configuration parameters, and an association with one enrolled identity certificate.

To view current certificates values:

1. Select **Security** > **Server Certificates** from the main menu tree.

2. Select the **Trustpoints** tab.



A panel (on the far left of the screen) displays the currently enrolled trustpoints.

The **Server Certificate** and **CA Root Certificate** tabs display read-only credentials for the certificates currently in use by the switch. A table displays the following **Issued To** and **Issued By** details for each:

Issued To

Country (C)	Displays the country of usage for which the certificate was assigned.
State (ST)	Displays the state (if within the US) or province within the country listed above wherein the certificate was issued.
City (L)	Lists the city wherein the server certificate request was made. The city should obviously be within the State/Prov stated.
Organization (O)	Displays the name of the organization making the certificate request.
Org. Unit (OU)	Displays the name of the organizational unit making the certificate request.
Common Name (CN)	If there is a common name (IP address) for the organizational unit making the certificate request, it displays here.

Issued By

Country (C)	Displays the Country of the certificate issuer.
State (ST)	Displays the state or province for the country the certificate was issued.
City (L)	Displays the city representing the state/province and country from which the certificate was issued.
Organization (O)	Displays the organization representing the certificate authority

Organizational Unit	If a unit exists within the organization that is representative of the certificate issuer, that name should be displayed here.
Common Name	If there is a common name (IP address) for the organizational unit issuing the certificate, it displays here.
Validity	
Issued On	Displays the date the certificate was originally issued.
Expires On	Displays the expiration date for the certificate.

3. Click the **Certificate Wizard** button to create a self signed certificate, upload an external server certificate (and/or a root certificate) and delete a server certificate (and/or a root certificate) of a trustpoint. For more information, see *Using the Wizard to Create a New Certificate on page 6-79*.

6.10.1.1 Creating a Server / CA Root Certificate

To create a Server Certificate or CA Root Certificate:

1. Select **Security** > **Server Certificates** from the main menu tree.
2. Click the **Certificate Wizard** button on the bottom of the screen.
3. The Certificate Wizard displays.

   Use this wizard to:

   - Create a new certificate
   - Upload an external certificate
   - Delete Operations
4. Select the **Create new certificate** radio button to generate a new self-signed certificate or prepare a certificate request which can be send to a *Certificate Authority* (CA).

   For more information, see *Using the Wizard to Create a New Certificate on page 6-79*.
5. Select the **Upload an external certificate** radio button to upload an existing Server Certificate or CA Root Certificate.

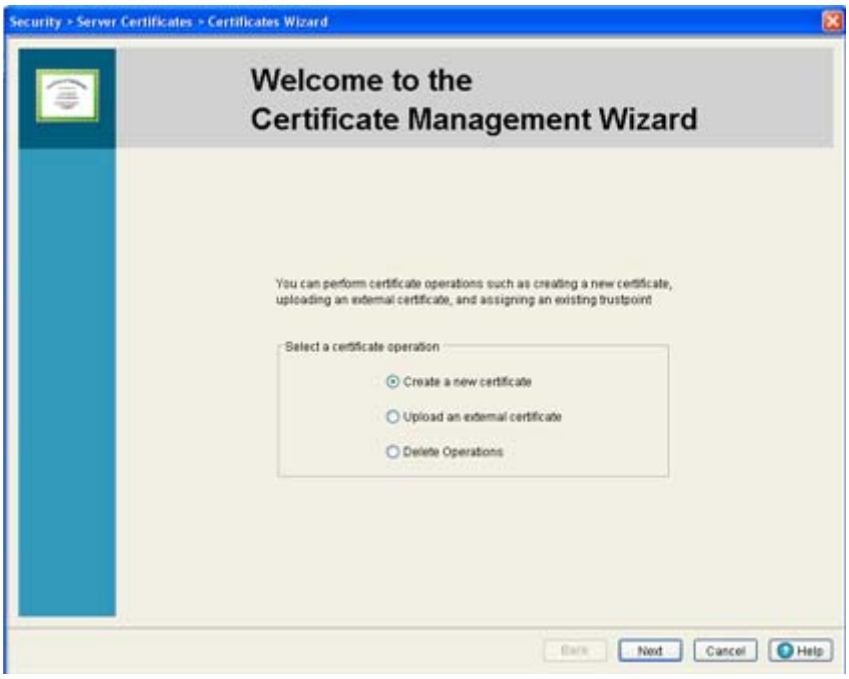
   For more information, see *Using the Wizard Delete Operation on page 6-84*.
6. Select the **Delete Operations** radio button to delete trustpoints and all related keys.

   For more information, see *Using the Wizard Delete Operation on page 6-84*.

Using the Wizard to Create a New Certificate

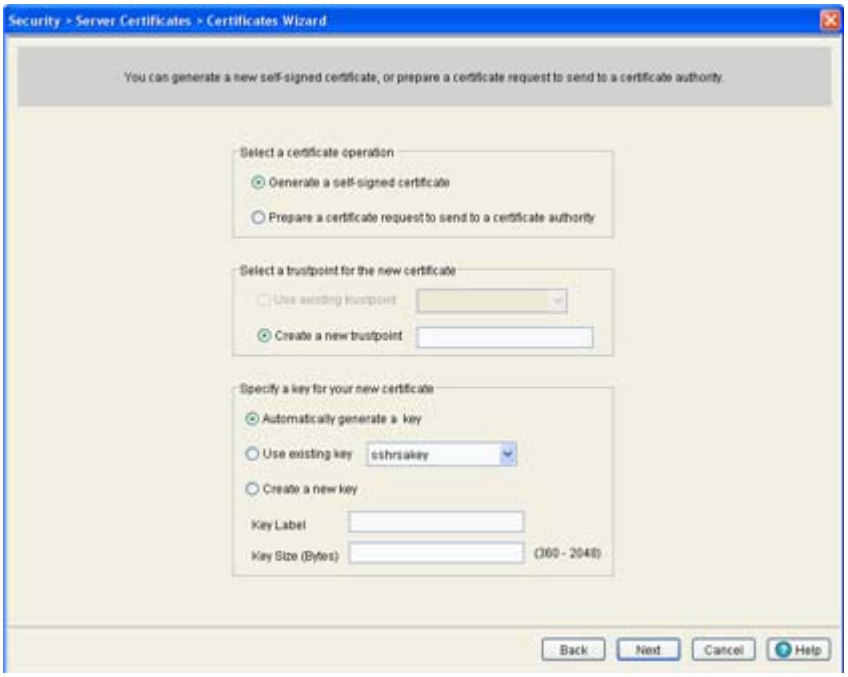
To generate a new self-signed certificate or prepare a certificate request which can be send to a Certificate Authority (CA):

1. Select the **Create new certificate** radio button in the wizard and click the **Next** button.



   The second page of the wizard contains two editable fields, **Select Certificate Operation** and **Specify a key for you new certificate**.

2. Use the second page to create either a self signed certificate or prepare for a certificate request. For certificate operation, select one of the following options:
   - *Generate a self signed certificate* — Configure the properties of a new self-signed certificate. Once the values of the certificate are defined, the user can create and install the certificate.
   - *Prepare a certificate request to send to a Certificate Authority* — Configure and save a valid certificate request. Once the values of the certificate are defined, the user can create and install the certificate.



Select a trustpoint for the new certificate

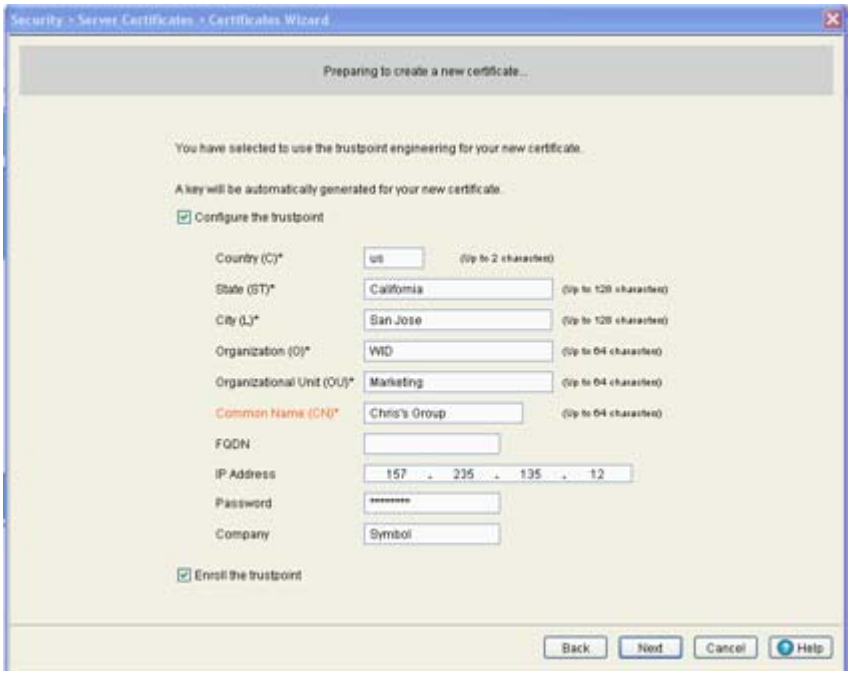
- *Use existing trustpoint* - Select an existing trustpoint from the drop-down menu.
- *Create a new trustpoint* - Provide a name for the new trustpoint in the space provided.

To specify the key for the new certificate, select one of the following options:

- *Automatically generate a key* — Select this option to automatically generate a key for the trustpoint.
- *Use existing key* — Select an existing key using the drop-down menu.
- *Use a new key* — Select this option to create a new key for the trustpoint. Define a Key Label and size as appropriate.

Associate the certificate selected with one of the options provided in the *Specify a key for your new certificate* and click the **Next** button.

If generating a new self-signed certificate (as selected in page 2 of the wizard), the wizard continues the installation. Use the third page of the wizard to enter a unique trustpoint name and other credentials required to create a new certificate.



3. Select the **Configure the trustpoint** checkbox to enable the new self signed certificate to be configured as a trustpoint.
4. Provide the following information for the certificate:

Country	Define the Country used in the Self-Signed Certificate. By default, the Country is US. The field can be modified by the user to other values. This is a required field and must not exceed 2 characters.
State	Enter a State/Prov. for the state or province name used in the Self-Signed Certificate. By default, the State/Prov. field is Province. This is a required field.
City	Enter a City to represent the city name used in the Self-Signed Certificate. By default, the City name is City. This is a required field.
Organization	Define an Organization for the organization used in the Self-Signed Certificate. By default, it is Company Name. The user is allowed to modify the Organization name. This is a required field.
Organization Unit	Enter an Org. Unit for the name of the organization unit used in the Self-Signed Certificate. By default, it is Department Name. This is a required field.
Common Name	Define a Common Name for the URL of the switch. This is a required value. The Common Name must match the URL used in the browser when invoking the switch applet.

FQDN	Enter a *fully qualified domain name* (FQDN) is an unambiguous domain name that specifies the node's position in the DNS tree hierarchy absolutely. To distinguish an FQDN from a regular domain name, a trailing period is added. ex: somehost.example.com. An FQDN differs from a regular domain name by its absoluteness; as a suffix is not added.
IP Address	Specify the switch IP address that can be used as the switch destination for certificate requests.
Password	Enter an alphanumeric password used to access the certificate configuration.
Company	Provide a Company name to be used on behalf of the certificate.

5. Select the **Enroll the trustpoint** checkbox to enroll the certificate request with the CA.
6. Click **Next** to proceed with the certificate creation.

   The fourth page of the wizard concludes the creation of the self certificate. The fourth page displays the details of the certificate.
   If you selected to prepare a certificate request in the page 2, the wizard continues, prompting the user for the required information to complete the certificate request. Click **Next** to continue.

   The fifth page of the wizard prompts the user to enter the trustpoint name and other credentials required to create a new certificate.
7. Use the **Enter trustpoint name** parameter to assign a name to the trustpoint.
8. Provide Certificate Credential information for the following:

Country	Define the **Country** used in the Self-Signed Certificate. By default, this Country is US. The field can be modified by the user to other values. This is a required field and must not exceed 2 characters.
State	Enter a State/Prov. for the state or province name used in the Self-Signed Certificate. By default, the State/Prov. field is Province. This is a required field.
City	Enter a **City** to represent the city name used in the Self-Signed Certificate. By default, the City name is City. This is a required field.
Organization	Define an Organization for the organization used in the Self-Signed Certificate. By default, it is Company Name. The user is allowed to modify the Organization name. This is a required field.
Organization Unit	Enter an Org. Unit for the name of the organization unit used in the Self-Signed Certificate. By default, it is Department Name. This is a required field.
Common Name	Define a Common Name for the switch URL. This is a required value. The Common Name must match the URL used in your browser when invoking the switch applet.
Password	Provide the password required to access the URL.
FQDN	Enter a *fully qualified domain name* (FQDN) is an unambiguous domain name that specifies the node's position in the DNS tree hierarchy absolutely. To distinguish an FQDN from a regular domain name, a trailing period is added. ex: somehost.example.com. An FQDN differs from a regular domain name by its absoluteness; as a suffix is not added

IP Address	Specify the switch IP address that can be used as the switch destination for certificate requests.

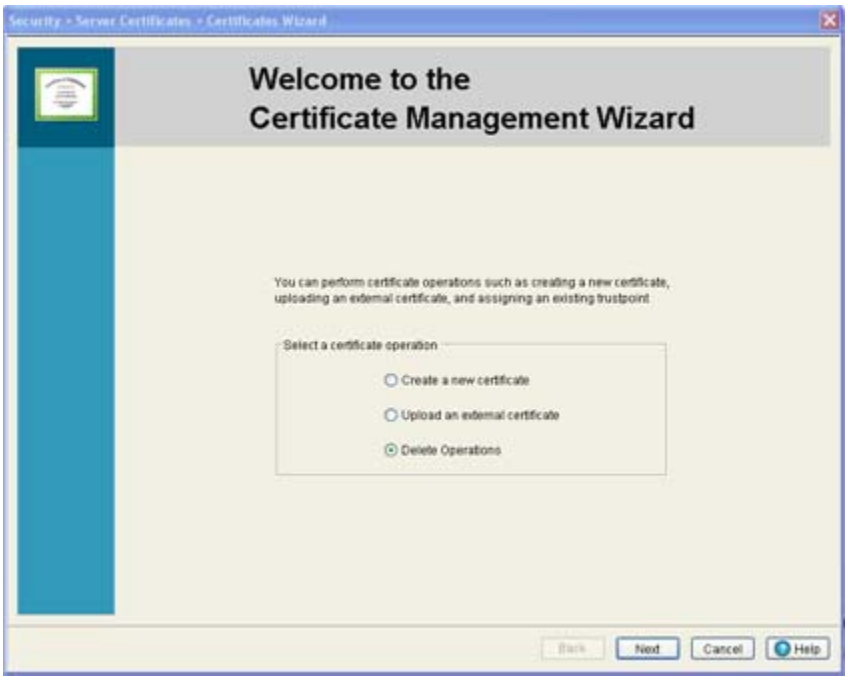
9. Click the **Next** button to continue preparing the certificate request.

Using the Wizard Delete Operation

The wizard can also be used to delete entire trustpoints, the certificate used with a trustpoint or the CA root certificate use with a trustpoint. Delete trustpoint properties as the become obsolete or the properties of a certificate are no longer relevant to the operation of the switch.

To use the wizard to delete trustpoint properties:

1. Select the **Delete Operations** radio button in the wizard and click the **Next** button.



   The next page of the wizard is used to delete a trustpoint.

2. Select the **Delete the following for trustpoint** checkbox and select the trustpoint to delete from the drop-down menu associated with it. This enables the following options:

Delete entire trustpoint	Select the checkbox and select a certificate to remove. If selected, the **Delete the following trustpoint** option is disabled.
Delete the following for trustpoint	Select this option to delete the trustpoint for the selected Server Certificate or CA Root Certificate.
Delete all the keys from the switch	Select this option to remove all of the keys that have previously been configured for the deleted trustpoints. Once removed, the keys cannot be restored.

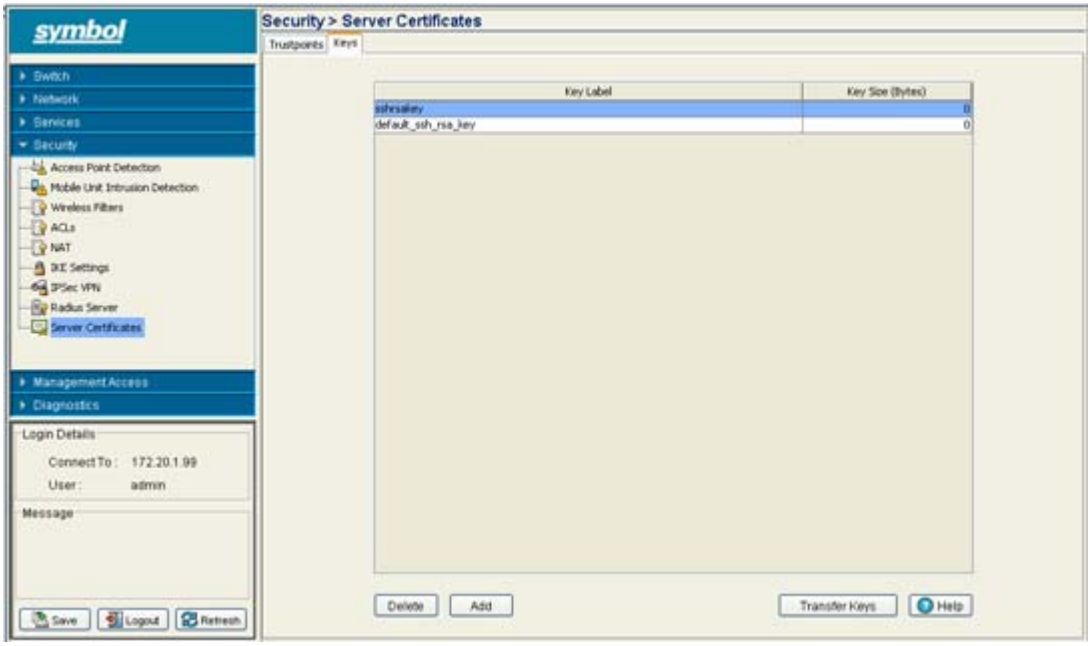
3. Click the Next button to complete the trustpoint removal.

6.10.2 Configuring Trustpoint Associated Keys

Trustpoint keys allow a user to configure the switch to use different *Rivest, Shamir, an Adelman* (RSA) key pairs. Therefore, the switch can maintain a different key pair for each certificate.

To configure the keys associated with trustpoints:

1. Select **Security** > **Server Certificates** from the main menu tree.
2. Select the **Keys** tab.



The Keys tab displays the following:

Key Label	The Key Label is the name of the key pair that can be automatically generated separately, or automatically when selecting a certificate. Specify your option within the wizard.
Key Sizes	The key size of the desired key. If not specified, a key size of 1024 is used.

3. Highlight a Key from the table and click the **Delete** button to delete it from the switch.
4. Click on **Add** button to add a new key label to the list of keys available to the switch. For more information, see *Adding a New Key on page 6-85*.
5. Click on **Transfer Keys** to archive the keys to a user-specified location. For more information, see *Transferring Keys on page 6-87*.

6.10.2.1 Adding a New Key

If none of the keys listed within the Keys tab are suitable for use with a certificate, consider creating a new key pair.

1. Select **Security** > **Server Certificates** from the main menu tree.
2. Select the Keys tab.

3. Click the **Add** button at the bottom of the screen.

4. Enter a **Key Label** in the space provided to specify a name for the new key pair.
5. Define the **Key Size** between 360 and 2048 in the space provided.
6. Refer to the **Status** field for the current state of the requests made from applet. This field displays error messages if something goes wrong in the transaction between the applet and the switch.
7. Click **OK** to save the changes to the running configuration and close the dialog.
8. Click **Cancel** to close the dialog without committing updates to the running configuration.

6.10.2.2 Transferring Keys

The **Transfer** screen allows for the transfer of keys to and from the switch to (and from) a server or local disk. Transferring keys is recommended to ensure server certificate key information is available if problems are encountered with the switch and this data needs to be retreived.

1. Select **Security** > **Server Certificate** from the main menu tree.
2. Click the **Keys** Tab.
3. Highlight a target file, and select the **Transfer Keys** button.
4. Use the **From** drop-down menu to specify the location from which the log file is sent. If only the applet is available as a transfer location, use the default switch option.
5. Select a target file for the file transfer from the **File** drop-down menu.

   The drop-down menu contains the log files listed within the Server Certificate screen.
6. Use the **To** drop-down menu to define whether the target log file is to be sent to the system's local disk (Local Disk) or to an external server (Server).
7. Provide the name of the file to be transferred to the location specified within the **Target** field.
8. Use the **Using** drop down-menu to configure whether the log file transfer will be sent using FTP or TFTP.
9. Enter the **IP Address** of destination server or system receiving the target log file.
10. Enter the **User ID** credentials required to send the file to the target location.

    Use the user ID for FTP transfers only.
11. Enter the **Password** required to send the file to the target location using FTP.
12. Specify the appropriate **Path** name to the target directory on the local system disk or server as configured using the "To" parameter.

    If the local server option is selected, use the browse button to specify the location on the local server.
13. Refer to the **Status** field for the current state of the requests made from applet. This field displays error messages if something goes wrong in the transaction between the applet and the switch.
14. Click the **Transfer** button when ready to move the target file to the specified location.

    Repeat the process as necessary to move each desired log file to the specified location.
    Click the **Close** button to exit the screen after a transfer. There are no changes to save or apply.

7 Switch Management

This chapter describes the Management Access main menu items used to configure the switch. This chapter contains following content:

NOTE HTTPS must be enabled to access the switch applet. Ensure that HTTPS access has been enabled before using the login screen to access the switch applet.

7.1 Displaying the Management Access Interface

Refer to the main Management Access interface for a high-level overview of the current switch firmware version and the current switch log output configuration. Use this information to discern whether a switch firmware upgrade is required (by checking the Symbol Website for a newer version) of if the switch is outputting log data appropriately.

NOTE When the switch's configuration is successfully updated (using the Web UI), the effected screen is closed without informing the user their change was successful. However, if an error were to occur, the error displays within the effected screen's Status field and the screen remains displayed. In the case of file transfer operations, the transfer screen remains open during the transfer operation and remains open upon completion (with status displayed within the Status field).

To display the main Management screen:

1. Select **Management Access** from the main menu tree.

2. Refer to the **Current Status** field to review the following read-only information:

Firmware In Use	The **Firmware In Use** value displays the software version currently running on the switch.
Log Output	The Log Output value displays the target location for log files output by the switch.

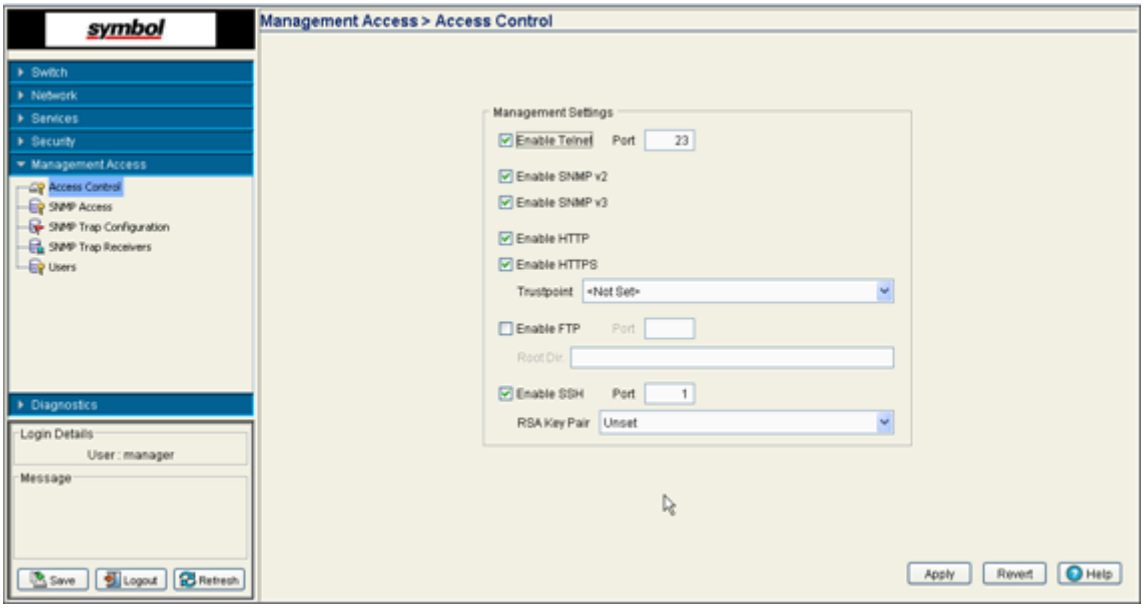
NOTE The **Apply** and **Revert** functions are greyed out within this screen, as this screen is read-only with no configurable parameters for the user to update and save.

7.2 Configuring Access Control

Refer to the Access Control screen to enable (or disable) the various access mechanisms available to the switch.

To configure access control settings on the switch:

1. Select **Management Access** > **Access Control** from the main menu tree.



2. Refer to the **Management Settings** field to enable or disable the following switch interfaces:

Enable Telnet	Select this checkbox to allow the switch to use telnet session access for communicating over the network. This setting is enabled by default.
Port	Define the port number used for the Telnet session with the switch.
Enable SNMP v2	Select this checkbox to enable SNMPv2 access to the switch and configuration activities over the SNMPv2 interface. This setting is enabled by default.
Enable SNMP v3	Select this checkbox to enable SNMPv3 access to the switch and configuration activities over the SNMPv3 interface. This setting is enabled by default.
Enable HTTP	Select this checkbox to enable HTTP access to the switch. The *Hypertext Transfer Protocol* (HTTP) is an application-level protocol for distributed, collaborative, hypermedia information systems. This setting is enabled by default.
Enable HTTPs	Select this checkbox to enable HTTPS access to the switch. *Hypertext Transfer Protocol over Secure Socket Layer* (HTTPS) is a Web protocol that encrypts and decrypts user page requests.This setting is enabled by default.

Trustpoint	Use the Trustpoint drop-down menu to select the local or default trustpoint or used with the HTTPS session with the switch. For information on creating a new certificate for use with the switch, see *Creating Server Certificates on page 6-77*.
Enable FTP	Select this checkbox to enable FTP access to the switch. *File Transfer Protocol* (FTP) is the language used for file transfers across the Web. This setting is disabled by default.
Port	Define the port number used for the FTP session with the switch (if using FTP).
Root Dir.	Define the root directory where the FTP server is located (if using FTP).
Enable SSH	Select this checkbox to enable SSH access to the switch. *Secure Shell* (SSH) is a program designed to perform a number of functions, such as file transfer between computers, command execution or logging on to a computer over a network. It is intended to do these tasks with greater security than programs such as Telnet or FTP. This setting is enabled by default.
Port	Define the port number used for the SSH session with the switch.
RSA Key Pair	Use the RSA Key Pair drop-down menu to define either a Unset or default_ssh_rsa_key for secure communications during the SSH session with the switch.

NOTE You cannot establish a SSH session with the switch when a RSA Key with a length of 360 is associated with the SSH-Server.

3. Click the **Apply** button to save changes made to the screen since the last saved configuration.
4. Click the **Revert** button to revert the screen back to its last saved configuration. Changes made since the contents of the screen were last applied are discarded.

7.3 Configuring SNMP Access

The SNMP Access menu allows you to view and configure existing SNMP v1/v2 and SNMP v3 details and their current access control details. You can also view the SNMP V2/V3 events and their current values. The SNMP Access window consists of the following tabs:

- *Configuring SNMP v1/v2 Access*
- *Configuring SNMP v3 Access*
- *Accessing SNMP v2/v3 Statistics*

CAUTION Your system must be running Sun JRE version 1.5.x (or higher) or Mozilla in order for the switch Web UI to be used with the WS5100 3.0 baseline SNMP interface.

NOTE The WS5100 Series Switch SNMP facility cannot retrieve a configuration file directly from its SNMP interface. You must first deposit the configuration file to a computer, then FTP the file to the switch.

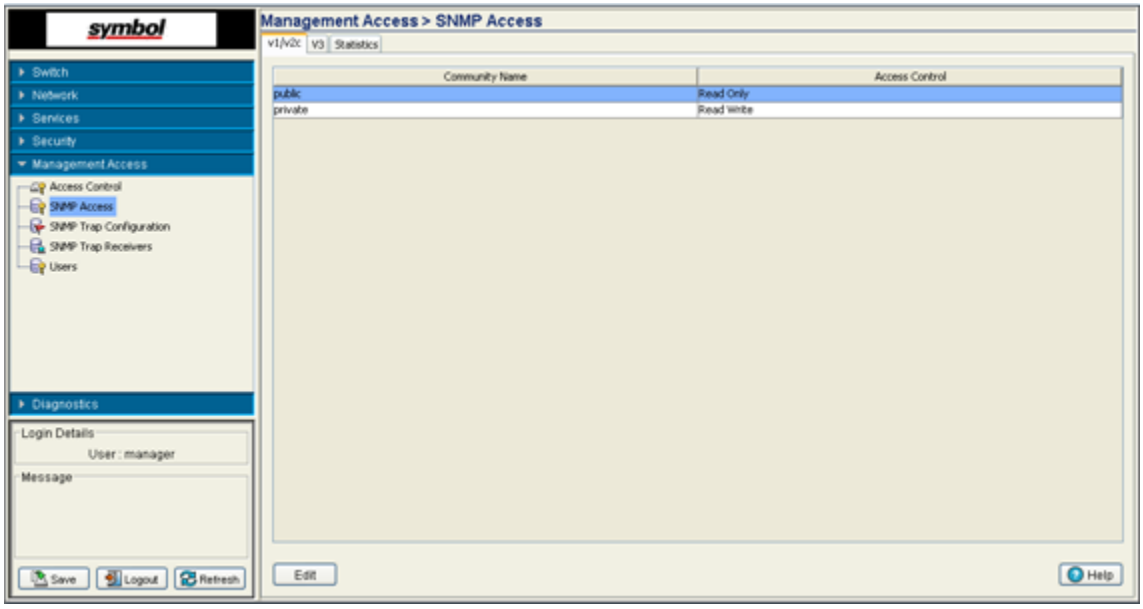
7.3.1 Configuring SNMP v1/v2 Access

Refer to the v1/v2c screen for information on existing SNMP v1/v2 community names and their current access control settings. Community names can be modified by selecting a community name and clicking the **Edit** button.

NOTE The SNMP undo feature is not supported.

To review existing SNMP v1/v2 definitions:

1. Select **Management Access** > **SNMP Access > v1/v2** from the main menu tree.



2. Refer to the **Community Name** and **Access Control** fields for the following information:

Community Name	Displays the read-only or read-write name used to associate a site-appropriate name for the community. The name is required to match the name used within the remote network management software. Click the **Edit** button to modify an existing Community Name.
Access Control	The Access Control field specifies a read-only (R) access or read/write (RW) access for the community. Read-only access allows a remote device to retrieve information, while read/write access allows a remote device to modify settings. Click the **Edit** button to modify an existing Access Control.

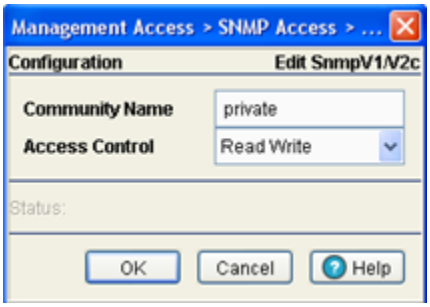
3. Highlight an existing entry and click the **Edit** button to modify the properties of an existing SNMP V1/v2 community and access control definition. For more information, see *Editing an Existing SNMP v1/v2 Community Name on page 7-6*.

7.3.1.1 Editing an Existing SNMP v1/v2 Community Name

The **Edit** screen allows the user to modify a community name and change its read-only or read/write designation. Since the community name is required to match the name used within the remote network management software, it is recommended the name be changed appropriately to match a new naming (and user) requirement used by the management software.

To modify an existing SNMP v1/v2 Community Name and Access Control setting:

1. Select **Management Access > SNMP Access> v1/v2** from the main menu tree.
2. Select an existing Community Name from those listed and click the **Edit** button.



3. Modify the **Community Name** used to associate a site-appropriate name for the community. The name revised from the original entry is required to match the name used within the remote network management software.
4. Modify the existing read-only (R) **access** or read/write (RW) **access** for the community. Read-only access allows a remote device to retrieve information, while read/write access allows a remote device to modify settings.
5. Click **OK** to save and add the changes to the running configuration and close the dialog.
6. Refer to the **Status** field for the current state of the requests made from applet. This field displays error messages if something goes wrong in the transaction between the applet and the switch
7. Click **Cancel** to return back to the SNMP v1/v2 screen without implementing changes.

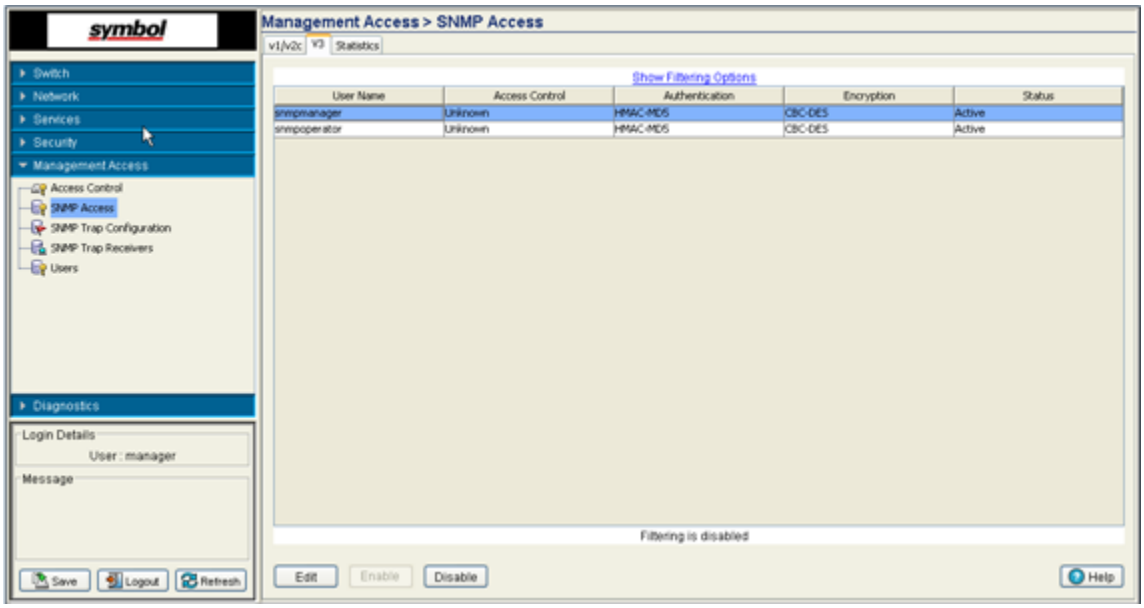
7.3.2 Configuring SNMP v3 Access

Refer to the **v3** screen to review the current SNMP v3 configuration. An Existing User Name can be selected and edited, enabled or disabled. .

NOTE The SNMP undo feature is not supported in this product.

To review existing SNMP v3 definitions:

1. Select **Management Access** > **SNMP Access** from the main menu tree.
2. Select the **v3** tab from within the SNMP Access screen.



3. Refer to the fields within the v3 screen for the following information:

User Name	Displays a read-only SNMP v3 username of operator or Admin. Operator typically has an Access Control of read-only and Admin typically has an Access Control of read/write.
Access Control	Displays a read-only (R) access or read/write (RW) access for the v3 user. Read-only access allows the user (when active) to retrieve information, while read/write access grants the user modification privileges.
Authentication	Displays the current authorization scheme used by this user for v3 access to the switch. Click the **Edit** button to modify the password required to change the authentication keys.
Encryption	Displays the current *Encryption Standard* (DES) protocol the user must adhere to for SNMP v3 access to the switch. Click the **Edit** button to modify the password required to change the encryption keys.
Status	Displays whether this specific SNMP v3 User Name is currently active. For more information, see *Accessing SNMP v2/v3 Statistics on page 7-9*.

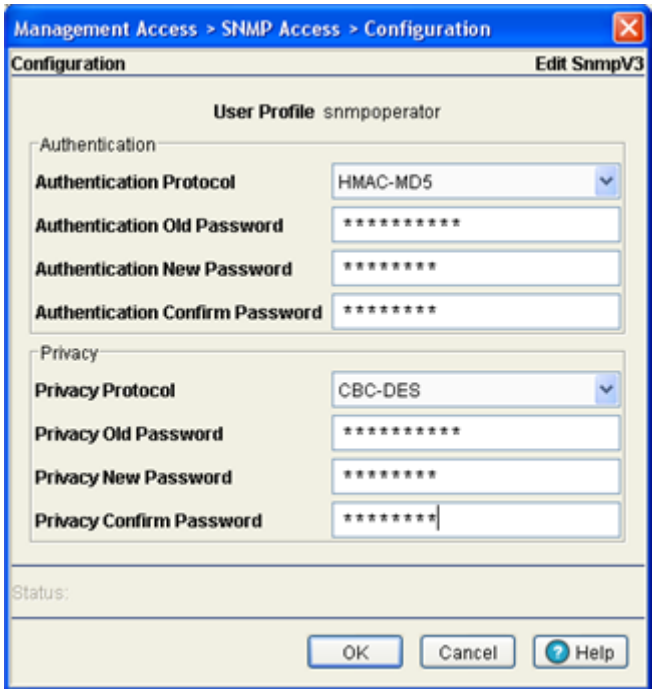
4. Highlight an existing v3 entry and click the **Edit** button to modify the password for the Auth Protocol and Priv Protocol.

   For additional information, see *Editing an Existing SNMP v1/v2 Community Name on page 7-6*
5. Highlight an existing SNMP v3 User Name and click the **Enable** button to enable the log-in for the specified user. When selected the status of the user is defined as active.
6. Highlight an existing SNMP v3 User Name and click the **Disable** button to disable the log-in for the specified user. When selected the status of the user is defined as inactive.

7.3.2.1 Editing a SNMP v3 Authentication and Privacy Password

The **Edit** screen enables the user to modify the password required to change the authentication keys. Updating the password requires logging off of the system. Updating the existing password creates new authentication and encryption keys. To edit an SNMP v3 user profile:

1. Select **Management Access > SNMP Access** from the main menu tree.
2. Select the **v3** tab from within the SNMP Access screen.
3. Highlight an existing SNMP v3 User Name and click the **Edit** button.



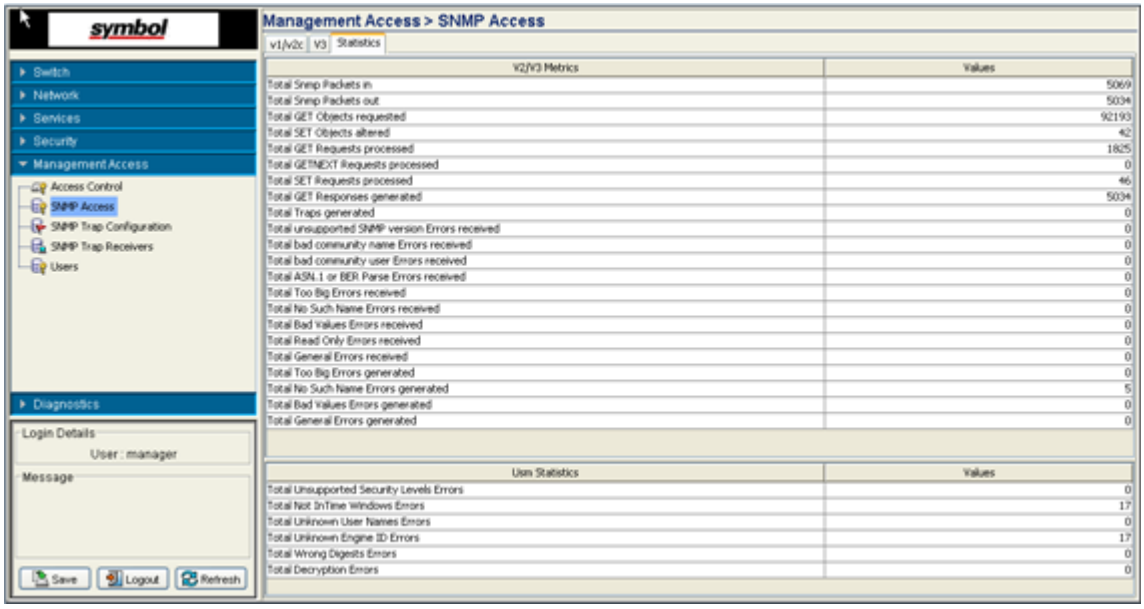
   The **Authentication Protocol** is the existing protocol for the User Profile. The Authentication Protocol is not an editable option. The **Privacy Protocol** is the existing protocol for the User Profile. The Privacy Protocol is also not an editable option.
4. Enter the **Old Password** used to grant Authentication Protocol and Privacy Protocol permissions for the User Profile.
5. Enter the **New Password**, then verify the new password within the **Confirm New Password** area.
6. Click **OK** to save and add the changes to the running configuration and close the dialog.
7. Refer to the **Status** field for the current state of the requests made from applet. This field displays error messages if something goes wrong in the transaction between the applet and the switch.
8. Click **Cancel** to close the dialog without committing updates to the running configuration.

7.3.3 Accessing SNMP v2/v3 Statistics

Refer to the **Statistics** screen for a read-only overview of SNMP V2/V3 events and their current values. The screen also displays Usm Statistics (SNMP V3 specific events specific to the User-based Security Model) and their values.

To edit an SNMP v3 user profile:

1. Select **Management Access** > **SNMP Access** from the main menu tree.
2. Select the **Statistics** tab from within the SNMP Access screen.



3. Refer to the following read-only statistics displayed within the SNMP Access Statistics screen:

V2/V3 Metrics	Displays the individual SNMP Access events capable of having a value tracked for them. The metrics range from general SNMP events (such as the number of SNMP packets in and out) to specific error types that can be used for troubleshooting SNMP events (such as Bad Value and Read-Only errors).
Values	Displays the current numerical value for the SNMP V2/V3 Metric described on the left-hand side of the screen. The value equals the number of times the target event has occurred. This data is helpful in troubleshooting SNMP related problems within the network.
Usm Statistics	Displays SNMP v3 events specific to Usm. The User-based Security Model (USM) decrypts incoming messages. The module then verifies authentication data. For outgoing messages, the USM module encrypts PDUs and generates authentication data. The module then passes the PDUs to the message processor, which then invokes the dispatcher. The USM module's implementation of the SNMP-USER-BASED-SM-MIB enables SNMP to issue commands to manage users and security keys. The MIB also enables the agent to ensure a requesting user exists and has the proper authentication information. When authentication is done, the request is carried out by the agent.

Values	Displays the current numerical value for the Usm Metric described on the left-hand side of the screen. The value equals the number of times the target event occurred. This data is helpful in troubleshooting Usm (Authentication and Encryption) related problems within the network.

7.4 Configuring SNMP Traps

Use the SNMP Trap Configuration screen to enable or disable trap generation individually or by functional group. It is also used for modifying the existing threshold conditions values for individual trap descriptions. The SNMP Trap Configuration window consists of the following tabs:

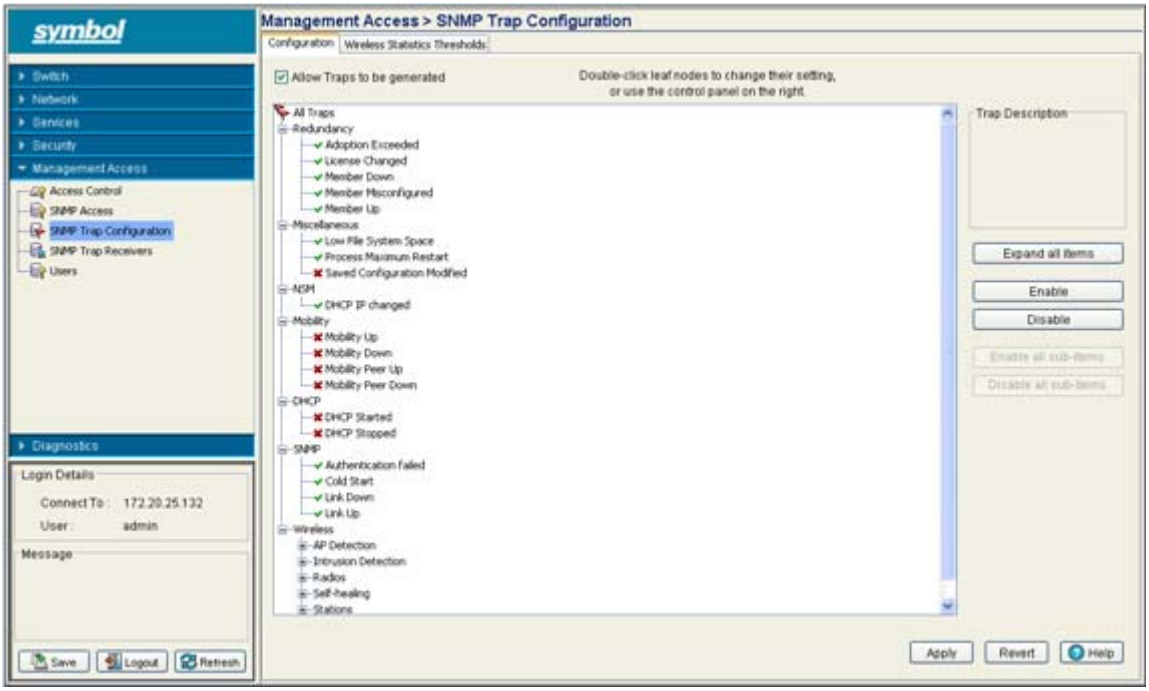
- *Enabling Trap Configuration*
- *Configuring Trap Thresholds*

7.4.1 Enabling Trap Configuration

If unsure whether to enable a specific trap, select it and view a brief description that may help your decision. Use **Expand all items** to explode each trap category and view all the traps that can be enabled. Traps can either be enabled by group or as individual traps within each parent category.

To configure SNMP trap definitions:

1. Select **Management Access** > **SNMP Trap Configuration** from the main menu tree.



2. Select the **Allow Traps to be generated** checkbox to enable the selection (and employment) of traps within the screen. Leaving the checkbox unselected renders the trap selection un-configurable.
3. Refer to trap categories within the Configuration screen to determine whether traps should be enabled by group or individually enabled within parent groups.
4. Select an individual trap, by expanding the node in the tree view, to view a high-level description of this specific trap within the **Trap Description** field. You can also select a trap family category

heading (such as "Redundnacy" or "NSM") to view a high-level description of the traps within that trap category.

Redundancy	Displays a list of sub-items (trap options) specific to the Redundancy (clustering) configuration option. Select an individual trap within this subsection and click the **Enable** button to enable this specific trap or highlight the trap family parent item and click **Enable all sub-items** to enable all traps within the Cluster category.
Miscellaneous	Displays a list of sub-items (trap options) specific to the Miscellaneous configuration option (traps that do not fit in any other existing category). Select an individual trap within this subsection and click the **Enable** button to enable this specific trap or highlight the Miscellaneous trap family parent item and click **Enable all sub-items** to enable all traps within the Miscellaneous category.
NSM	Displays a list of sub-items (trap options) specific to the NSM configuration option. Select an individual trap within this subsection and click the **Enable** button to enable this specific trap or highlight the NSM trap family parent item and click **Enable all sub-items** to enable all traps within the NSM category.
Mobility	Displays a list of sub-items (trap options) specific to the Mobility configuration option. Select an individual trap within this subsection and click the **Enable** button to enable this specific trap or highlight the Mobility trap family parent item and click **Enable all sub-items** to enable all traps within the Mobility category.
SNMP	Displays a list of sub-items (trap options) specific to the SNMP configuration option. Select an individual trap within this subsection and click the **Enable** button to enable this specific trap or highlight the SNMP trap family parent item and click **Enable all sub-items** to enable all traps within the SNMP category.
Wireless	Displays the list of sub-items (trap options) specific to Wireless configuration. These include traps specific to wireless interoperability between the switch and its associated devices. Select an individual trap and click the **Enable** button to enable a specific trap or highlight the Wireless trap family parent item and click **Enable all sub-items** to enable all traps within the Wireless category.

5. Click the **Expand All Items** button to display the sub-items within each trap category. Use this item to display every trap that can be enabled.

   Once expanded, traps can then be enabled by trap category or individually within each trap category.

6. Highlight a specific trap and click the **Enable** button to enable this specific trap as an active SNMP trap.

   The items previously disabled (with an "X" to the left) now display with a check to the left of it.

7. Highlight a specific trap and click the **Disable** button to disable the item as an active SNMP trap.

   The items previously enabled (with a check to the left) now display with an "X" to the left of it.

8. Highlight a sub-menu header (such as Redundancy or Update Server) and click the **Enable all sub-items** button to enable the item as an active SNMP trap.

Those sub-items previously disabled (with an "X" to the left) now display with a check to the left of them. Once the **Apply** button is clicked, the selected items are now active SNMP traps on the system.

9. Highlight a sub-menu header (such as Redundancy or SNMP) and click the **Disable all** sub-items button to disable the item as an active SNMP trap.

   Those sub-items previously enabled (with a check to the left) now display with an "X" to the left of them.

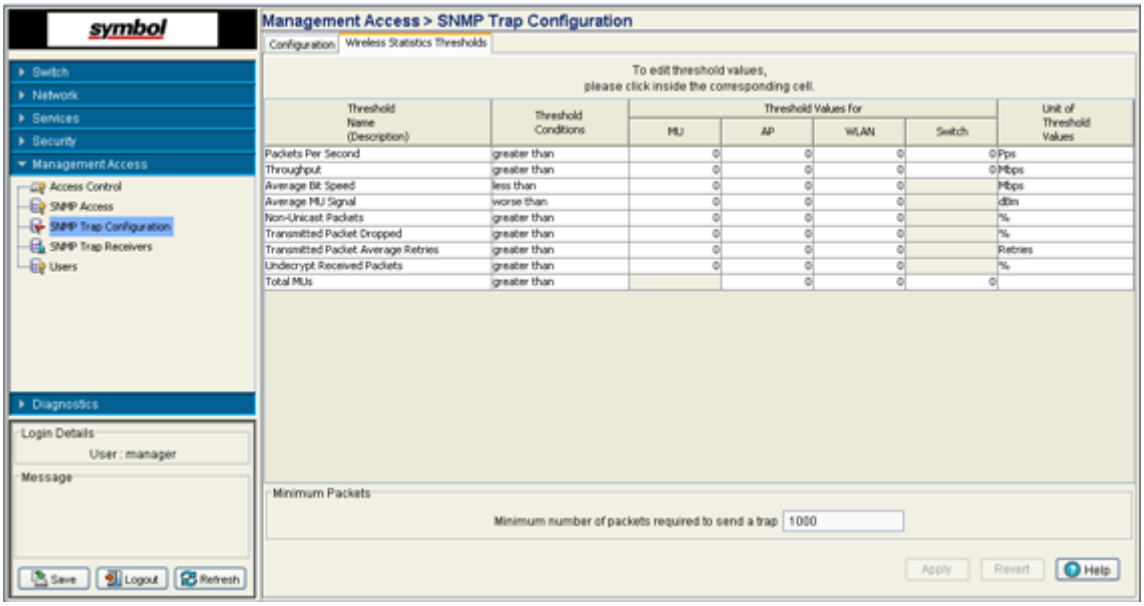
10. Click **Apply** to save the trap configurations enabled using the Enable or Enable all sub-items options.
11. Click **Revert** to discard any updates and revert back to its last saved configuration.

7.4.2 Configuring Trap Thresholds

Use the **Wireless Statistics Thresholds** screen to modify existing threshold conditions values for individual trap descriptions. Refer to the greater than, less than and worse than conditions to interpret how the values should be defined. Additionally, unit of threshold Values increment should be referenced to interpret the unit of measurement used.

To configure SNMP trap threshold values:

1. Select **Management Access** > **SNMP Trap Configuration** from the main menu tree.
2. Click the **Wireless Statistics Thresholds** tab.



3. Refer to the following information for thresholds descriptions, conditions, editable threshold values and units of measurement.

Threshold Name (Description)	Displays the target metric for the data displayed to the right of the item. It defines a performance criteria used as a target for trap configuration.
Threshold Conditions	Displays the criteria used for generating a trap for the specific event. The Threshold conditions appear as greater than, less then or worse then and define a baseline for trap generation.

Threshold values for: MU	Displays a threshold value for associated MUs. Use the **Threshold Name** and **Threshold Conditions** as input criteria to define an appropriate Threshold Value unique to the MUs within the network. For information on specific values, see *Wireless Trap Threshold Values on page 7-13*.
Threshold values for: AP	Set a threshold value for associated radios. Use the **Threshold Name** and **Threshold Conditions** as input criteria to define an appropriate Threshold Value unique to the radios within the network. For information on specific values, see *Wireless Trap Threshold Values on page 7-13*.
Threshold values for: WLAN	Define a threshold value for associated WLANs. Use the **Threshold Name** and **Threshold Conditions** as input criteria to define an appropriate Threshold Value unique to the WLANs within the network. For information on specific values, see *Wireless Trap Threshold Values on page 7-13*.
Threshold values for: Switch	Use the **Threshold Name** and **Threshold Conditions** as input criteria to define an appropriate Threshold Value unique to the module. For information on specific values, see *Wireless Trap Threshold Values on page 7-13*.
Unit of Threshold Values	Displays the measurement value used to define whether a threshold value has been exceeded. Typical values include Mbps, retries and %. For information on specific values, see *Wireless Trap Threshold Values on page 7-13*.

4. Use the **Maximum Number of Packets to Send a Trap** field (at the bottom of the screen) to enter a value used as the minimum number of data packets required for a trap to be generated for a target event. Ensure the value is realistic, as setting it to low could generate traps unnecessarily. Refer to *Wireless Trap Threshold Values on page 7-13* for additional information.
5. Click the **Apply** button to save changes made to the screen since the last saved configuration.
6. Click the **Revert** button to revert the screen back to its last saved configuration. Changes made since the contents of the screen were last applied are discarded.

7.4.2.1 Wireless Trap Threshold Values

The table below lists the Wireless Trap threshold values:

Table 7.1 Wireless Traps Threshold values

#	Threshold Name	Condition	Station Range	Radio Range	WLAN Range	Wireless Service Range	Units
1	Packets per Second	Greater than	A decimal number greater than 0.00 and less than or equal to 100000.00	A decimal number greater than 0.00 and less than or equal to 100000.00	A decimal number greater than 0.00 and less than or equal to 100000.00	A decimal number greater than 0.00 and less than or equal to 100000.00	Pps

Table 7.1 Wireless Traps Threshold values

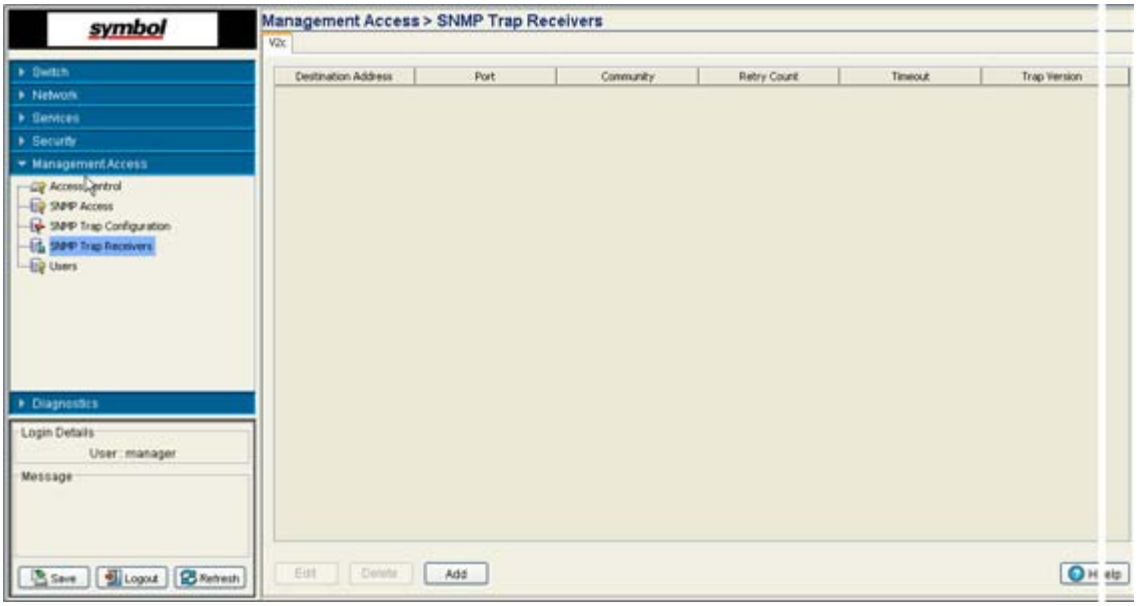
#	Threshold Name	Condition	Station Range	Radio Range	WLAN Range	Wireless Service Range	Units
2	Throughput	Greater than	A decimal number greater than 0.00 and less than or equal to 100000.00	A decimal number greater than 0.00 and less than or equal to 100000.00	A decimal number greater than 0.00 and less than or equal to 100000.00	A decimal number greater than 0.00 and less than or equal to 100000.00	Mbps
3	Average Bit Speed	Less than	A decimal number greater than 0.00 and less than or equal to 54.00	A decimal number greater than 0.00 and less than or equal to 54.00	A decimal number greater than 0.00 and less than or equal to 54.00	N/A	Mbps
4	Average MU Signal	Worse than	A decimal number less than -0.00 and greater than or equal to -120.00	A decimal number less than -0.00 and greater than or equal to -120.00	A decimal number less than -0.00 and greater than or equal to -120.00	N/A	dBm
5	Non Unicast Packets	Greater than	A decimal number greater than 0.00 and less than or equal to 100.00	A decimal number greater than 0.00 and less than or equal to 100.00	A decimal number greater than 0.00 and less than or equal to 100.00	N/A	%
6	Transmitted Packet dropped	Greater than	A decimal number greater than 0.00 and less than or equal to 100.00	A decimal number greater than 0.00 and less than or equal to 100.00	A decimal number greater than 0.00 and less than or equal to 100.00	N/A	%
7	Transmitted Packet Average retries	Greater than	A decimal number greater than 0.00 and less than or equal to 16.00	A decimal number greater than 0.00 and less than or equal to 16.00	A decimal number greater than 0.00 and less than or equal to 16.00	N/A	Retries
8	Undecrypted received packets	Greater than	A decimal number greater than 0.00 and less than or equal to 100.00	A decimal number greater than 0.00 and less than or equal to 100.00	A decimal number greater than 0.00 and less than or equal to 100.00	N/A	%
9	Total MUs	Greater than	N/A	N/A A decimal N/A in the range <1-1000>	N/A A decimal N/A in the range <1-1000>	A decimal number in the range <1-1000>	Count

7.5 Configuring SNMP Trap Receivers

Refer to the **v2c** screen to review the attributes of existing SNMP v2c trap receivers (including destination address, port, community, retry count, timeout and trap version). A new v2c trap receiver can be added to the existing list by clicking the **Add** button.

To configure the attributes of SNMP v2c trap receivers:

1. Select **Management Access > SNMP Trap Receivers** from the main menu tree.



2. Refer to the following SNMP v2c trap receiver data to assess whether modifications are required.

Destination Address	The **Destination Address** defines the numerical (non DNS name) destination IP address for receiving the traps sent by the SNMP agent.
Port	The **Port** specifies a destination User Datagram Protocol receiving traps.
Community	Enter a **Community** name specific to the SNMP-capable client that receives the traps. The community name is *public* .
Retry Count	The **Retry Count** specifies the maximum number of retries attempted (to reach the destination address) before the session times out.
Timeout	The **Timeout** value specifies the time (in seconds) for the retransmission of packets. If this time is exceeded, the session is terminated. The deafult (and perminant value is 1500).
Trap Version	The **Trap Version** defines the kind of trap that will be made by the SNMP-capable client that is receiving the trap. A v2 trap designation cannot be modified.

3. Highlight an existing V2c Trap Receiver and click the **Edit** button to display a sub-screen used modify the Trap Receiver IP Address and Trap Receiver Port Number of the highlighted Trap Receiver.

Edit Trap Receivers as needed if the existing trap receiver information is insufficient. You can only modify the IP address within the Edit screen. For more information, see *Editing SNMP v2c Trap Receivers on page 7-16*.

4. Highlight an existing V2c Trap Receiver and click the **Delete** button to remove the Trap Receiver from the list of available destinations available to receive SNMP V2c trap information.

   Remove Trap Receivers as needed if the destination address information is no longer available on the system.

5. Click the **Add** button to display a sub-screen used add a new Trap Receiver IP Address and Trap Receiver Port Number to the list of V2c trap information displayed within this screen.

   Add trap receivers as needed if the existing trap receiver information is insufficient. You can only modify the IP address and port number within the Add page. For more information, see *Adding SNMP v2c Trap Receivers on page 7-16*.

7.5.1 Editing SNMP v2c Trap Receivers

Use the **Edit** screen to modify the trap receiver IP address for an existing v2c trap receiver. Consider adding a new receiver before editing an existing one or risk overwriting a valid receiver. Edit existing destination trap receivers as required to suit the various traps enabled and their function in supporting the switch managed network.

To edit an existing SNMP v2c trap receiver:

1. Select **Management Access > SNMP Trap Receivers > v2c** from the main menu tree.
2. Select (highlight) an existing SNMP v2c trap receiver and click the **Edit** button.
3. Modify the existing address if it is no longer a valid address.

   If it is still a valid IP address, consider clicking the **Add** button from within the V2c screen to add a new address without overwriting this existing one.

4. Click **OK** to save and add the changes to the running configuration and close the dialog.
5. Refer to the **Status** field for the current state of the requests made from applet. This field displays error messages if something goes wrong in the transaction between the applet and the switch.
6. Click **Cancel** to close the dialog without committing updates to the running configuration.

7.5.2 Adding SNMP v2c Trap Receivers

The SNMP v2 c **Add** screen is designed to create a new SNMP v2c trap receiver. Use the Add screen to create a new trap receiver IP address. Add new destination trap receivers as required to suit the various traps enabled and their function in supporting the switch managed network.

To add a new SNMP v2c trap receiver:

1. Select **Management Access > SNMP Trap Receivers > v2c** from the main menu tree.
2. Click the **Add** button at the bottom of the v2c screen.
3. Create a new (non DNS name) destination IP address for the new trap receiver to be used for receiving the traps sent by the SNMP agent.
4. Click **OK** to save and add the changes to the running configuration and close the dialog.
5. Refer to the **Status** field for the current state of the requests made from applet. This field displays error messages if something goes wrong in the transaction between the applet and the switch.
6. Click **Cancel** to close the dialog without committing updates to the running configuration.

7.6 Configuring Management Users

Refer to the **Users** window to view the administrative privileges assigned to different types of switch users. You can configure the associated roles and access modes assigned to each user. This window also allows you to configure the authentication methods used by the switch. This window consists of the following tabs:

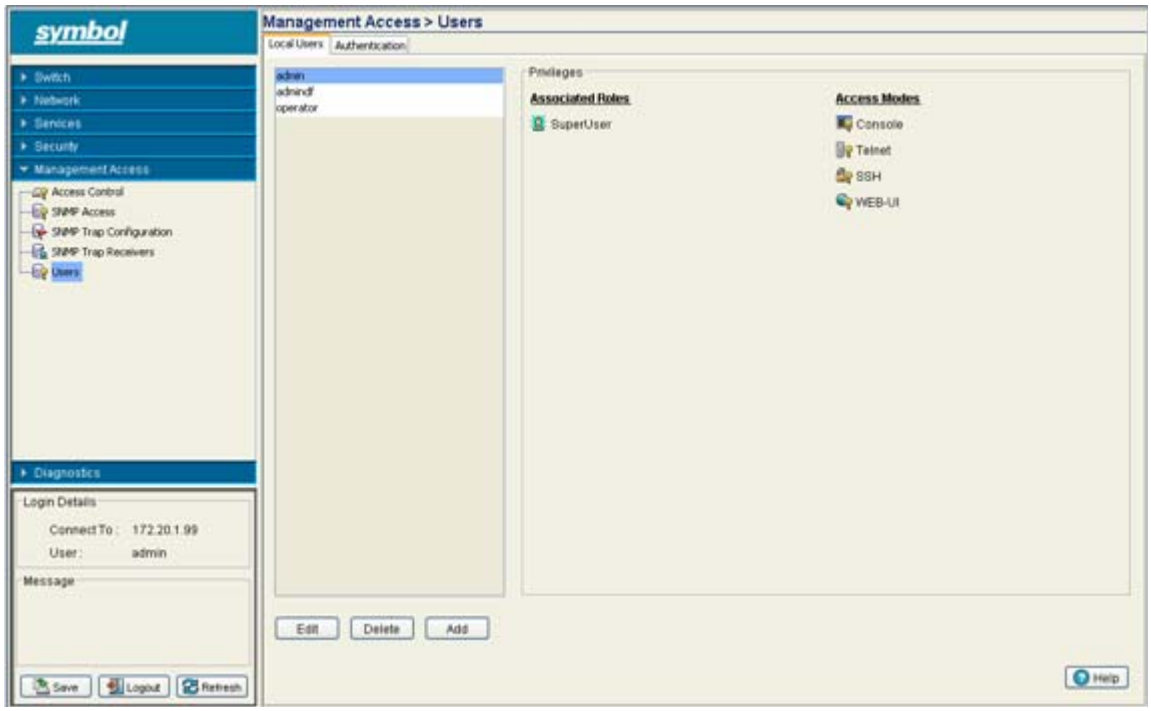
- *Configuring Local Users*
- *Configuring Switch Authentication*

7.6.1 Configuring Local Users

Refer to the Local User tab to view the administrative privileges assigned to different types of switch users, create a new user and configure the associated roles and access modes assigned to each user.

To configure the attributes of Local User Details:

1. Select **Management Access** > **Users** from the main menu tree.
2. Click the **Local Users** tab.



The Local User window consists of 2 sections:

- Users – This frame displays the users authorized to use the switch. By default the switch has two default users, Admin and Operator.
- Privileges – This frame displays the privileges assigned to different type of user.

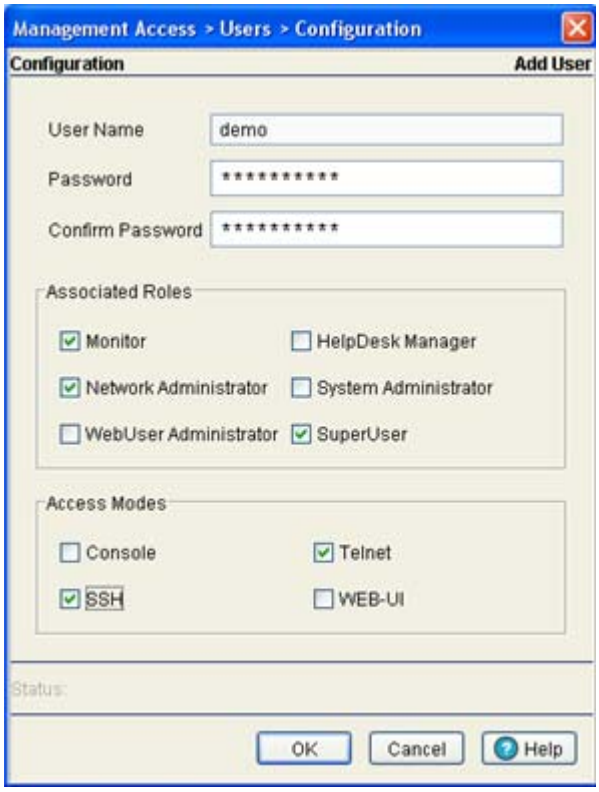
3. Select the user (Admin, Operator or user defined) from the **Users** frame and the **Privilege** frame displays the rights authorized to the user.
4. Click on the **Edit** button to modify the associated roles and access modes of the selected user. By default, the switch has two default users – Admin and Operator.
   Admin's role is that of a superuser and Operator the role will be monitored (read only).
5. Click on **Add** button to add and assign rights to a new user.
6. Click on **Delete** button to delete the selected user from the Users frame.

7.6.1.1 Creating a New Local User

Local users are those users connected directly into the switch and do not require any sort of configurable remote connection.

To create a new local user:

1. Select **Management Access** > **Users** from the main menu tree.
2. Click the **Add** button.



3. Enter the login name for the user in the **Username** field.
4. Enter the authentication password for the new user in the **Password** field and reconfirm the same again in the **Confirm Password** field.
5. Select the role you want to assign to the new user from the options provided in the **Associated Roles** panel. Select one or more of the following options:

Monitor	Select **Monitor** to assign regular user permissions without any administrative rights. The Monitor option provides *read-only* permissions.
Help Desk Manager	Assign this role to someone who typically troubleshoots and debugs problems reported by the customer. the Help Desk Manager typically runs troubleshooting utilities (like a sniffer), executes service commands, views/retrieves logs and reboots the switch.
Network Administrator	The **Network Administrator** provides configures all wired and wireless parameters like IP config, VLANs, L2/L3 security, WLANs, radios, IDS and hotspot.

System Administrator	Select **System Administrator** to allow the user to configure general settings like NTP, boot parameters, licenses, perform image upgrade, auto install, manager redundancy/clustering and control access.
Web User Administrator	Assign **Web User Administrator** privileges to add users for Web authentication (hotspot).
Super User	Select **Super User** to assign complete administrative rights.

NOTE There are some basic operations/CLI commands like exit, logout, help available to all the user roles. All the roles except Monitor can perform Help Desk role operations.

NOTE By default, the switch is https enabled with a self signed certificate. This is required since the applet uses https for user authentication.

6. Select the access modes to assign to the new user from the options provided in the **Access Modes** panel. Select one or more of the following options:

Console	This option provides the new user access to the switch using the console (applet)
SSH	This option provides the new user access to the switch using SSH.
Telnet	This option provides the new user access to the switch using Telnet
Applet	This option provides the new user access to the switch the Web UI (applet).

7. Refer to the **Status** field for the current state of the requests made from applet. This field displays error messages if something goes wrong in the transaction between the applet and the switch.
8. Click the **OK** button to create the new user.
9. Click **Cancel** to revert back to the last saved configuration without saving any of your changes.

7.6.1.2 Modifying an Existing Local User

To create a new local user:

1. Select **Management Access** > **Users** from the main menu tree.
2. Select a user from the Users list and click the **Edit** button.
3. The **Username** field is read-only field and displays the log name of the user.
4. Enter the new authentication password for the user in the **Password** field and reconfirm the same again in the **Confirm Password** field.
5. Select the role to assign to the user from the options provided in the **Associated Roles** field. Select one or more of the following options:

Monitor	If necessary, modify user permissions without any administrative rights. The Monitor option provides *read-only* permissions.

Help Desk Manager	Optionally assign this role to someone who typically troubleshoots and debugs problems reported by the customer. the Help Desk Manager typically runs troubleshooting utilities (like a sniffer), executes service commands, views/retrieves logs and reboots the switch.
Network Administrator	The **Network Administrator** provides configures all wired and wireless parameters like IP config, VLANs, L2/L3 security, WLANs, radios, IDS and hotspot.
System Administrator	Select **System Administrator** (if necessary) to allow the user to configure general settings like NTP, boot parameters, licenses, perform image upgrade, auto install, manager redundancy/ clustering and control access.
Web User Administrator	Assign **Web User Administrator** privileges (if necessary) to add users for Web authentication (hotspot).
Super User	Select **Super User** (if necessary) to assign complete administrative rights.

NOTE By default, the switch is https enabled with a self signed certificate. This is required since applet uses https for user authentication.

NOTE There are some basic operations/CLI commands like exit, logout, help available to all the user roles. All the roles except Monitor can perform Help Desk role operations.

6. Select the access modes you want to assign to the user from the options provided in the **Access Modes** panel. Select one or more of the following options:

Console	This option provides the new user access to the switch using the console (applet)
SSH	This option provides the new user access to the switch using SSH.
Telnet	This option provides the new user access to the switch using Telnet
Applet	This option provides the new user access to the switch the Web UI (applet).

7. Refer to the **Status** field for an indication of any problems that may have arisen.

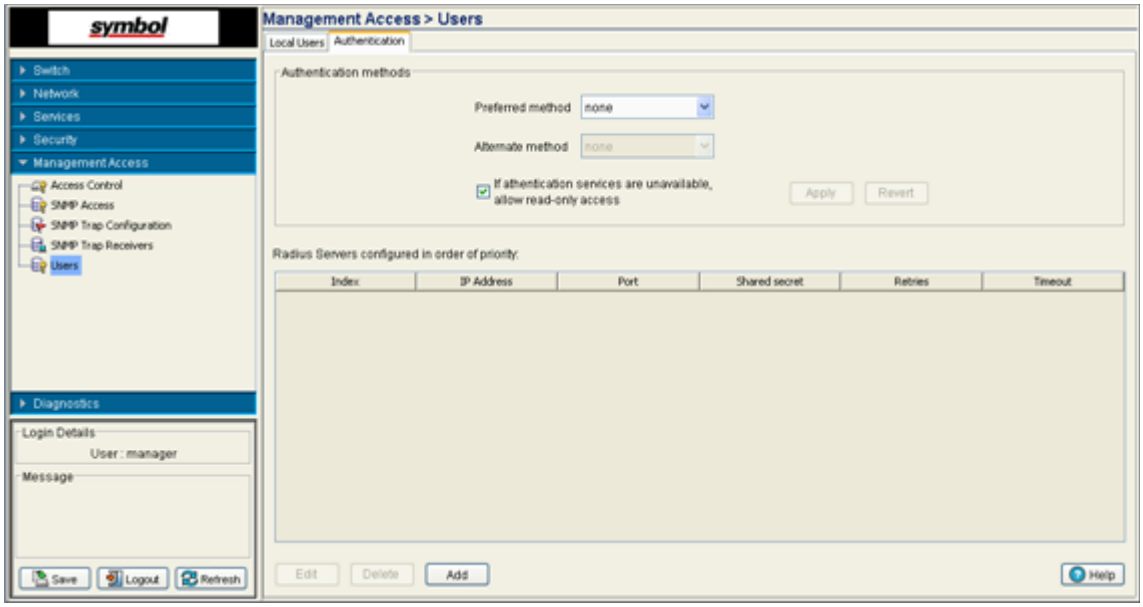
   The Status is the current state of the requests made from applet. This field displays error messages if something goes wrong in the transaction between the applet and the switch.
8. Click on **OK** to complete the modification of the users privileges.
9. Click **Cancel** to revert back to the last saved configuration without saving any of your changes.

7.6.2 Configuring Switch Authentication

The switch provides the capability to proxy authenticate requests to a remote RADIUS server. Refer to the **Authentication** tab to view and configure the Radius Server used by the local user to log into the switch.

NOTE The Radius configuration activities described in this section is independent of other Radius Server configuration activities performed using other parts of the switch.

1. Select **Management Access** > **Users** from the main menu tree.
2. Click on the **Authentication** tab.



3. Refer to the **Authentication methods** field for the following:

Preferred Method Select the preferred method for authentication. Options include:

- None
- Local - The user employs a local user authentication resource.
- Radius - Uses and external Radius Server.

Alternate Method Select an alternate method for authentication. This drop-down menu will obviously not list the option already selected as the preferred method. Select either of the remaining authentication methods as an alternate method.

If **authentication services are not available**, due to technical reasons, then select the option provided in the panel to avail read-only access.

4. Click the **Apply** button to commit the authentication method for the switch.
5. Click the **Revert** button to rollback to the authentication method changes made earlier.

6. Refer to the bottom half of the Authentication screen to view the Radius Servers configured for switch authentication. The servers are listed in order of their priority.

Index	Displays a numerical **Index** value for the Radius Server to help distinguish this Radius Server from other servers with a similar configuration. The maximum number that can be assigned is 32.
IP Address	Displays the IP address of the external Radius server. Ensure this address is a valid IP address and not a DNS name.
Port	Displays the TCP/IP port number for the Radius Server. The port range available for assignment is from 1 - 65535.
Shared Secret	Displays the shared secret used to verify RADIUS messages (with the exception of the Access-Request message) are sent by a RADIUS-enabled device configured with the same shared secret. The shared secret is a case-sensitive string that can include letters, numbers, or symbols. Ensure the shared secret is at least 22 characters long to protect the RADIUS server from brute-force attacks.
Retries	Displays the maximum number of times for the switch to retransmit a Radius Server frame before it times out the authentication session.
Timeout	Displays the maximum time (in seconds) the switch waits for the Radius Server's acknowledgment of authentication request packets before the switch times out of the session.

7. Select a Radius server from the table and click the **Edit** button to modify how the authentication method is used. For more information, see *Modifying the Properties of an Existing Radius Server on page 7-22*.
8. Highlight a Radius Server from those listed and click the **Delete** button to remove the server from the list of available servers.
9. Click the **Add** button at the bottom of the screen to display a sub-screen used to add a Radius Server to the list of servers available to the switch. For more information, see *Adding a New Radius Server on page 7-23*.

7.6.2.1 Modifying the Properties of an Existing Radius Server

Some of the attributes of an existing Radius Server can be modified by the WS5100 to better reflect the Radius Server's existing connection with the switch.

To modify the attributes of an existing Radius Server:

1. Select **Management Access** > **Users** from the main menu tree.

   The Users screen displays.
2. Click on the **Authentication** tab.
3. Select an existing Radius Server from those listed and click the **Edit** button at the bottom of the screen.

4. Modify the following Radius Server attributes as necessary:

Radius Server Index	Revise the numerical **Index** value for the Radius Server to help distinguish this Radius Server from other servers with a similar configuration (if necessary). The maximum number that can be assigned is 32.
Radius Server IP Address	Modify the IP address of the external Radius server (if necessary). Ensure this address is a valid IP address and not a DNS name.
Radius Server Port	Change the TCP/IP port number for the Radius Server (if necessary). The port range available for assignment is from 1 - 65535.
Number of retries to communicate with Radius Server	Revise (if necessary) the maximum number of times for the switch to retransmit a Radius Server frame before it times out the authentication session.
Time to wait for Radius Server to reply	Revise (if necessary) the maximum time (in seconds) the switch waits for the Radius Server's acknowledgment of authentication request packets before the switch times out of the session.
Encryption key shared with Radius Server	Enter the encryption key the switch and Radius Server share and must validate before the user based authentication provided by the Radius Server can be initiated.

5. Refer to the **Status** field for the current state of the requests made from applet. This field displays error messages if something goes wrong in the transaction between the applet and the switch.
6. Click on **OK** to complete the modification of the Radius Server.
7. Click **Cancel** to revert back to the last saved configuration without saving any of your changes.

7.6.2.2 Adding a New Radius Server

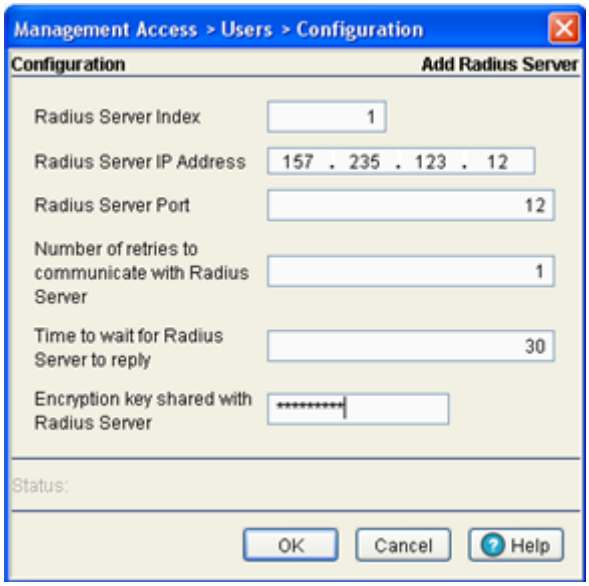
The attributes of a new Radius Server can be defined by the WS5100 to provide a new user authentication server. Once the Radius Server is configured and added, it displays within the Authentication tab as an option available to the switch.

To define the attributes of a new Radius Server:

1. Select **Management Access** > **Users** from the main menu tree.

   The Users screen displays.
2. Click on the **Authentication** tab.

3. Click the **Add** button at the bottom of the screen.



4. Configure the following Radius Server attributes:

Radius Server Index	Enter a numerical **Index** value for the Radius Server to help distinguish this Radius Server from other servers with a similar configuration. The maximum number that can be assigned is 32.
Radius Server IP Address	Provide the IP address of the external Radius server. Ensure this address is a valid IP address and not a DNS name.
Radius Server Port	Enter the TCP/IP port number for the Radius Server. The port range available for assignment is from 1 - 65535.
Number of retries to communicate with Radius Server	Enter the maximum number of times for the switch to retransmit a Radius Server frame before it times out the authentication session.
Time to wait for Radius Server to reply	Define the maximum time (in seconds) the switch waits for the Radius Server's acknowledgment of authentication request packets before the switch times out of the session.
Encryption key shared with Radius Server	Enter the encryption key the switch and Radius Server share and must validate before the user based authentication provided by the Radius Server can be initiated.

5. Refer to the **Status** field for the current state of the requests made from applet. This field displays error messages if something goes wrong in the transaction between the applet and the switch.
6. Click on **OK** to complete the addition of the Radius Server.
7. Click **Cancel** to revert back to the last saved configuration without saving any of your changes.

8 Diagnostics

This chapter describes the various diagnostic features available to monitor switch performance. It consists of the following sections:

NOTE HTTPS must be enabled to access the switch applet. Ensure that HTTPS access has been enabled before using the login screen to access the switch applet.

8.1 Displaying the Main Diagnostic Interface

Use the main diagnostic screen to configure and monitor the following switch features:

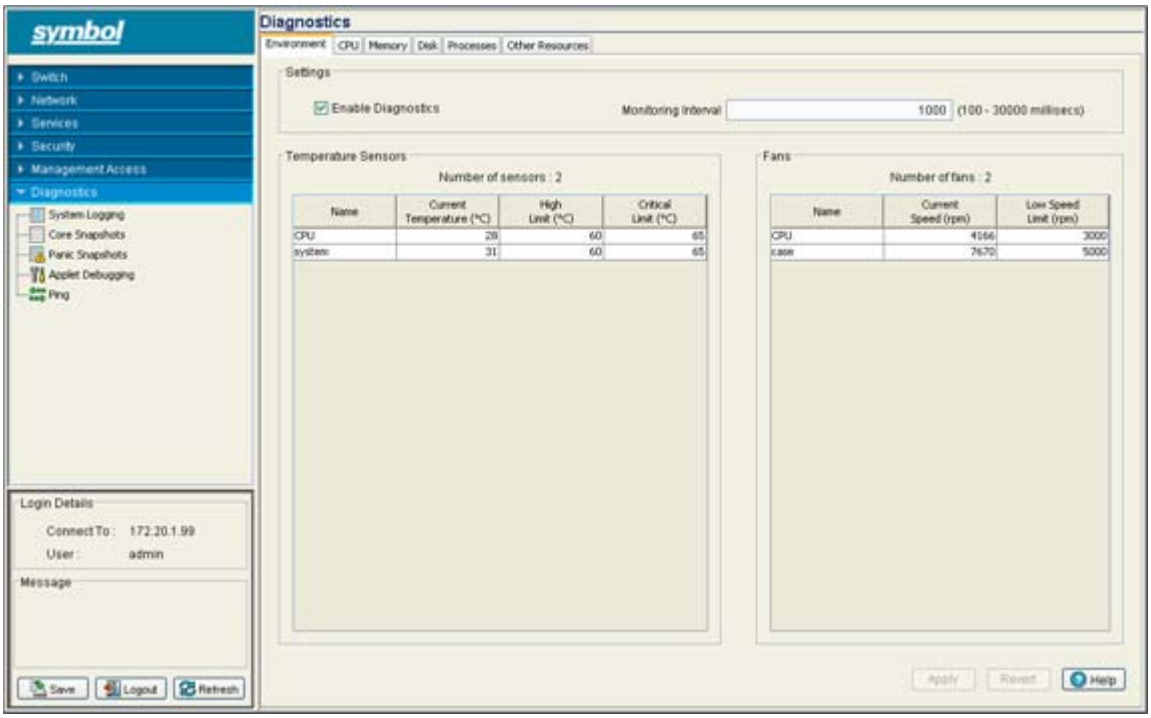
- *Switch Environment*
- *CPU Performance*
- *Switch Memory Allocation*
- *Switch Disk Allocation*
- *Switch Memory*
- *Other Switch Resources*

NOTE When the switch's configuration is successfully updated (using the Web UI), the effected screen is closed without informing the user their change was successful. However, if an error were to occur, the error displays within the effected screen's Status field and the screen remains displayed. In the case of file transfer operations, the transfer screen remains open during the transfer operation and remains open upon completion (with status displayed within the Status field).

8.1.1 Switch Environment

Use the **Environment** screen to view and modify the switch diagnostic interval, temperature sensors and fan speeds.

1. Select **Diagnostics** from the main tree menu.
2. Select the **Environment** tab.



3. The Environment tab has the following fields:
   - Settings
   - Temperature Sensors

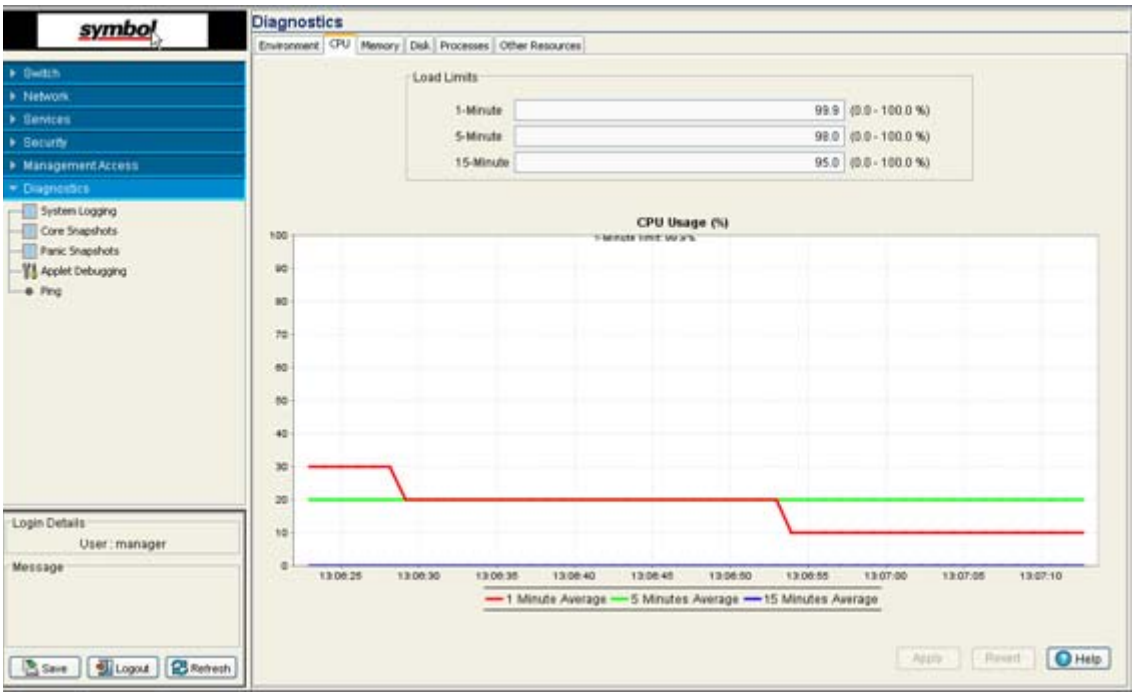
- Fans

4. In the **Settings** field, select on the **Enable Diagnostics** checkbox to enable/disable diagnostics and set monitoring interval in the text field associated with it.
5. Use the **Temperature Sensors** field to monitor the CPU and system temperatures.
6. Refer to the The **Fans** field to monitor the CPU and system fan speeds.
7. Click on the **Apply** button to commit and apply the changes.
8. Click the **Revert** button to revert back to the last saved configuration.

8.1.2 CPU Performance

Use the **CPU** screen to view and modify the CPUs load statistics in terms of last 1, 5, and 15 minutes.

1. Select **Diagnostics** from the main tree menu.
2. Select the **CPU** tab.

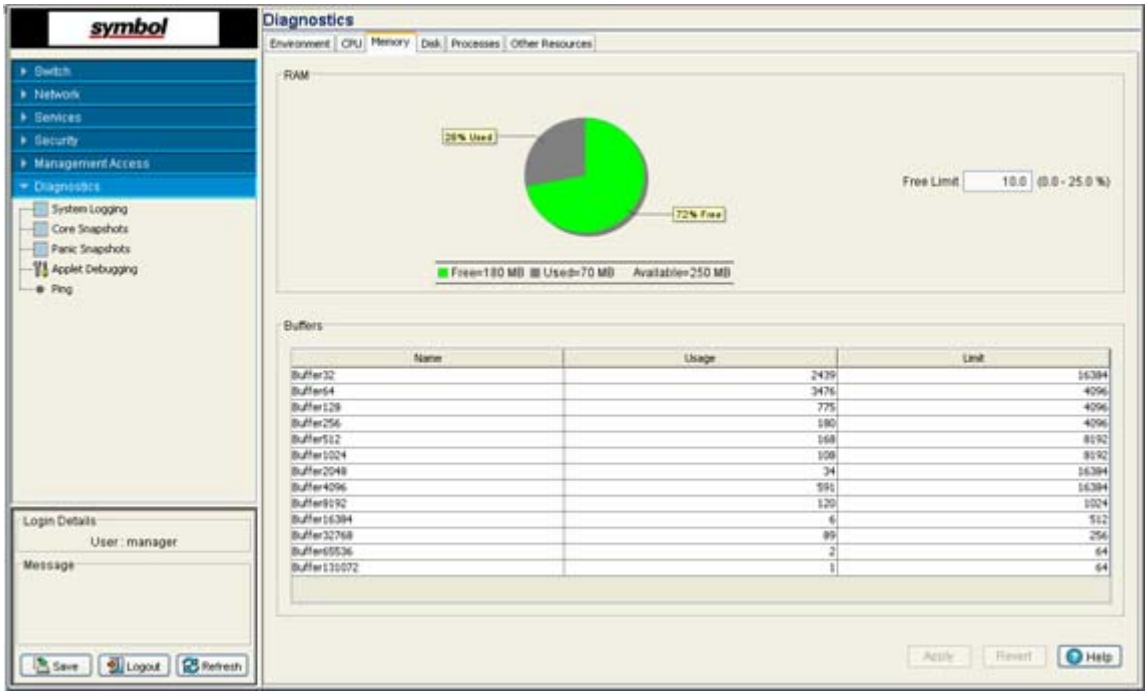


3. The CPU screen has 2 fields:
   - Load Limits
   - CPU Usage
4. The **Load Limit** field displays the CPU load statistics in terms of last 1, 5, and 15 minutes.
5. The **CPU Usage** field displays the real time CPU consumption values from the switch.
6. Click the **Apply** button to commit and apply the changes.
7. Click the **Revert** button to revert back to the last saved configuration.

8.1.3 Switch Memory Allocation

Use the **Memory** screen to view and modify the CPUs load statistics in terms of last 1, 5, and 15 minutes.

1. Select **Diagnostics** from the main tree menu.
2. Select the **Memory** tab.



The Memory tab has the following two fields:

- RAM
- Buffer

3. Refer to the **RAM** field to view the percentage of CPU memory in use in a pie chart format. Use the **Free Limit** field to change the CPUs memory allocation limits.

4. The **Buffers** field displays buffer usage information. It consists of a table with the following information:

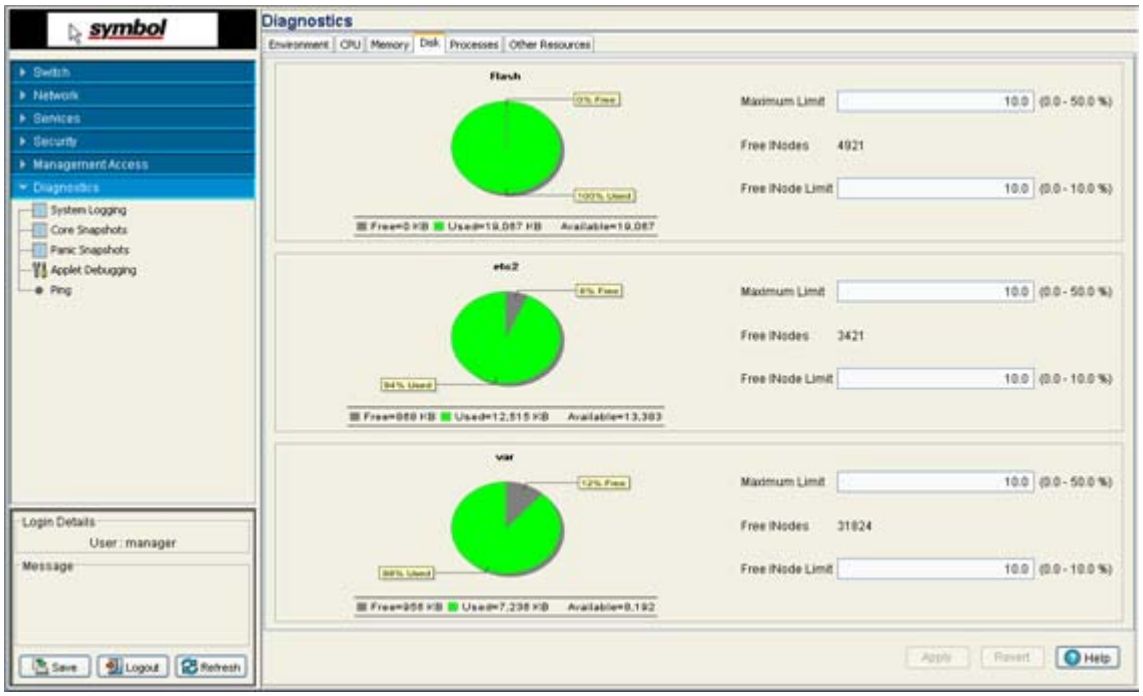
Name	The name of the buffer.
Usage	Buffers current usage
Limit	The buffer limit.

5. Click the **Apply** button to commit and apply the changes.
6. Click the **Revert b**utton to revert back to the last saved configuration.

8.1.4 Switch Disk Allocation

The Disk tab contains all parameters related to the various disk partitions on the switch. It also displays available space in the external drives (such as USB drive or compact flash etc).

1. Select **Diagnostics** from the main tree menu.
2. Select the **Disk** tab.

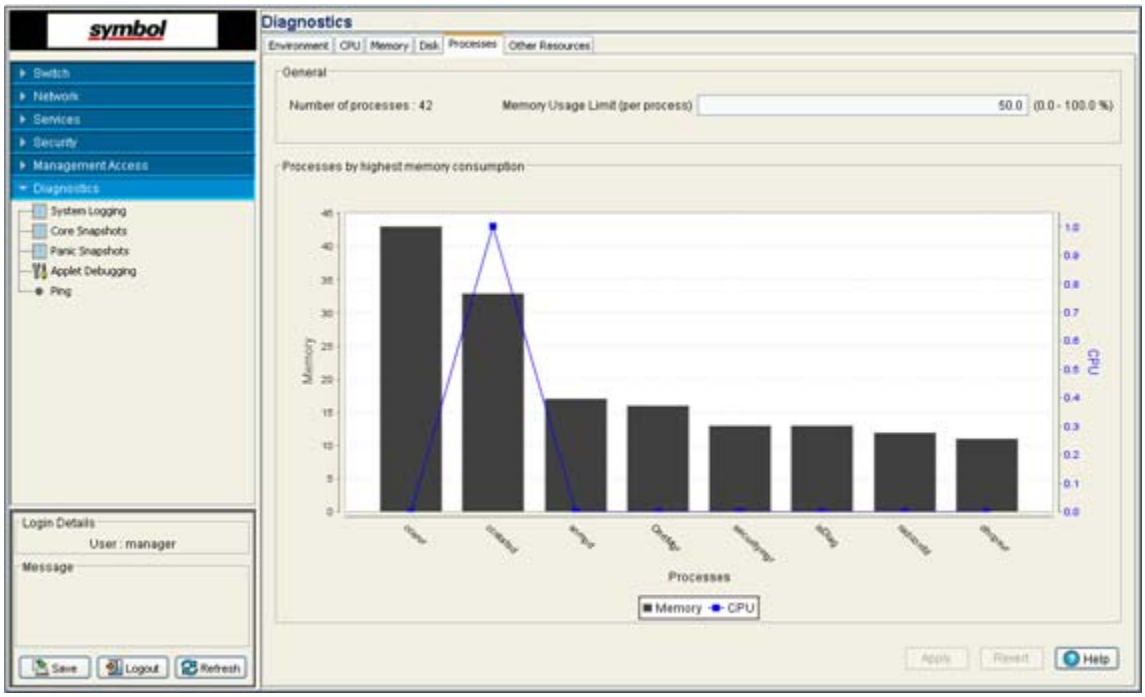


3. This Disk tab displays the status of the various disks on the switch. Each section displays the following information:
   - Maximum Limit
   - Free INodes
   - Free INode Limit
4. Click the **Apply** button to commit and apply the changes.
5. Click the **Revert** button to revert back to the last saved configuration.

8.1.5 Switch Memory

The Processes tab displays the number of processes in use and percentage of memory usage limit per process.

1. Select **Diagnostics** from the main tree menu.
2. Select the **Processes** tab

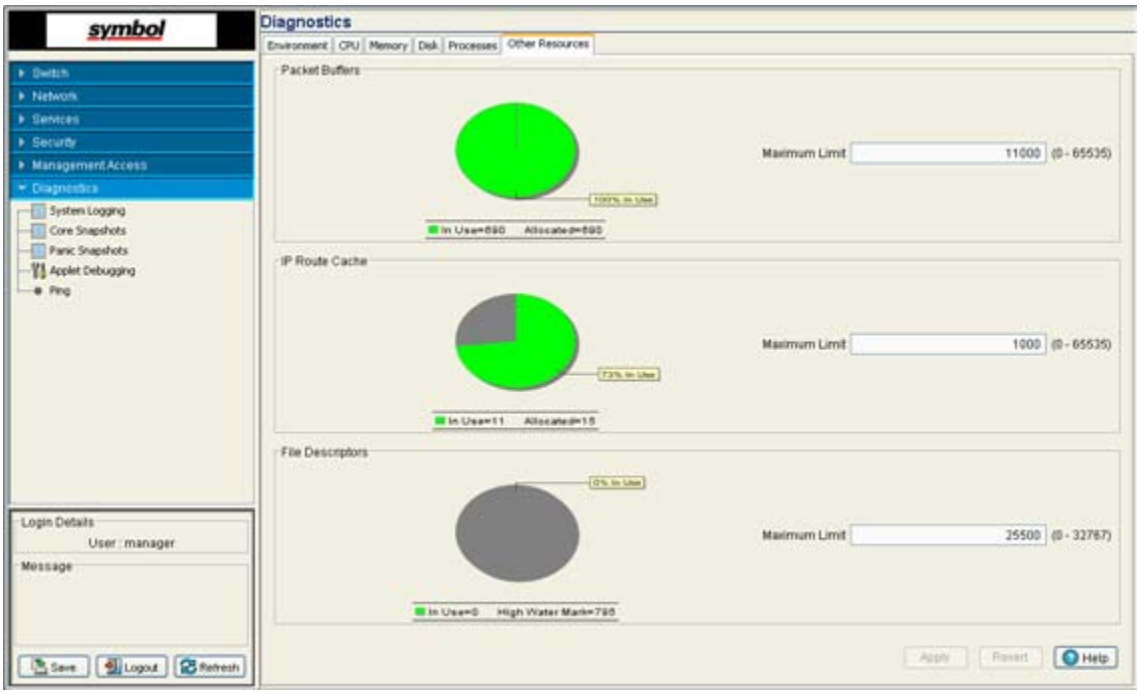


3. The Processes tab has 2 fields:
   - General
   - Processes by highest memory consumption
4. Refer to the **General** field for the number of processes in use and percentage of memory usage per process.
5. **Processes by highest memory consumption** displays a graph of the top ten switch processes based on memory consumption.
6. Click the **Apply** button to commit and apply the changes.
7. Click the **Revert** button to revert back to the last saved configuration.

8.1.6 Other Switch Resources

The Other Resources tab displays the memory allocation of Packet Buffer, IP Route Cache and File Descriptors.

1. Select **Diagnostics** from the main tree menu.
2. Select the **Other Resources** tab.



The Other Resources tab displays the memory allocation of Packet Buffer, IP Route Cache and File Descriptors.

8.2 Configuring System Logging

Use the **System Logging** screen for logging system events. Its important to log individual switch events to discern an overall pattern that may be natively impacting switch performance. The System Logging screen consist of the following tabs:

- *Log Options*
- *File Management*

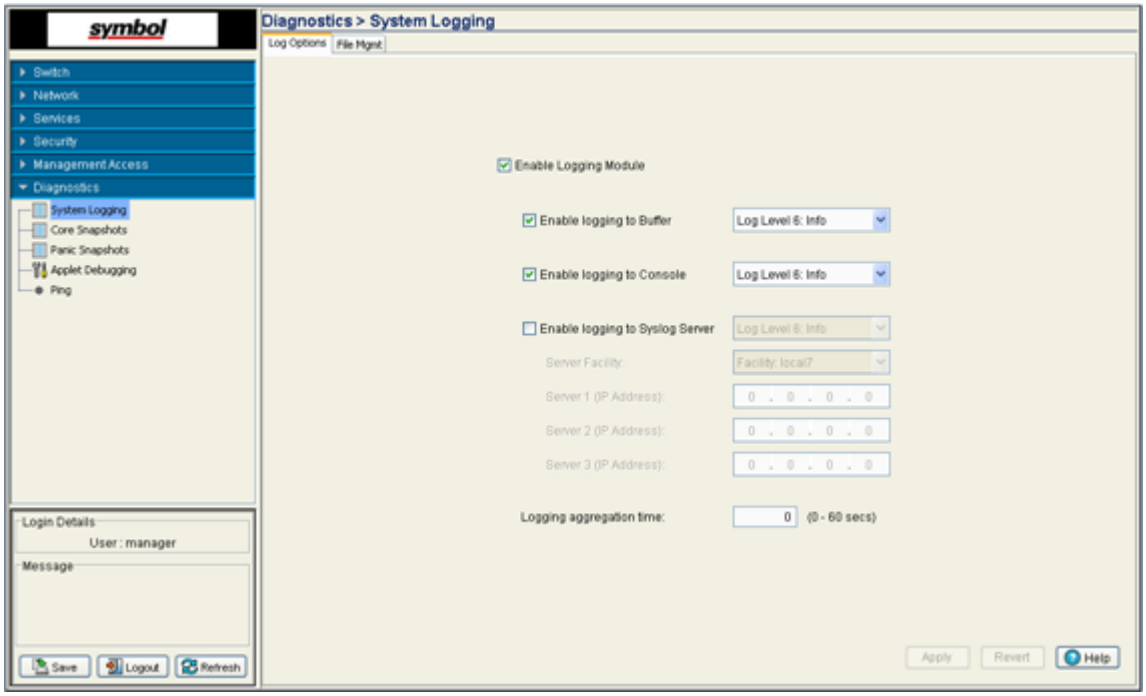
8.2.1 Log Options

Use the Log Options screen to enable logging and define the medium used to capture system events and append them to the log file. Ensure the correct destination server address is supplied.

To view the Log options:

1. Select **Diagnostics** > **System Logging** from the main menu tree.

2. Select the **Log Options** tab.



3. Select the **Enable Logging Module** checkbox to enable the switch to log system events to a local log file or a syslog server.
4. Select the **Enable Logging to Buffer** checkbox to enable the switch to log system events to a buffer. Use the drop-down menu to select the desired log level for tracking system events to a local log file.
5. Select the **Enable Logging to Console** checkbox to enable the switch to log system events to the system console. Use the drop-down menu to select the desired log level for tracking system events to a local log file.
6. Select the **Enable Logging to Syslog Server** checkbox to enable the switch to log system events for tracking system events and sending them to an external syslog server. Selecting this option also enables the Server Facility feature. Use the drop-down menu to select the desired log level for tracking system events to a local log file.
   a. Use the **Server Facility** drop-down menu to specify the local server facility (if used) for the transfer.
   b. Specify the numerical (non DNS name) IP address for the first choice syslog server to log system events in the **Server 1** field.
   c. Optionally, use the **Server 2** parameter to specify the numerical (non DNS name) IP address of an alternative syslog server if the first syslog server is unavailable.
   d. Optionally, use the **Server 3** parameter to specify the numerical (non DNS name) IP address of a third syslog server to log system events if the first two syslog servers are unavailable.

NOTE 255.255.255.255 is accepted as a valid entry for the IP address of a logging server.

7. Use the **Logging aggregation time** parameter to define how often system events are logged as they occur (0-60 seconds).

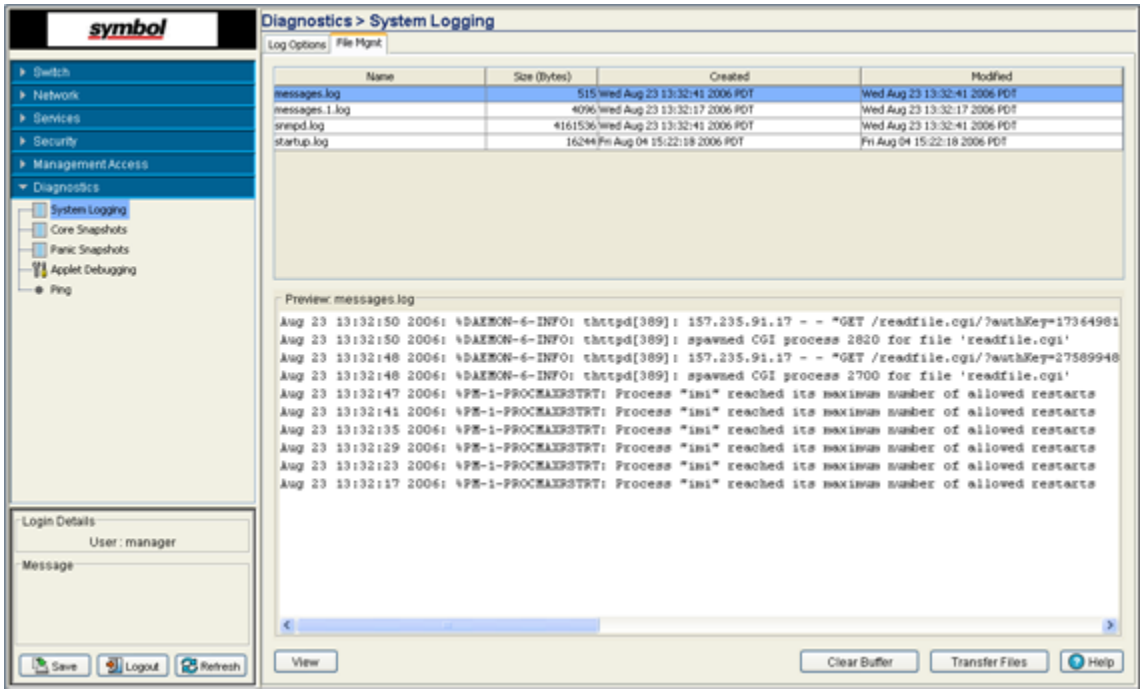
8. Click **Apply** to save the changes made to the screen. This will overwrite the previous configuration.
9. Click the **Revert** button to move the display back to the last saved configuration.

8.2.2 File Management

Use the **File Mgt** screen to view existing system logs. Select a file to display its details in the **Preview** field. Click the **View** button to display the file's entire contents. Once viewed, the user has the option of clearing the file or transferring the file to a user-defined location.

To view the Log options:

1. Select **Diagnostics** > **System Logging** from the main menu tree.
2. Select the **File Mgmt** tab.



3. The **System Logging** screen displays existing log files. Refer to the following for log file details:

Name	Displays a read-only list of the log files created since the last time the display was cleared. To define the type of log files created, click the **Log Options** tab to enable logging and define the log level.
Size	Displays the log file size in bytes. This is the current size of the file, if modifications were made, they have been accounted for.
Created	Displays the date, year and time of day the log file was initially created. This value only states the time the file was initiated, not the time it was modified or appended.
Modified	Displays the date, year and time of day the log file was modified since its initial creation date.

4. Highlight an existing log file to display the file's first page within the **Preview** field.

   The time, module, severity, mnemonic and description of the file are displayed. For a more detailed description of the entire log file click the **View** button.

5. Highlight a file from the list of log files available within the File Mgt tab and click the **View** button to display a detailed description of the entire contents of the log file.

   To view the entire content of an individual log file, see *Viewing the Entire Contents of Individual Log Files on page 8-10*.

6. Click the **Clear Buffer** button to remove the contents of the File Mgt tab. This is only recommended if you consider the contents of this file obsolete and wish to begin gathering new log file data.

   When the button is selected, a confirmation prompt displays verifying whether the contents of the log files is to be cleared.

7. Click the **Transfer Files** button to display a sub-screen wherein log files can be sent to an external location (as defined by you) via a user-defined file transfer medium.

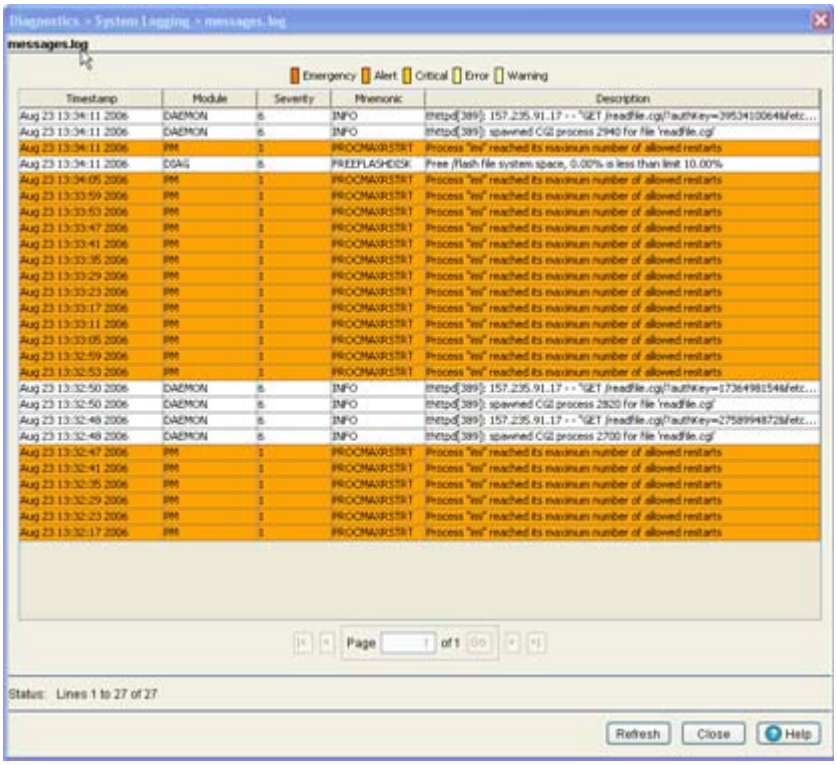
   Transferring files is recommended when the log file is frequently cleared, but an archive of the log files is required in a safe location. For more information on transferring individual log files, see *Transferring Log Files on page 8-12*.

8.2.2.1 Viewing the Entire Contents of Individual Log Files

Symbol recommends the entire contents of a log file be viewed to make an informed decision whether to transfer the file or clear the buffer. The **View** screen provides additional details about a target file by allowing the entire contents of a log file to be reviewed.

To display the entire contents of a log file:

1. Select **Diagnostics** > **System Logging** > **File Mgt** from the main menu tree.
2. Select an individual log file whose properties you wish to display in detail and click the **View** button.



3. Refer to the following for information on the elements that can be viewed within a log file:

Timestamp	Displays the date, year and time of day the log file was initially created. This value only states the time the file was initiated, not the time it was modified or appended.
Module	Displays the name of the switch logging the target event.
Severity	The **Severity** level coincides with the logging levels defined within the Log Options tab. Use these numeric identifiers to assess the criticality of the displayed event. The severity levels include: • 0 - Emergency • 1 - Alert • 2 - Critical • 3 - Errors • 4 - Warning • 5 - Notice • 6 - Info • 7 - Debug
Mnemonic	Use the **Mnemonic** as a text version of the severity code information.
Description	Displays a high-level overview of the event, and (when applicable) message type, error or completion codes for further clarification of the event. Use this information for troubleshooting purposes or for metric collection.

4. Refer to the **Status** field for the current state of the requests made from applet. This field displays error messages if something goes wrong in the transaction between the applet and the switch.
5. Click the **Refresh** button to update the contents of the screen to the latest values.
6. Click the **Close** button to exit the screen. Clicking Close does not lose any data, as there are no values configured within this screen (it is view-only).

8.2.2.2 Transferring Log Files

If a system log contains data that may require archiving, consider using the **Transfer Files** screen to export the log file to an external location (that you designate) where there is no risk of deleting the contents of the log.

To transfer a log file to a user specified location:

1. Select **Diagnostics** > **System Logging** > **File Mgt** from the main menu tree.
2. Select a target log file to transfer and click the **Transfer File** button.

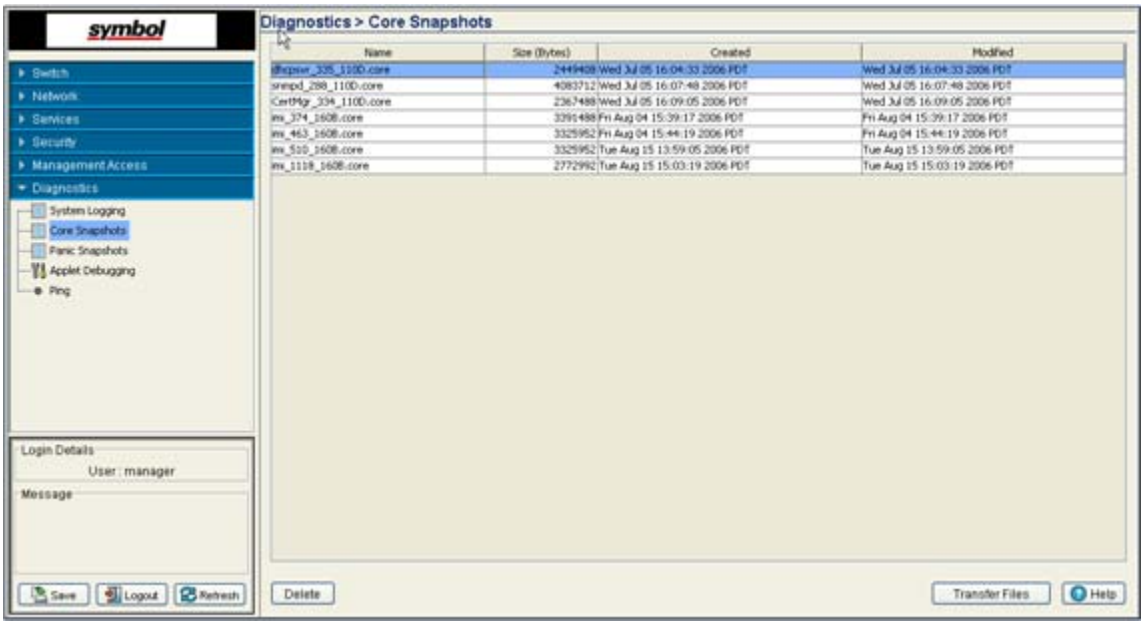
3. Use the **From** drop-down menu (within the Source field) to specify the location from which the log file is sent. If only the applet is available as a transfer location, use the default switch option.
4. Select a target file for transfer from the **File** drop-down menu. The drop-down menu contains the log files listed within the File-Mgmt screen.
5. Use the **To** drop-down menu (within the Target field) to define whether the target log file is to be sent to the system's local disk (Local Disk) or to an external server (Server).
6. Provide the name of the file to be transferred within the **File** parameter. Ensure the file name is correct.
7. If Server has been selected as the source, use the **Using** drop down-menu to configure whether the log file transfer will be sent using FTP or TFTP.
8. If Server has been selected as the source, enter the **IP Address** of the destination server or system receiving the log file. Ensure the IP address is valid or risk jeopardizing the success of the log file transfer.
9. If Server has been selected as the source, enter the **User ID** credentials required to send the log file to the target location.
10. If Server has been selected as the source, use the **Password** parameter to enter the password required to send the log file to the target location.
11. Specify the appropriate **Path** name to the target directory on the local system disk or server as configured using the **To** parameter. If the local disk is selected, a browse button is available.
12. Click the **Transfer** button when ready to move the target file to the specified location. Repeat the process as necessary to move each desired log file to the specified location.
13. Refer to the **Status** field for the current state of the requests made from applet. This field displays error messages if something goes wrong in the transaction between the applet and the switch.
14. Click the **Close** button to exit the screen. No values need to be saved once the transfer has been made.

8.3 Reviewing Core Snapshots

Use the **Core Snapshots** screen to view the core snapshots (system events with .core extension) logged by the system. Once reviewed, core files can be deleted or transferred for potential archive.

To view the core snapshots available on the switch:

1. Select **Diagnostics** > **Core Snapshots** from the main menu tree.



2. Refer to the following table headings within the Core Snapshots screen:

Name	Displays the title of the process, process ID (pid) and build number separated by underscores. The file extension is always .core for core files.
Size (Bytes)	Displays the size of the core file in bytes.
Created	Displays the date and time the core file was generated. This information may be useful in troubleshooting issues.
Modified	Displays the modification date of the core file. It may be helpful to continually review those files that have modifications since their original creation date.

3. Select a target file and click the **Delete** button to remove the selected file. This option is not recommended until the severity of the core snapshot has been assessed.
4. Click the **Transfer Files** button to open the transfer dialogue to enable a file to be copied to another location. For more information on transferring core snapshots, see *Transferring Core Snapshots on page 8-13*.

8.3.1 Transferring Core Snapshots

Use the **Transfer** screen to define a source for transferring core snapshot files to a secure location for potential archive.

To transfer core snapshots to a user defined location:

1. Select **Diagnostics** > **Core Snapshots** from the main menu tree.
2. Select a target file, and select the **Transfer Files** button.

3. Use the **From** drop-down menu to specify the location from which the log file is sent.

   If only the applet is available as a transfer location, use the default switch option.
4. Select a target file for the file transfer from the **File** drop-down menu.

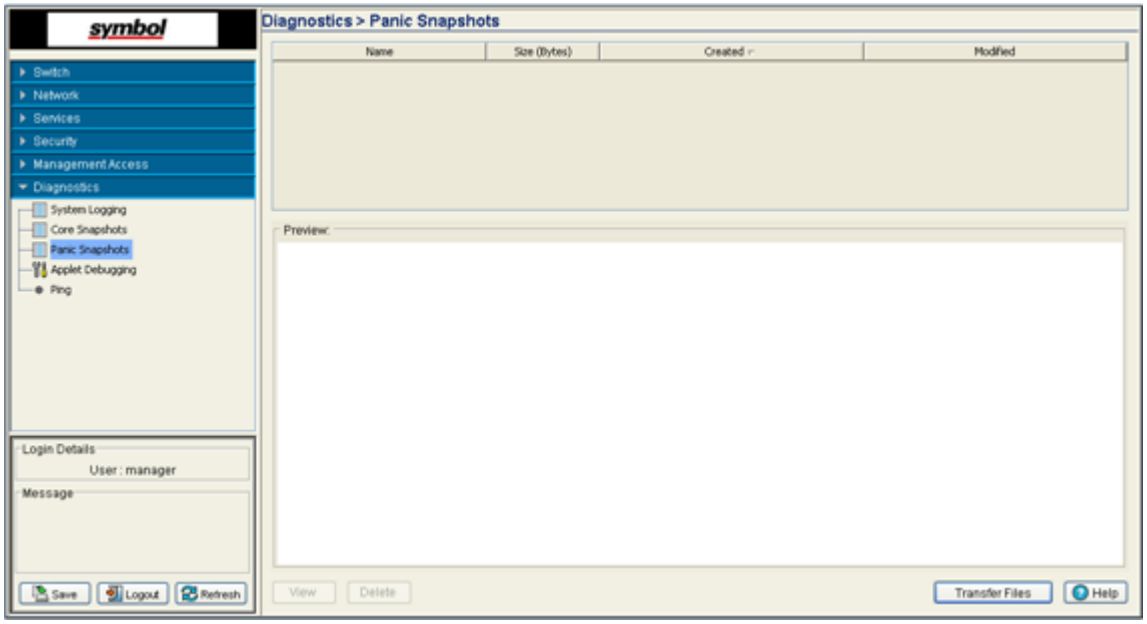
   The drop-down menu contains the core files listed within the File-Mgmt screen.
5. Use the **To** drop-down menu (within the Target field) to define whether the target log file is to be sent to the system's local disk (Local Disk) or to an external server (Server).
6. Provide the name of the file to be transferred to the location specified within the **File** field.
7. If Server has been selected as the source, use the **Using** drop down-menu to configure whether the log file transfer will be sent using FTP or TFTP.
8. If Server has been selected as the source, enter the **IP Address** of destination server or system receiving the target log file.
9. If Server has been selected as the source, enter the **User ID** credentials required to send the file to the target location. Use the user ID for FTP transfers only.
10. If Server has been selected as the source, enter the **Password** required to send the file to the target location using FTP.
11. Specify the appropriate **Path** name to the target directory on the local system disk or server as configured using the "To" parameter. If the local disk option is selected, use the browse button to specify the location on the local disk.
12. Refer to the **Status** field for the current state of the requests made from applet. This field displays error messages if something goes wrong in the transaction between the applet and the switch.
13. Click the **Transfer** button when ready to move the target file to the specified location. Repeat the process as necessary to move each desired log file to the specified location.
14. Click the **Close** button to exit the screen after a transfer. There are no changes to save or apply.

8.4 Reviewing Panic Snapshots

Refer to the **Panic Snapshots** screen for an overview of the panic files available. Use the information displayed within the screen you can make informed decisions whether a target file should be discarded or transferred to a secure location for permanent archive.

To review the current Panic Snapshots on the switch:

1. Select **Diagnostics** > **Panic Snapshots** from the main menu.



2. Refer to the following table headings within the Panic Snapshots screen:

Name	Displays the title of the panic file. Panic files are named n.panic where n is in the range 0-9. 0 is always the oldest saved panic file and the highest number is the most recent. If the system experiences a panic, there are ten existing panics, the oldest is deleted and the remaining nine are renamed so the newest can be saved as 9.
Size	Displays the size of the panic file in bytes.
Created	Displays the date and time the panic file was created. The panic file is created after the system reboots, however the panic information within the file contains the date and time the panic actually occurred.
Modified	Refer to the **Modified** value to assess the time the panic was last modified. It may be helpful to continually review those files that have modifications since their original creation date.

3. Refer to the **Preview** field for panic information in ASCII text. When a panic file is selected, the corresponding text is displayed in the preview screen. Use this information as a high-level overview of the panic.
4. Select a target panic file and click the **Delete** button to remove the file.
5. Select a target panic file and click the **View** button to open a separate viewing screen to display the panic information in greater detail. For more information, see *Viewing Panic Details on page 8-16*.
6. Click the **Transfer Files** button to open the transfer dialogue to transfer the file to another location. For more information, see *Transferring Panic Files on page 8-16*.

8.4.1 Viewing Panic Details

Use the **View** facility to review the entire contents of a panic snapshot before transferring or deleting the file. The view screen enables you to display the entire file.

To review Panic Snapshots:

1. Select **Diagnostics** > **Panic Snapshots** from the main menu.
2. Select a panic from those available and click the **View** button.
3. Refer to the following information to review the severity of the panic file:

Main	The **Main** parameter displays detailed panic information for the selected kernel.
Page	Panic information may be spread across multiple pages. The Page value allows the user to view complete information on the panic. Use the < and > options to navigate through the contents of the file.
Refresh	Click the **Refresh** button to update the data displayed within the screen to the latest values.
Close	Click the **Close** button to exit the screen.

8.4.2 Transferring Panic Files

It is recommended panic snapshots files be kept in a safe location off the system used to create the initial files. Use the **Transfer Files** screen to specify a location where files can be archived without the risk of them being lost or corrupted.

For information on transferring panic files:

1. Select **Diagnostics** > **Panic Snapshots** from the main menu.
2. Select a record from those available and click the **Transfer** button.

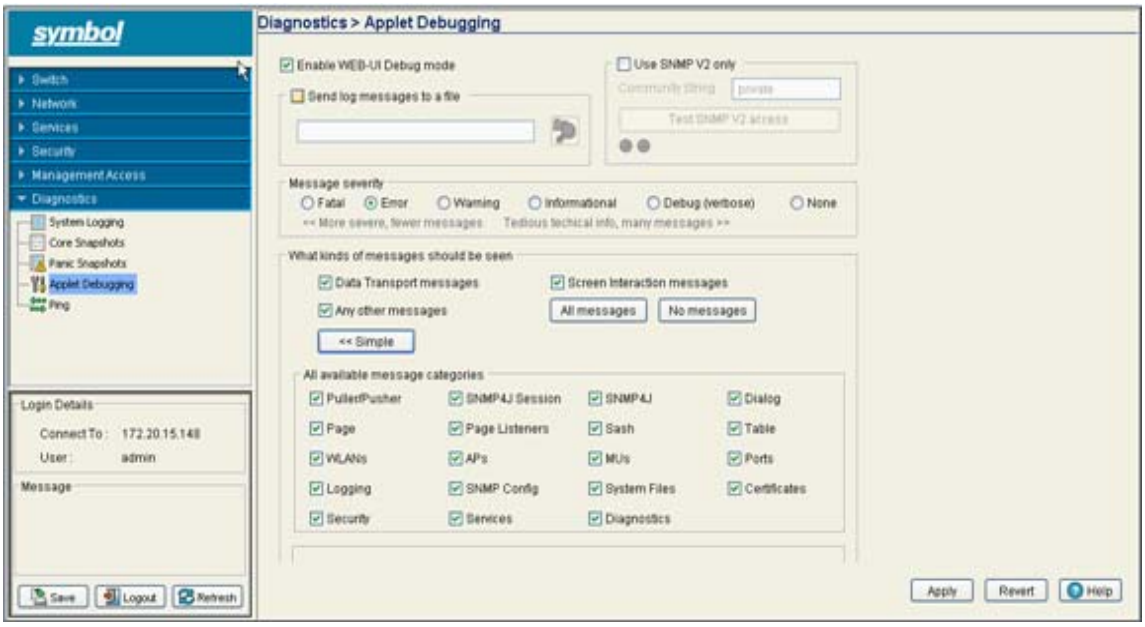
3. Use the **From** drop-down menu to specify the location from which the file is sent. If only the applet is available as a transfer location, use the default switch option.
4. Select a file for the file transfer from the **File** drop-down menu. The drop-down menu contains the panic files listed within the File-Mgmt screen.
5. Use the **To** drop-down menu (within the Target field) to define whether the target panic file is to be sent to the system's local disk (Local Disk) or to an external server (Server).
6. Provide the name of the file to be transferred to the location specified within the **File** field.

7. If Server has been selected as the source, use the **Using** drop down-menu to configure whether the panic file transfer will be sent using FTP or TFTP.
8. If Server has been selected as the source, enter the **IP Address** of destination server or system receiving the target panic file.
9. If Server has been selected as the source, enter the **User ID** credentials required to send the file to the target location. The User ID is required for FTP transfers only.
10. If Server has been selected as the source, enter the **Password** required (for FTP transfers) to send the file to the target location.
11. Specify the appropriate path name to the target directory on the local system disk or server as configured using the "To" parameter. If local server is selected, use the Browse button to specify a location on your local machine.
12. Refer to the **Status** field for the current state of the requests made from applet. This field displays error messages if something goes wrong in the transaction between the applet and the switch.
13. Click the **Make Transfer** button when ready to move the target file to the specified location. Repeat the process as necessary to move each desired log file to the specified location.
14. Click the **Close** button to exit the dialogue and abandon the transfer.

8.5 Debugging the Applet

Refer to the **Applet Debugging** screen to debug the applet.

1. Select **Diagnostics** > **Applet Debugging** from the main menu.



2. To use this window, select the **Enable Applet Debug Mode** checkbox.
3. The Applet Debugging window has the following sections:
   - Send log message to a file.
   - Use SNMP v2 only.
   - Message Severity.
   - What kinds of message should be seen.

4. Select the **Send log message to a file** checkbox if you wish to store the log message.

   Enabling this checkbox allows you to select the file location where you wish to store the log message.
5. Select the **Use SNMP V2 only** checkbox to use SNMP v2 to debug the applet.

   Check whether you have access to SNMP v2 by clicking on the **Test SNMP V2 access** button.
6. Select the severity of the message that you wish to store in the log file.

   The **Message Severity** section allows you to report a bug and log it as per the following severity levels:
   - Fatal
   - Error
   - Warning
   - Informational
   - Debug
   - None
7. Select the message when a bug is raised.

   The **What Kind of message should be seen** field allows you to select a range of parameters for which you can see a message while you debug. Place your mouse pointer over the message type check box for the message description.
   a. Click the **Advanced** button to see the entire list of message categories for when switch bugs are raised. Select the checkboxes corresponding to the message types you would like to receive.

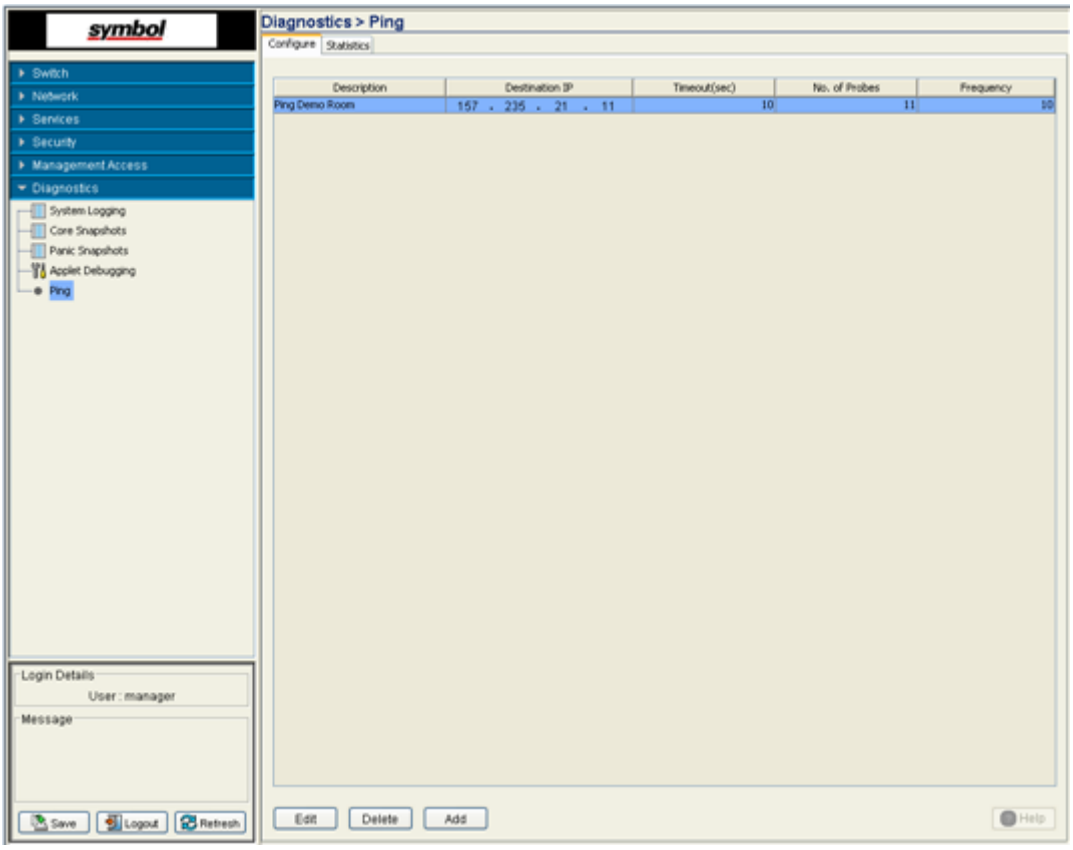
      Each message category is enabled by default. Click the **Simple** button to minimize this area and hide the available message categories.
   b. Click the **All Messages** button to select all the message categories.
   c. Click the **No Messages** button if you do not want to select any of the message categories.
8. Click the **Apply** button to save the changes you have applied within this screen.
9. Click the **Revert** button to revert back to the last saved configuration.

8.6 Configuring a Ping

The switch can verify its link with other switches and associated MUs by sending ping packets to the associated device. Use a ping to test the connection between the switch and IP destinations you specify. For each ping transmitted by the switch, statistics are gathered for the *round-trip time* (RTT) between switch and destination. The RTT is the time in milliseconds for a ping packet to travel from the switch to its target destination and back again. This number can vary significantly because of the random nature of packet routings and random loads on the switch and its destination.

To view the switch's existing ping configuration:

1. Select **Diagnostics** > **Ping** from the main menu.



2. Refer to the following information displayed within the Configuration tab:

Description	Displays the user assigned description of the ping test. The name is read-only. Use this title to determine whether this test can be used as is, modified under the same description or if a new ping test is required.
Destination IP	Displays the IP address of the target device. This is the numeric destination for the device sent the ping packets.
Timeout (sec)	Displays the timeout value (in seconds) used to timeout the ping test if a round trip packet is not received by the switch from its target device.
No. of Probes	Displays the number of packets transmitted to the target IP address to discern the round trip time between the switch and its connected device.
Frequency	Displays the interval between ping packet transmissions.

3. To edit the properties of an existing ping test, select a ping based on the description listed and click the Edit button. For more information, see *Modifying the Configuration of an Existing Ping Test on page 8-20*.
4. Select an existing ping test from those displayed within the Configure tab and click the **Delete** button to remove the ping test from those displayed.
5. Click the Add button to display a screen used to define the attributes of a new ping test. For more information, see *Adding a New Ping Test on page 8-20*.

8.6.1 Modifying the Configuration of an Existing Ping Test

The properties of an existing ping tests can be modified in order to ping an existing (known) device whose network address attributes may have changed and require modification to connect (ping) to it.

To modify the attributes of an existing ping test:

1. Select **Diagnostics** > **Ping** from the main menu.
2. Highlight an existing ping test within the Configuration tab and select the **Edit** button.
3. Modify the following information (as needed) to edit the existing ping test:

Description	If necessary, modify the description for the ping test. Ensure this description is representative of the test, as this is the description displaying within the Configuration tab.
Destination IP	If necessary, modify the IP address of the target device. This is the numeric (non DNS address) destination for the device transmitted the ping packets.
No. of Probes	If necessary, modify the number of packets transmitted to the target IP address to discern the round trip time between the switch and its connected device.
Timeout(sec)	If necessary, modify the timeout value (in seconds) used to timeout the ping test if a round trip packet is not received by the switch from its target device. Ensure this interval is long enough to account for network congestion between the switch and its target device.
Frequency	If necessary, modify the interval (in seconds) between ping packet transmissions. Define a longer interval if high levels of network congestion are anticipated between the switch and its target device. Use a value of 0 to execute a single ping test or stop a currently running ping test.

4. Click **OK** to save and add the changes to the running configuration and close the dialog.
5. Refer to the **Status** field for the current state of the requests made from applet. This field displays error messages if something goes wrong in the transaction between the applet and the switch.
6. Click **Cancel** to return back to the Configuration tab without implementing changes.

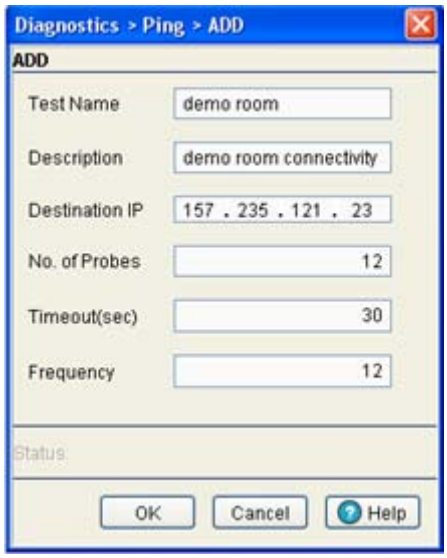
8.6.2 Adding a New Ping Test

If the attributes of an existing ping test do not satisfy the requirements of a new connection test, and you do not want to modify an existing ping test, a new ping test can be created and added to the list of existing ping tests displayed within the Configuration tab.

To create a new ping test and add it to the list of existing tests:

1. Select **Diagnostics** > **Ping** from the main menu.

2. Click the **Add** button at the bottom of the Configuration tab.



3. Enter the following information to define the properties of the new ping test:

Test Name	Enter a short name for the ping test to describe either the target destination of the ping packet or the ping test's expected result. Use the name provided in combination with the ping test description to convey the overall function of the test.
Description	Ensure the description is representative of the test, as this is the description displaying within the Configuration tab.
Destination IP	Enter the IP address of the target device. This is the numeric (non DNS address) destination for the device transmitted the ping packets.
No. of Probes	Define the number of ping packets transmitted to the target device. This value represents the number of packets to be transmitted to the target IP address to discern the round trip time between the switch and its connected device.
Timeout(sec)	Configure the timeout value (in seconds) used to timeout the ping test if a round trip packet is not received by the switch from its target device. Ensure this interval is long enough to account for network congestion between the switch and its target device.
Frequency	Define the interval (in seconds) between ping packet transmissions. Define a longer interval if high levels of network congestion are anticipated between the switch and its target device. Use a value of 0 to execute a single ping test or stop a currently running ping test.

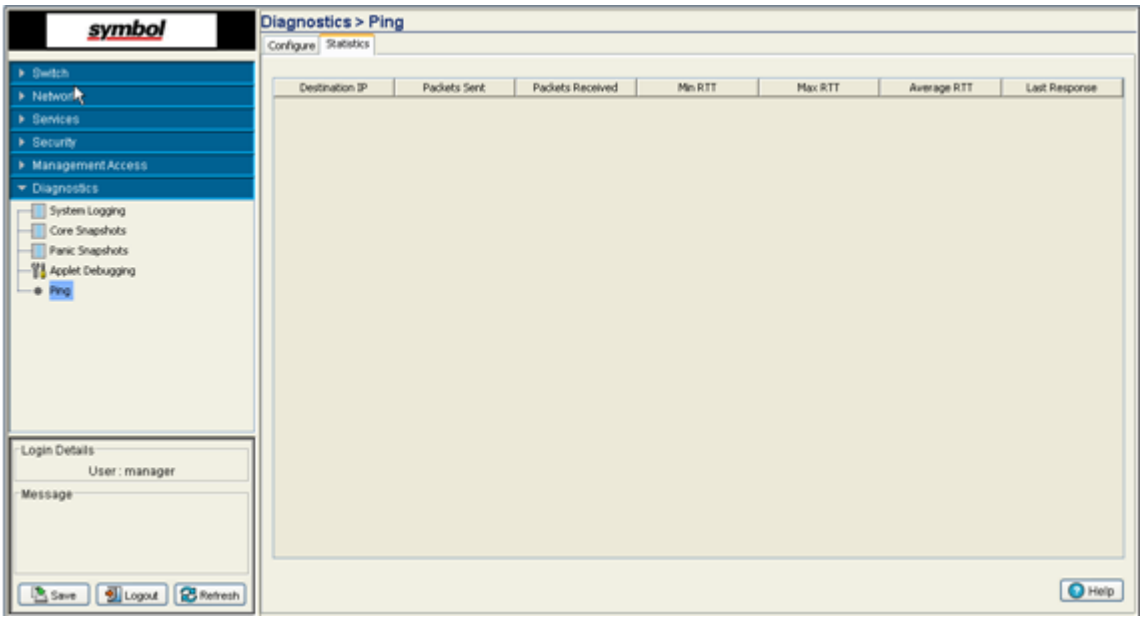
4. Click **OK** to save and add the changes to the running configuration and close the dialog.
5. Refer to the **Status** field for the current state of the requests made from applet. This field displays error messages if something goes wrong in the transaction between the applet and the switch
6. Click **Cancel** to return back to the Configuration tab without implementing changes.

8.6.3 Viewing Ping Statistics

Refer to the Ping Statistics tab for an overview of the overall success of the ping test with the destination IP addresses displayed within the screen. Use this information to determine whether the destination IP represents a device that could offer the switch a viable connection to either extend the switch's existing radio coverage area or provide support for additional MUs within an existing network segment.

To view ping test statistics:

1. Select **Diagnostics** > **Ping** from the main menu.
2. Select the **Statistics** tab.



3. Refer to the following content within the Statistics tab to assess the connection with the target device:

Destination IP	Displays the numeric (non DNS address) destination for the device transmitted the ping packets.
Packets Sent	Displays the number of packets transmitted from the switch to the target device IP address. Compare this value with the number of packets received to assess the connection quality with the target device.
Packets Received	Displays the number of packets received back from the target device. If this number is significantly lower than the number sent to the target device from the switch, then consider removing this device from consideration for permanent connection with the switch.
Min RTT	Displays the quickest round trip time for ping packets transmitted from the switch to its destination IP address. This may reflect the time when data traffic was at its lightest for the two devices.
Max RTT	Displays the longest round trip time for ping packets transmitted from the switch to its destination IP address. This may reflect the time when data traffic was at its most congested for the two devices.

Average RTT	Displays the average round trip time for ping packets transmitted between the switch and its destination IP address. Use this value as a general baseline (along with packets sent vs packets received) for the overall connection and association potential between the switch and target device.
Last Response	Displays the time (in seconds) the switch last "heard" the destination IP address over the switch managed network. Use this time (in contention with the RTT values displayed) to determine whether this device warrants a permanent connection with the switch.

9 MIB Reference

9.1 Introduction

This chapter includes a sample of the MIBs available with the 3.0 baseline of the WS5100 Series Switch.

MIB is a database of objects that can be monitored by a network management system. Objects in the MIB are defined using Structure of Management Information version 2 (SMIv2). MIB is a hierarchical database where each entry is addressed by an object identifier.

Object identifiers are unique Ids that identifies each object in a MIB database. A typical example of an *Object Identifier* (OID) is:

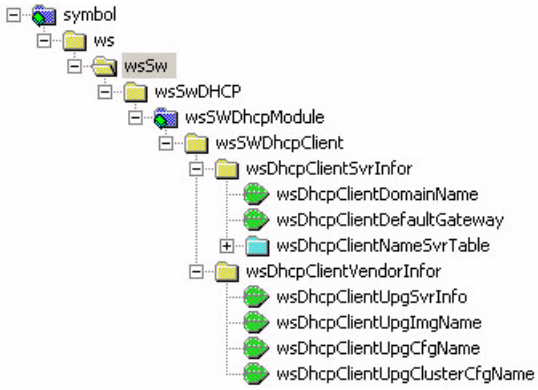
1.3.6.1.4.1.388.14.2.3.4.1

In general, MIB objects can be classified as Scalar and Tabular. Scalar objects can be accessed directly through the OID that are unique to each object. However, Tabular objects are referred through a combination of the OID of the columns and the unique index assigned to each row in the table.

Each network object that can be controlled using a Network Manager has a .mib file that lists all the objects that can be controlled for the network object.

9.2 WS-SW-DHCP-MIB

The WS-SW-DHCP-MIB.mib file provides a description of all the OIDs defined for managing and configuring the *Dynamic Host Control Protocol* (DHCP) Client.



The objects under WS-SW-DHCP-MIB can be classified into Scalar Objects or Tabular Objects. *Table 9.1* lists the Scalar objects and *Table 9.2* the Tabular objects.

Table 9.1 Scalar Objects for DHCP Client MIB

Object Name	Object Identifier (OID)	Access Permission
wsDhcpClientDomainName	1.3.6.1.4.1.388.14.2.3.4.1.1.1	Read-Only
wsDhcpClientDefaultGateway	1.3.6.1.4.1.388.14.2.3.4.1.1.2	Not Accessible
wsDhcpClientVendorInfor	1.3.6.1.4.1.388.14.2.3.4.1.2	Not Accessible
wsDhcpClientUpgSvrInfo	1.3.6.1.4.1.388.14.2.3.4.1.2.1	Read-Only
wsDhcpClientUpgImgName	1.3.6.1.4.1.388.14.2.3.4.1.2.2	Read-Only
wsDhcpClientUpgCfgName	1.3.6.1.4.1.388.14.2.3.4.1.2.3	Read-Only
wsDhcpClientUpgClusterCfgName	1.3.6.1.4.1.388.14.2.3.4.1.2.4	Read-Only

Table 9.2 Tabular Objects for DHCP Client MIB

Object Name	Object Identifier (OID)
wsDhcpClientNameSvrTable	1.3.6.1.4.1.388.14.2.3.4.1.1.3

9.2.1 wsSWDhcpModule

This OID defines the DHCP module.

Object Identifier (OID)	1.3.6.1.4.1.388.14.2.3.4
Parent Module	wsSwDhcp
Object Number	4
Description	Defines the OID for the DHCP module

9.2.2 wsSWDhcpClient

This OID defines the Client object for the DHCP module.

Object Identifier (OID)	1.3.6.1.4.1.388.14.2.3.4.1
Parent Object	wsSWDhcpModule
Object Number	1
Description	Defines the OID for the Client object

For the sub objects under this OID, see *wsSWDhcpClient Sub Objects*.

9.2.2.1 wsSWDhcpClient Sub Objects

The following objects are defined under the wsSWDhcpClient object.

- wsSWDhcpClientSvrInfor
- wsSWDhcpClientVendorInfor

9.2.2.2 wsSWDhcpClientSvrInfor

The wsSWDhcpClientSvrInfor object is a sub-object of wsSWDhcpClient object. It is defined as:

Object Identifier (OID)	1.3.6.1.4.1.388.14.2.3.4.1.1
Parent Object	wsDhcpClient
Object Number	1
Description	Defines the OID for the DHCP Client Server Information object

The following objects are contained in the wsSWDhcpClientSvrInfor object.

- wsDhcpClientDomainName
- wsDhcpClientDefaultGateway
- wsDhcpClientNameSvrTable

wsDhcpClientDomainName

The wsDhcpClientDomainName object identifies the domain where the DHCP server is located.

Object Identifier (OID)	1.3.6.1.4.1.388.14.2.3.4.1.1.1
Parent Object	wsDhcpClientSvrInfor
Object Number	1
Type	String with length between 0 and 80 characters
Access	Read-Only
Status	Current
Description	Defines the OID for the Client Domain Name received from the DHCP Server

wsDhcpClientDefaultGateway

The wsDhcpClientDefaultGateway object identifies the default gateway address for the DHCP server.

Object Identifier (OID)	1.3.6.1.4.1.388.14.2.3.4.1.1.2
Parent Object	wsDhcpClientSvrInfor

Object Number	2
Type	IP Address - 32-bit internet address
Access	Read-Only
Status	Current
Description	Defines the OID for the Client Domain Name received from the DHCP Server

wsDhcpClientNameSvrTable

This OID defines the table that stores information about the Name Server.

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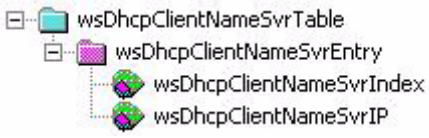


The wsDhcpClientNameSvrTable is defined as:

Object Identifier (OID)	1.3.6.1.4.1.388.14.2.3.4.1.1.3
Parent Object	wsDhcpClientSvrInfor
Object Number	3
Type	Conceptual Table made up of a sequence of WsDhcpClientNameSvrEntry objects
Access	Not accessible
Status	Current
Description	Defines the OID for a table that contains the DHCP Client Name Server information

The wsDhcpClientNameSvrTable is made up of a number of wsDhcpClientNameSvrEntry objects. The wsDhcpClientNameSvrTableEntry object is a sequence of these objects:

- wsDhcpClientNameSvrEntry
- wsDhcpClientNameSvrIndex
- wsDhcpClientNameSvrIP

wsDhcpClientNameSvrEntry

The object wsDhcpClientNameSvrEntry defines the OID for the contents of the wsDhcpClientNameSvrTable object. It is defined as:

Object Identifier (OID)	1.3.6.1.4.1.388.14.2.3.4.1.1.3.1
Parent Object	wsDhcpClientNameSvrTable
Object Number	1
Type	WsDhcpClientNameSvrEntry object definition
Access	Not accessible
Status	Current
Index	wsDhcpClientNameSvrIndex
Description	Name Sever Table entry

wsDhcpClientNameSvrIndex

The object wsDhcpClientNameSvrIndex is defined as:

Object Identifier (OID)	1.3.6.1.4.1.388.14.2.3.4.1.1.3.1.1
Parent Object	wsDhcpClientNameSvrEntry
Object Number	1
Type	Integer with values between 1 and 8 (both inclusive)
Access	Not accessible
Status	Current
Description	Index of the entry in the wsDhcpClientNameSvrTable table object

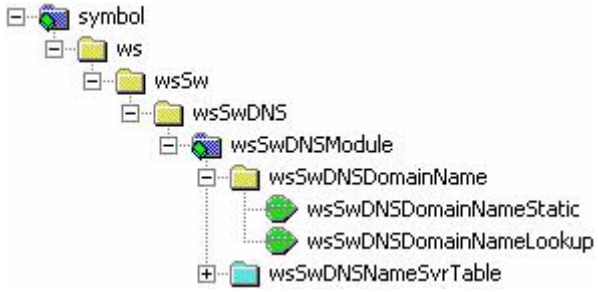
wsDhcpClientNameSvrIP

The object wsDhcpClientNameSvrIP is defined as:

Object Identifier (OID)	1.3.6.1.4.1.388.14.2.3.4.1.1.3.1.2
Parent Object	wsDhcpClientNameSvrEntry
Object Number	2
Type	IP address - 32-bit internet address
Access	Read Only
Status	Current
Description	Name Server IP

9.3 WS-SW-DHCP-SERVER-MIB

The WS-SW-DHCP-SERVER-MIB.mib file provides a description of all the Object Identifiers (OID) that are defined for the Domain Name Server information.



The objects under WS-SW-DHCP-SERVER-MIB can be classified into Scalar Objects or Tabular Objects. *Table 9.3* lists the Scalar objects and *Table 9.4* lists the Tabluar objects.

Table 9.3 Scalar Objects for DNS MIB

Object Name	Object Identifier (OID)	Access Permission
wsSwDNSModule	1.3.6.1.4.1.388.14.2.2.1	Not Accessible
wsSwDNSDomainName	1.3.6.1.4.1.388.14.2.2.1.1	Not Accessible
wsSwDNSDomainNameStatic	1.3.6.1.4.1.388.14.2.2.1.1.1	Read-Write
wsSwDNSDomainNameLookup	1.3.6.1.4.1.388.14.2.2.1.1.2	Read-Write

Table 9.4 Tabular Objects for DNS MIB

Object Name	Object Identifier (OID)
wsSwDNSNameSvrTable	1.3.6.1.4.1.388.14.2.2.1.2

9.3.1 wsSwDNSModule

This OID defines module object for the DNS MIBs.

Object Identifier (OID)	1.3.6.1.4.1.388.14.2.2.1
Parent Module	wsSwDNS
Object Number	1
Description	This OID defines the module object for the DNS MIBs1

The following objects are defined under the wsSwDNSModule

- wsSwDNSDomainName
- wsSwDNSNameSvrTable

9.3.1.1 wsSwDNSDomainName

This OID defines the object for storing the domain name information.

Object Identifier (OID)	1.3.6.1.4.1.388.14.2.2.1.1

Parent Module	wsSwDNSModule
Object Number	1
Description	This OID defines a container for storing DNS domain name information

For the sub objects under this OID, refer *wsSwDNSDomainName*

9.3.1.2 wsSwDNSNameSvrTable

This OID defines the static DNS table.

Object Identifier (OID)	1.3.6.1.4.1.388.14.2.2.1.2
Parent Module	wsSwDNSModule
Object Number	2
Description	Defines the OID for the static DNS table

For the sub objects under this OID, refer *wsSwDNSNameSvrTable*

9.3.2 wsSwDNSDomainName

The following objects are defined under the wsSwDNSDomainName object:

- wsSwDNSDomainNameStatic
- wsSwDNSDomainNameLookup

9.3.2.1 wsSwDNSDomainNameStatic

This OID defines the object for storing the static domain name information.

Object Identifier (OID)	1.3.6.1.4.1.388.14.2.2.1.1.1
Parent Module	wsSwDNSDomainName
Object Number	1
Type	Display String
Access	Read-Write
Status	Current
Description	This OID defines an object to store the static domain name

9.3.2.2 wsSwDNSDomainNameLookup

This OID defines the object for enabling domain name lookup feature.

Object Identifier (OID)	1.3.6.1.4.1.388.14.2.2.1.1.2
Parent Module	wsSwDNSDomainName
Object Number	2
Type	Truth Value
Access	Read-Write
Status	Current
Description	This OID defines an object to enable or disable domain name lookup

9.3.3 wsSwDNSNameSvrTable

This OID defines the DNS name server table.

The wsSwDNSNameSvrTable is described as:

Object Identifier (OID)	1.3.6.14.1.388.14.2.2.1.2
Parent Module	wsSwDNSModule
Object Number	2
Type	Conceptual table made up of WsSwDNSNameSvrEntry entries
Access	Not Accessible
Status	Current
Description	Table containing entries that are the DNS Name Server entries

The wsSwDNSNameSvrTable is made up of sequence of WsSwDNSNameSvrEntry objects. The WsSwDNSNameSvrEntry is a sequence of these objects:

- wsSwDNSNameSvrEntry
- wsSwDNSNameSvrIp
- wsSwDNSNameSvrPriority
- wsSwDNSNameSvrType
- wsSwDNSNameSvrRowStatus

9.3.3.1 wsSwDNSNameSvrEntry

The wsSwDNSNameSvrEntry defines the OID for the contents of the swSwDNSNameSvrTable object. It is defined as:

Object Identifier (OID)	1.3.6.1.4.1.388.14.2.2.1.2.1
Parent Module	wsSwDNSNameSvrTable
Object Number	1
Type	WsSwDNSNameSvrEntry object definition
Access	Not Accessible
Status	Current
Index	wsSwDNSNameSvrIp, wsSwDNSNameSvrType
Description	Defines the OID that defines the DNS name server entry

9.3.3.2 wsSwDNSNameSvrIP

This OID defines the IP address object for the DNS Name Server Table.

Object Identifier (OID)	1.3.6.1.4.1.388.14.2.2.1.2.1.1
Parent Module	wsSwDNSNameSvrEntry
Object Number	1
Type	IP Address
Access	Read-Only
Status	Current
Description	Defines the OID that stores the IP address for the DNS entry

9.3.3.3 wsSwDNSNameSvrPriority

This OID defines the priority object for the DNS Name Server Table.

Object Identifier (OID)	1.3.6.1.4.1.388.14.2.2.1.2.1.2
Parent Module	wsSwDNSNameSvrEntry
Object Number	2
Type	Unsigned 32-bit Integer
Access	Read-Only
Status	Current
Description	Defines the OID that stores the priority level for the DNS entry

9.3.3.4 wsSwDNSNameSvrType

This OID defines the server type object for the DNS Name Server Table.

Object Identifier (OID)	1.3.6.1.4.1.388.14.2.2.1.2.1.3
Parent Module	wsSwDNSNameSvrEntry
Object Number	3
Type	Unsigned 32-bit Integer
Access	Read-Only
Status	Current
Description	The valid values for DNS name server type are: • Static • Dynamic

9.3.3.5 wsSwDNSNameSvrRowStatus

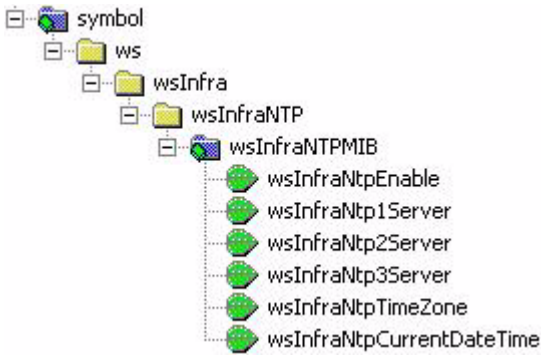
This OID defines the IP address object for the DNS Name Server Table.

Object Identifier (OID)	1.3.6.1.4.1.388.14.2.2.1.2.1.4
Parent Module	wsSwDNSNameSvrEntry
Object Number	4
Type	Row Status

Access	Read-Only
Status	Current
Description	Status of the row for the wsSwDNSNameSvrEntry object

9.4 wsInfraNTP

The wsInfraNTP file provides a description of all the Object Identifiers (OID) that are defined for the Infrastructure NTP information.



The objects under wsInfraNTP can be classified into Scalar Objects or Tabular Objects. *Table 9.5* lists the Scalar objects under the Infrastucture NTP MIB.

Table 9.5 Scalar Objects for Infra NTP MIB

Object Name	Object Identifier (OID)	Access Permission
wsInfraNTP	1.3.6.1.4.1.388.14.1.10	Not Accessible
wsInfraNTPMIB	1.3.6.1.4.1.388.14.1.10.1	Not Accessible
wsInfraNtpEnable	1.3.6.1.5.1.388.14.1.10.1.1	Obsolete
wsInfraNtp1Server	1.3.6.1.5.1.388.14.1.10.1.2	Obsolete
wsInfraNtp2Server	1.3.6.1.5.1.388.14.1.10.1.3	Obsolete
wsInfraNtp3Server	1.3.6.1.5.1.388.14.1.10.1.4	Obsolete
wsInfraNtpTimeZone	1.3.6.1.5.1.388.14.1.10.1.5	Read-Write
wsInfraNtpCurrentDateTime	1.3.6.1.5.1.388.14.1.10.1.6	Read-Write

This OID defines the wsInfraNTP parent object.

Object Identifier (OID)	1.3.6.1.4.1.388.14.1.10
Parent Module	wsInfra
Object Number	10
Description	Defines the OID for the wsInfraNTP object

The following objects are defined under the wsInfraNTP object.

- wsInfraNTPMIB

9.4.1 wsInfraNTPMIB

This OID defines the wsInfraNTPMIB object.

Object Identifier (OID)	1.3.6.1.4.1.388.14.1.10.1
Parent Module	wsInfraNTP
Object Number	1
Description	Defines the OID for the wsInfraNTPMIB object

The following object are defined under the wsInfraNTPMIB object

- wsInfraNtpEnable
- wsInfraNtp1Server
- wsInfraNtp2Server
- wsInfraNtp3Server
- wsInfraNtpTimeZone
- wsInfraNtpCurrentDateTime

9.4.1.1 wsInfraNtpEnable

This OID defines the wsInfraNtpEnable object. This object is used to enable or disable NTP.

Object Identifier (OID)	1.3.6.1.4.1.388.14.1.10.1.1
Parent Module	wsInfraNTPMIB
Object Number	1
Type	TruthValue
Access	Read-Write
Status	Obsolete
Description	Defines the OID that enables or disables NTP

9.4.1.2 wsInfraNtp1Server

This OID defines the wsInfraNtp1Server object. This object is used to store the preferred NTP Server IP address.

Object Identifier (OID)	1.3.6.1.4.1.388.14.1.10.1.2
Parent Module	wsInfraNTPMIB
Object Number	2
Type	IP Address
Access	Read-Write
Status	Obsolete
Description	Defines the OID that stores the IP address of the first preferred NTP Server

9.4.1.3 wsInfraNtp2Server

This OID defines the wsInfraNtp2Server object. This object is used to store the address of the second preferred NTP Server.

Object Identifier (OID)	1.3.6.1.4.1.388.14.1.10.1.3
Parent Module	wsInfraNTPMIB
Object Number	3
Type	IP Address
Access	Read-Write
Status	Obsolete
Description	Defines the OID that stores the IP address of the second preferred NTP Server

9.4.1.4 wsInfraNtp3Server

This OID defines the wsInfraNtp3Server object. This object is used to store the address of the third preferred NTP Server.

Object Identifier (OID)	1.3.6.1.4.1.388.14.1.10.1.4
Parent Module	wsInfraNTPMIB
Object Number	4
Type	IP Address
Access	Read-Write
Status	Obsolete
Description	Defines the OID that stores the IP address of the third preferred NTP Server

9.4.1.5 wsInfraNtpTimeZone

This OID defines the wsInfraNtpTimeZone object. This object is used to define the time zone in use by the device.

Object Identifier (OID)	1.3.6.1.4.1.388.14.1.10.1.5
Parent Module	wsInfraNTPMIB
Object Number	5
Type	Display String
Access	Read-Write
Status	Current
Description	Defines the OID that stores the time zone in use by the device. The valid values include:

- Pacific/Tongatapu
- Pacific/Fiji
- Pacific/Auckland
- Asia/Magadan
- Asia/Vladivostok
- Australia/Hobart
- Pacific/Guam
- Australia/Sydney
- Australia/Brisbane
- Australia/Adelaide
- Asia/Yakutsk
- Asia/Seoul
- Asia/Tokyo
- Asia/Taipei
- Australia/Perth
- Asia/Kuala_Lumpur
- Asia/Irkutsk
- Asia/Hong_Kong
- Asia/Krasnoyarsk
- Asia/Bangkok
- Asia/Rangoon
- Asia/Colombo
- Asia/Dhaka
- Asia/Almaty
- Asia/Katmandu
- Asia/Calcutta
- Asia/Karachi
- Asia/Yekaterinburg
- Asia/Kabul
- Asia/Baku
- Asia/Dubai
- Asia/Tehran
- Africa/Nairobi
- Europe/Moscow
- Asia/Kuwait
- Asia/Baghdad
- Asia/Jerusalem
- Europe/Helsinki
- Africa/Harare
- Africa/Cairo
- Europe/Bucharest
- Europe/Athens
- Africa/Lagos
- Europe/Warsaw
- Europe/Brussels
- Europe/Belgrade
- Europe/Amsterdam
- Africa/Casablanca
- Europe/Dublin
- Atlantic/Azores
- Atlantic/Cape_Verde
- Atlantic/South_Georgia
- America/Sao_Paulo
- America/Buenos_Aires
- America/Thule
- America/St_Johns
- America/Montreal
- America/Caracas
- America/Santiago
- America/Bogota
- America/New_York
- America/Indianapolis
- America/Costa_Rica
- America/Chicago
- America/Mexico_City
- America/Winnipeg
- America/Phoenix
- America/Tegucigalpa
- America/Denver
- America/Los_Angeles
- America/Anchorage
- Pacific/Honolulu
- Pacific/Apia
- MIT

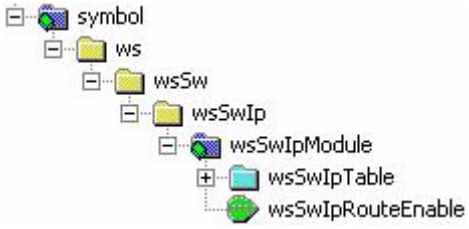
9.4.1.6 wsInfraNtpCurrentDateTime

This OID defines the wsInfraNtpCurrentDateTime object. This object is used to store the current date and time for the device.

Object Identifier (OID)	1.3.6.1.4.1.388.14.1.10.1.6
Parent Module	wsInfraNTPMIB
Object Number	6
Type	Date and Time
Access	Read-Write
Status	Obsolete
Description	Defines the OID that stores current date and time. If the NTP is not running or is not yet synchronized, this value will be Zero (0).

9.5 WS-SW-IP-MIB

The WS-SW-IP-MIB file provides a description of all the *Object Identifiers* (OID) that are defined for the Intenet Protocol information.



The objects under WS-SW-IP-MIB can be classified into Scalar Objects or Tabular Objects. *Table 9.6* lists the Scalar objects and *Table 9.7* the Tabular objects.

Table 9.6 Scalar Objects for IP MIB

Object Name	Object Identifier (OID)	Access Permission
wsSwIp	1.3.6.1.4.1.388.14.2.5	Not Accessible
wsSwIpModule	1.3.6.1.4.1.388.14.2.5.1	Not Accessible
wsSwIpRouteEnable	1.3.6.1.5.1.388.14.2.5.1.2	Read-Write

Table 9.7 Tabular Objects for IP MIB

Object Name	Object Identifier (OID)
wsSwIpTable	1.3.6.1.4.1.366.14.2.5.1.1

9.5.1 wsSwIp

This OID defines the wsSwIp parent object.

Object Identifier (OID)	1.3.6.1.4.1.388.14.2.5
Parent Module	wsSw
Object Number	5
Description	Defines the OID for the wsSwIp object

The following objects are defined under the wsSwIp object.

- wsSwIpModule

9.5.1.1 wsSwIpModule

This OID defines the wsSwIpModule object.

Object Identifier (OID)	1.3.6.1.4.1.388.14.2.5.1
Parent Module	wsSwIp
Object Number	1
Description	Defines the OID for the wsSwIpModule module object

The following objects are defined under the wsSwIpModule object

- wsSwIpRouteEnable
- wsSwIpTable

wsSwIpRouteEnable

This OID defines the Route Enable scalar object.

Object Identifier (OID)	1.3.6.1.4.1.388.14.2.5.1.2
Parent Module	wsSwIpModule
Object Number	2
Type	TruthValue
Access	Read-Write
Status	Current
Description	Defines the OID that enables or disables IP routing

wsSwIpTable

This OID defines the wsSwIpTable object.

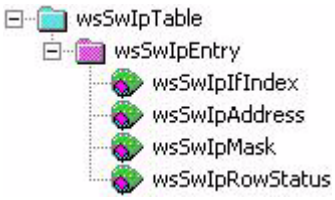
Object Identifier (OID)	1.3.6.1.4.1.388.14.2.5.1.1
Parent Module	wsSwIpModule
Object Number	1
Description	Defines the OID for the Ip Table object

For sub objects under this OID refer *wsSwIpTable*.

9.5.2 wsSwIpTable

This OID defines the table that stores information about the Ip addresses, their masks for the current device.

.



The wsSwIpTable is described as:

Object Identifier (OID)	1.3.6.1.4.1.388.14.2.5.1.1
Parent Module	wsSwIpModule
Object Number	1
Type	Conceptual table made up of WsSwIpEntry entries
Access	Not Accessible

Status	Current
Description	Table containing switching IP entries

The wsSwIpTable is made up of sequence of WsSwIpEntry objects. The WsSwIpEntry is a sequence of these objects:

- wsSwIpEntry
- wsSwIpAddress
- wsSwIpMask
- wsSwRowStatus

9.5.2.1 wsSwIpEntry

The wsSwIpEntry defines the OID for the contents of the wsSwIpTable object. It is defined as:

Object Identifier (OID)	1.3.6.1.4.1.388.14.2.5.1.1.1
Parent Module	wsSwIpTable
Object Number	1
Type	WsSwIpEntry object definition
Access	Not Accessible
Status	Current
Index	wsSwIpIfIndex, wsSwIpAddress, wsSwIpMask
Description	Defines the OID that defines the Ip mapping entry

wsSwIpIfIndex

This OID defines the Ip-If Index object for the IP table.

Object Identifier (OID)	1.3.6.1.4.1.388.14.2.5.1.1.1.1
Parent Module	wsSwIpEntry
Object Number	1
Type	Unsigned 32-bit Integer
Access	Not Accessible
Status	Current
Description	Defines the OID that stores the VLAN IF Index number

9.5.2.2 wsSwIpAddress

This OID defines the Ip address for the IP mapping table object.

Object Identifier (OID)	1.3.6.1.4.1.388.14.2.8.1.1.1.2
Parent Module	wsSwIpEntry
Object Number	2
Type	IP Address
Access	Not Accessible
Status	Current

Description	Defines the OID that stores the IP address for the IP Table entry

9.5.2.3 wsSwIpMask

This OID defines the mask for the Ip mapping table object.

Object Identifier (OID)	1.3.6.1.4.1.388.14.2.8.1.1.1.3
Parent Module	wsSwIpEntry
Object Number	3
Type	IP Address
Access	Not Accessible
Status	Current
Description	Defines the OID that stores the mask for the IP Table entry

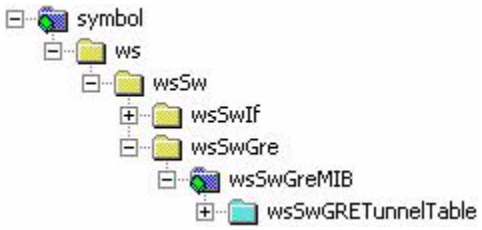
9.5.2.4 wsSwIpRowStatus

This OID defines the object that defines the status of a row in the IP Table.

Object Identifier (OID)	1.3.6.1.4.1.388.14.2.8.1.1.1.4
Parent Module	wsSwIpEntry
Object Number	4
Type	Row Status
Access	Read-Create
Status	Current
Description	Defines the OID that defines the status of a row in the IP Table

9.6 WS-SW-GRE-MIB

The WS-SW-GRE.mib file provides a description of all the Object Identifiers (OID) that are defined for the SW-GRE information.



The objects under WS-SW-GRE.mib can be classified into Scalar Objects or Tabular Objects. *Table 9.8* lists the Scalar objects and *Table 9.9* the Tabular objects.

Table 9.8 Scalar Objects for GRE MIB

Object Name	Object Identifier (OID)	Access Permission
wsSwGre	1.3.6.1.4.1.388.14.2.8	Not Accessible
wsSwGreMIB	1.3.6.1.4.1.388.14.2.8.1	Not Accessible

Table 9.9 Tabular Objects for GRE MIB

Object Name	Object Identifier (OID)
wsSwGRETunnelTable	1.3.6.1.4.1.366.14.2.8.1.1

9.6.1 wsSwGre

This OID defines the wsSwGre parent object.

Object Identifier (OID)	1.3.6.1.4.1.388.14.2.8
Parent Module	wsSw
Object Number	8
Description	Defines the OID for the wsSwGre object

The following objects are defined under the wsSwGre object.

- wsSwGreMIB

9.6.1.1 wsSwGreMIB

This OID defines the wsSwGreMIB object.

Object Identifier (OID)	1.3.6.1.4.1.388.14.2.8.1
Parent Module	wsSwGre
Object Number	1
Description	Defines the OID for the wsSwGreMIB object

The following object is defined under the wsSwGreMib object

- wsSwGRETunnelTable

wsSwGRETunnelTable

This OID defines the wsSwGRETunnelTable object.

Object Identifier (OID)	1.3.6.1.4.1.388.14.2.8.1.1
Parent Module	wsSwGreMIB
Object Number	1
Description	Defines the OID for the GRE Tunnel Table object

For sub objects under this OID refer *wsSwGRETunnelTable*.

9.6.2 wsSwGRETunnelTable

The wsSwGRETunnelTable is described as:

Object Identifier (OID)	1.3.6.1.4.1.388.14.2.8.1.1
Parent Module	wsSwGreMIB
Object Number	1
Type	Conceptual table made up of WsSwGRETunnelTableEntry entries
Access	Not Accessible
Status	Current
Description	Table containing GRE Tunnel information

The wsSwGRETunnelTable is made up of sequence of WsSwGRETunnelTableEntry objects. The WsSwGRETunnelTableEntry is a sequence of these objects:

- wsSwGRETunnelEntry
- wsSwGRETunnelLocalIpAddr
- wsSwGRETunnelRemoteIpAddr
- wsSwGRETunnelTTL

9.6.2.1 wsSwGRETunnelEntry

The wsSwGRETunnelEntry defines the OID for the contents of the wsSwGRETunnelTable object. It is defined as:

Object Identifier (OID)	1.3.6.1.4.1.388.14.2.8.1.1.1
Parent Module	wsSwGRETunnelTable
Object Number	1
Type	WsSwGRETunnelEntry object definition
Access	Not Accessible
Status	Current
Index	wsIfNumber
Description	Defines the OID that defines the GRE Tunnel entry

9.6.2.2 wsSwGRETunnelLocalIpAddr

This OID defines the local Ip Address object for the Tunnel.

Object Identifier (OID)	1.3.6.1.4.1.388.14.2.8.1.1.1.1
Parent Module	wsSwGRETunnelEntry
Object Number	1
Type	Ip Address
Access	Read-Write
Status	Current
Description	Defines the OID that stores the local IP address for the tunnel entry

9.6.2.3 wsSwGRETunnelRemoteIpAddr

This OID defines the remote Ip address object.

Object Identifier (OID)	1.3.6.1.4.1.388.14.2.8.1.1.1.2
Parent Module	wsSwGRETunnelEntry
Object Number	2
Type	Ip Address
Access	Read-Write
Status	Current
Description	Defines the OID that stores the remote IP address for the tunnel entry

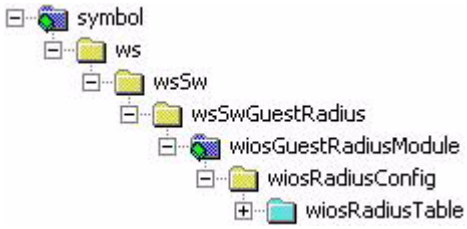
9.6.2.4 wsSwGRETunnelTTL

This OID defines the Tunnel TTL object.

Object Identifier (OID)	1.3.6.1.4.1.388.14.2.8.1.1.1.3
Parent Module	wsSwGRETunnelEntry
Object Number	3
Type	Unsigned 32-bit Integer
Access	Read-Write
Status	Current
Description	Defines the OID that stores the Time To Live (TTL) duration for the tunnel entry

9.7 WS-SW-GUEST-USER-RAD-MIB

The WS-SW-GUEST-USER-RAD-MIB file provides a description of all the Object Identifiers (OID) that are defined for the Guest Radius information.



The objects under WS-SW-GUEST-USER-RAD-MIB can be classified into Scalar Objects or Tabular Objects. *Table 9.10* lists the Scalar objects and *Table 9.11* the Tabular objects.

Table 9.10 Scalar Objects for Guest User Radius MIB

Object Name	Object Identifier (OID)	Access Permission
wsSwGuestRadius	1.3.6.1.4.1.388.14.2.80	Not Accessible
wiosSwGuestRadiusModule	1.3.6.1.4.1.388.14.2.80.1	Not Accessible
wiosRadiusConfig	1.3.6.1.4.1.388.14.2.80.1.1	Not Accessible

Table 9.11 Tabular Objects for Guest User Radius MIB

Object Name	Object Identifier (OID)
wiosRadiusTable	1.3.6.1.4.1.388.14.2.80.1.1.1

9.7.1 wsSwGuestRadius

This OID defines the wsSwGuestRadius parent object.

Object Identifier (OID)	1.3.6.1.4.1.388.14.2.80
Parent Module	wsSw
Object Number	80
Description	Defines the OID for the wsSwGuestRadius object

The following objects are defined under the wsSwGuestRadius object.

- wiosGuestRadiusModule

9.7.1.1 wiosGuestRadiusModule

This OID defines the wiosGuestRadiusModule object.

Object Identifier (OID)	1.3.6.1.4.1.388.14.2.80.1
Parent Module	wsSwGuestRadius
Object Number	1
Description	Defines the OID for the wiosGuestRadiusModule object

The following object is defined under the wiosGuestRadiusModule object

- wiosRadiusConfig

wiosRadiusConfig

This OID defines the wiosRadiusConfig object.

Object Identifier (OID)	1.3.6.1.4.1.388.14.2.80.1.1
Parent Module	wiosGuestRadiusModule
Object Number	1
Description	Defines the OID for the wiosRadiusConfig object

The following object is defined under the wiosRadiusConfig object:

- wiosRadiusTable

wiosRadiusTable

This OID defines the Saved Configuration Changed Counter object.

Object Identifier (OID)	1.3.6.1.4.1.388.14.2.80.1.1.1
Parent Module	wiosRadiusConfig
Object Number	1
Description	Defines the OID for the Radius Table object

9.7.2 wiosRadiusTable

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The wiosRadiusTable is described as:

Object Identifier (OID)	1.3.6.1.4.1.388.14.2.80.1.1.1.1
Parent Module	wiosRadiusConfig
Object Number	1
Type	Conceptual table made up of WiosRadiusEntry
Access	Not Accessible
Status	Current
Description	Table containing Guest User information

The wiosRadiusTable is made up of sequence of WiosRadiusEntry objects. The WiosRadiusEntry is a sequence of these objects:

- wiosRadiusUsername
- wiosRadiusPassword
- wiosRadiusGroup
- wiosRadiusExpireDateAndTime

9.7.2.1 wiosRadiusUserName

This OID defines the Radius Guest User Name object.

Object Identifier (OID)	1.3.6.1.4.1.388.14.2.80.1.1.1.1.1
Parent Module	wiosRadiusEntry
Object Number	1
Type	Display String
Access	Read-Create
Status	Current
Description	Defines the OID that stores the name of the guest user

9.7.2.2 wiosRadiusPassword

This OID defines the Radius Guest User Password object.

Object Identifier (OID)	1.3.6.1.4.1.388.14.2.80.1.1.1.1.2
Parent Module	wiosRadiusEntry
Object Number	2
Type	Display String
Access	Read-Create
Status	Current
Description	Defines the OID that stores the password of the guest user

9.7.2.3 wiosRadiusGroup

This OID defines the Radius User Group object.

Object Identifier (OID)	1.3.6.1.4.1.388.14.2.80.1.1.1.1.3
Parent Module	wiosRadiusEntry
Object Number	3
Type	Display String
Access	Read-Create
Status	Current
Description	Defines the OID that stores the group to which the guest user belongs

9.7.2.4 wiosRadiusExpireDateAndTime

This OID defines the Radius User Expire Date And Time object.

Object Identifier (OID)	1.3.6.1.4.1.388.14.2.80.1.1.1.1.4
Parent Module	wiosRadiusEntry
Object Number	4
Type	Display String
Access	Read-Create
Status	Current
Description	Defines the OID that stores the date and time when the Guest User information expires

9.8 WS-SW-SMI-MIB

The WS-SW-SMI-MIB file provides a description of all the Object Identifiers (OID) that are defined for the WS-SW top level MIB object.

The objects under any MIB can be classified into Scalar Objects or Tabular Objects. *Table 9.12* lists the Scalar objects under the WS-SW-SMI-MIB..

Table 9.12 Scalar Objects for WS-SW-DHCP-SERVER-MIB MIB

Object Name	Object Identifier (OID)	Access Permission
ws	1.3.6.1.4.1.388.14	Not Accessible
wsInfra	1.3.6.1.4.1.388.14.1	Not Accessible
wsSw	1.3.6.1.4.1.388.14.2	Not Accessible
wsCc	1.3.6.1.4.1.388.14.3	Not Accessible
wsMgmt	1.3.6.1.4.1.388.14.4	Not Accessible
wsTrap	1.3.6.1.4.1.388.14.5	Not Accessible
wsSec	1.3.6.1.4.1.388.14.6	Not Accessible

9.8.1 ws

This OID defines the parent ws object.

Object Identifier (OID)	1.3.6.1.4.1.388.14

Parent Module	symbol
Object Number	14
Description	The top level OID for the ws objects.

The following objects are defined under the ws object.

- wsInfra
- wsSw
- wsCc
- wsMgmt
- wsTrap
- wsSec

9.8.1.1 wsInfra

This OID defines the top level container for the Infrastructure objects.

Object Identifier (OID)	1.3.6.1.4.1.388.14.1
Parent Module	ws
Object Number	1
Description	This OID defines the top level container for the infrastructure objects

9.8.1.2 wsSw

This OID defines the top level container for the Sw objects.

Object Identifier (OID)	1.3.6.1.4.1.388.14.2
Parent Module	ws
Object Number	2
Description	This OID defines the top level container for the Sw objects

9.8.1.3 wsCc

This OID defines the top level container for the Cc objects.

Object Identifier (OID)	1.3.6.1.4.1.388.14.3
Parent Module	ws
Object Number	3
Description	This OID defines the top level container for the Cc objects

9.8.1.4 wsMgmt

This OID defines the top level container for the management objects.

Object Identifier (OID)	1.3.6.1.4.1.388.14.4
Parent Module	ws
Object Number	4
Description	This OID defines the top level container for the management objects

9.8.1.5 wsTrap

This OID defines the top level container for the Trap objects.

Object Identifier (OID)	1.3.6.1.4.1.388.14.5
Parent Module	ws
Object Number	5
Description	This OID defines the top level container for the trap objects

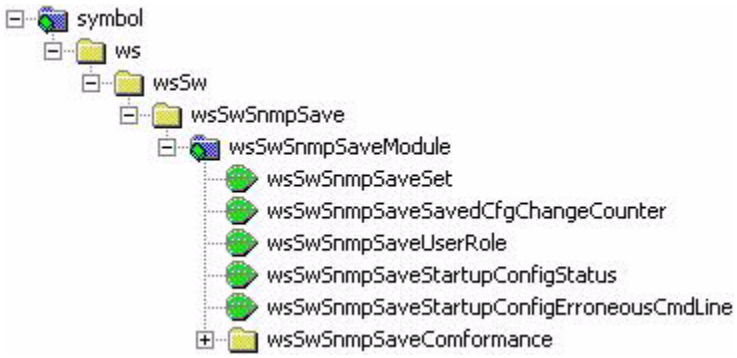
9.8.1.6 wsSec

This OID defines the top level container for the security objects.

Object Identifier (OID)	1.3.6.1.4.1.388.14.6
Parent Module	ws
Object Number	6
Description	This OID defines the top level container for the security objects

9.9 WS-SW-SNMP-SAVE-MIB

The WS-SW-SNMP-SAVE-MIB provides a description of all the Object Identifiers (OID) that are defined for the SNMP Save feature.



The objects under any MIB can be classified into Scalar Objects or Tabular Objects. *Table 9.13* lists the Scalar objects for the WS-SW-SNMP-SAVE-MIB .

Table 9.13 Scalar Objects for SNMP Save MIB

Object Name	Object Identifier (OID)	Access Permission
wsSwSnmpSave	1.3.6.1.4.1.388.14.2.6	Not Accessible
wsSwSnmpSaveModule	1.3.6.1.4.1.388.14.2.6.1	Not Accessible
wsSwSnmpSaveSet	1.3.6.1.4.1.388.14.2.6.1.1	Read-Write
wsSwSnmpSaveSavedCfgChangedCounter	1.3.6.1.4.1.388.14.2.6.1.2	Read-Only
wsSwSnmpSaveUserRole	1.3.6.1.4.1.388.14.2.6.1.3	Read-Write
wsSwSnmpSaveStartupConfigStatus	1.3.6.1.4.1.388.14.2.6.1.4	Read-Only
wsSwSnmpSaveStartupConfigErroneousCmdLine	1.3.6.1.4.1.388.14.2.6.1.5	Read-Only

9.9.1 wsSwSnmpSave

This OID defines the wsSwSnmpSave parent object.

Object Identifier (OID)	1.3.6.1.4.1.388.14.2.6
Parent Module	wsSw
Object Number	6
Description	Defines the OID for the wsSwSnmpSave object

The following objects are defined under the wsSwSnmpSave object.

- wsSwSnmpSaveModule

9.9.1.1 wsSwSnmpSaveModule

This OID defines the wsSwSnmpSaveModule object.

Object Identifier (OID)	1.3.6.1.4.1.388.14.2.6.1
Parent Module	wsSwSnmpSave
Object Number	1
Description	Defines the OID for the wsSwSnmpSaveModule object

The following objects are defined under the wsSwSnmpSaveModule object

- wsSwSnmpSaveSet
- wsSwSnmpSaveSavedCfgChangeCounter
- wsSwSnmpSaveUserRole
- wsSwSnmpSaveStartupConfigStatus
- wsSwSnmpSaveStartupConfigErroneousCmdLine

wsSwSnmpSaveSet

This OID defines the Snmp Save Set object.

Object Identifier (OID)	1.3.6.1.4.1.388.14.2.6.1.1
Parent Module	wsSwSnmpSaveModule
Object Number	1
Description	Defines the OID for the wsSwSnmpSaveSet object

wsSwSnmpSaveSavedCfgChangeCounter

This OID defines the Saved Configuration Changed Counter object.

Object Identifier (OID)	1.3.6.1.4.1.388.14.2.6.1.2
Parent Module	wsSwSnmpSaveModule
Object Number	2
Description	Defines the OID for storing the value for the number of times the ‘Save Config’ was performed using the CLI/SNMP/Applet

wsSwSnmpSaveUserRole

This OID defines the Saved Configuration Changed Counter object.

Object Identifier (OID)	1.3.6.1.4.1.388.14.2.6.1.2
Parent Module	wsSwSnmpSaveModule
Object Number	2
Description	Defines the OID for specifying the privileges for the user currently logged on

wsSwSnmpSaveStartupConfigStatus

This OID defines the Startup Configuration Status object.

Object Identifier (OID)	1.3.6.1.4.1.388.14.2.6.1.4
Parent Module	wsSwSnmpSaveModule
Object Number	4
Description	Defines the OID that sets the status of config playback during startup. This value is used to enable playback of configuration commands. It is then used to inform the user if any configuration commands failed.

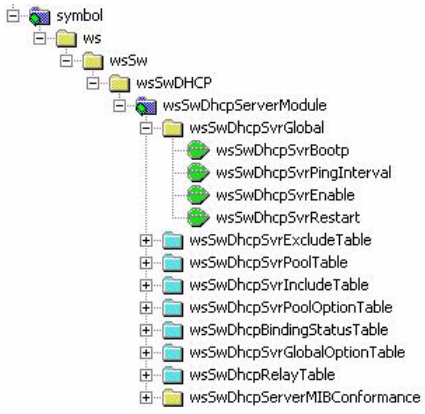
wsSwSnmpSaveStartupConfigErroneousCmdLine

This OID defines the Startup Config Erroneous Command Line object.

Object Identifier (OID)	1.3.6.1.4.1.388.14.2.6.1.5
Parent Module	wsSwSnmpSaveModule
Object Number	5
Description	Defines the OID that stores the line in the startup-config file that failed during bootup.

9.10 WS-SW-DHCP-SERVER-MIB

The WS-SW-DHCP-SERVER-MIB.mib file provides a description of all the Object Identifiers (OID) that are defined for managing and configuring the Dynamic Host Control Protocol (DHCP) Server.



The objects under WS-SW-DHCP-SERVER-MIB can be classified into Scalar Objects or Tabular Objects. *Table 9.14* lists the Scalar objects and *Table 9.15* the Tabular objects.

Table 9.14 Scalar Objects for DHCP Server MIB

Object Name	Object Identifier (OID)	Access Permission
wsSwDhcpServerModule	1.3.6.1.4.1.388.14.2.3.5	Not Accessible
wsSwDhcpSvrGlobal	1.3.6.1.4.1.388.14.2.3.5.1	Not Accessible
wsSwDhcpSvrBootp	1.3.6.1.4.1.388.14.2.3.5.1.1	Read-Write
wsSwDhcpSvrPingInterval	1.3.6.1.4.1.388.14.2.3.5.1.2	Read-Write
wsSwDhcpSvrEnable	1.3.6.1.4.1.388.14.2.3.5.1.3	Read-Write
wsSwDhcpSvrRestart	1.3.6.1.4.1.388.14.2.3.5.1.4	Read-Write

Table 9.15 Tabular Objects for DHCP Server MIB

Object Name	Object Identifier (OID)
wsSwDhcpSvrExcludeTable	1.3.6.1.4.1.388.14.2.3.5.2
wsSwDhcpSvrPoolTable	1.3.6.1.4.1.388.14.2.3.5.3
wsSwDhcpSvrIncludeTable	1.3.6.1.4.1.388.14.2.3.5.4
wsSwDhcpSvrPoolOptionTable	1.3.6.1.4.1.388.14.2.3.5.5
wsSwDhcpSvrBindingStatusTable	1.3.6.1.4.1.388.14.2.3.5.6
wsSwDhcpSvrGlobalOptionTable	1.3.6.1.4.1.388.14.2.3.5.7
wsSwDhcpSvrRelayTable	1.3.6.1.4.1.388.14.2.3.5.8

9.10.1 wsSwDhcpServerModule

This OID defines the DHCP Server module.

Object Identifier (OID)	1.3.6.1.4.1.388.14.2.3.5
Parent Module	wsSwDhcp
Object Number	5
Description	Defines the OID for the DHCP Server module

The following objects are defined under the wsSwDhcpServer object.

- wsSwDhcpSvrGlobal
- wsSwDhcpSvrExcludeTable
- wsSwDhcpSvrPoolTable
- wsSwDhcpSvrIncludeTable
- wsSwDhcpSvrPoolOptionTable
- wsSwDhcpBindingStatusTable
- wsSwDhcpSvrGlobalOptionTable
- wsSwDhcpRelayTable

9.10.1.1 wsSwDhcpSvrGlobal

This OID defines the Server Global object for the DHCP Server module.

Object Identifier (OID)	1.3.6.1.4.1.388.14.2.3.5.1
Parent Object	wsSwDhcpServerModule
Object Number	1
Description	Defines the OID for the Server Global object

For the sub objects under this OID, refer *wsSWDhcpClient Sub Objects*.

9.10.1.2 wsSwDhcpSvrExcludeTable

This OID defines the Server Exclude Table object.

Object Identifier (OID)	1.3.6.1.4.1.388.14.2.3.5.2
Parent Object	wsSwDhcpServerModule
Object Number	2
Description	Defines the OID for the Server Exclude Table

For the sub objects under this OID, refer *wsSwDhcpSvrExcludeTable*.

9.10.1.3 wsSwDhcpSvrPoolTable

This OID defines the Server Pool Table object.

Object Identifier (OID)	1.3.6.1.4.1.388.14.2.3.5.3
Parent Object	wsSwDhcpServerModule
Object Number	3
Description	Defines the OID for the Server Pool Table

For the sub objects under this OID, refer *wsSwDhcpSvrPoolTable*.

9.10.1.4 wsSwDhcpSvrIncludeTable

This OID defines the Server Include Table object.

Object Identifier (OID)	1.3.6.1.4.1.388.14.2.3.5.4
Parent Object	wsSwDhcpServerModule
Object Number	4
Description	Defines the OID for the Server Include Table

For the sub objects under this OID, refer *wsSwDhcpSvrIncludeTable*.

9.10.1.5 wsSwDhcpSvrPoolOptionTable

This OID defines the Server Pool Option Table object.

Object Identifier (OID)	1.3.6.1.4.1.388.14.2.3.5.5
Parent Object	wsSwDhcpServerModule
Object Number	5

Description	Defines the OID for the Server Pool Option Table

For the sub objects under this OID, refer *wsSwDhcpSvrPoolOptionTable*.

9.10.1.6 wsSwDhcpBindingStatusTable

This OID defines the Binding Status Table object.

Object Identifier (OID)	1.3.6.1.4.1.388.14.2.3.5.6
Parent Object	wsSwDhcpServerModule
Object Number	6
Description	Defines the OID for the Binding Status Table

For the sub objects under this OID, refer *wsSwDhcpBindingStatusTable*.

9.10.1.7 wsSwDhcpSvrGlobalOptionTable

This OID defines the Server Global Option Table object.

Object Identifier (OID)	1.3.6.1.4.1.388.14.2.3.5.7
Parent Object	wsSwDhcpServerModule
Object Number	7
Description	Defines the OID for the Server Global Option Table

For the sub objects under this OID, refer *wsSwDhcpSvrGlobalOptionTable*.

9.10.1.8 wsSwDhcpRelayTable

This OID defines the DHCP Relay Table object.

Object Identifier (OID)	1.3.6.1.4.1.388.14.2.3.5.8
Parent Object	wsSwDhcpServerModule
Object Number	8
Description	Defines the OID for the DHCP Relay Table

For the sub objects under this OID, refer *wsSwDhcpRelayTable*.

9.10.2 wsSWDhcpSvrGlobal Sub Objects

The following objects are defined under the wsSWDhcpClient object.

- wsSwDhcpSvrBootp
- wsSwDhcpSvrPingInterval
- wsSwDhcpSvrEnable
- wsSwDhcpSvrRestart

9.10.2.1 wsSwDhcpSvrBootp

The wsSwDhcpSvrBoop object sets the access for bootp requests. Access can be Allow / Ignore Bootp requests. It is defined as:

Object Identifier (OID)	1.3.6.1.4.1.388.14.2.3.5.1.1
Parent Object	wsDhcpSvrGlobal
Object Number	1
Type	TruthValue
Access	Read-Write
Status	Current
Description	Defines the OID for the Bootp access

9.10.2.2 wsSwDhcpSvrPingInterval

The wsSwDhcpSvrPingInterval object sets the time interval between pings. It is defined as:

Object Identifier (OID)	1.3.6.1.4.1.388.14.2.3.5.1.2
Parent Object	wsDhcpSvrGlobal
Object Number	2
Type	Integer with values between 0 and 10, both inclusive
Access	Read-Write
Status	Current
Description	Defines the OID for the ping interval

9.10.2.3 wsSwDhcpSvrEnable

The wsSwDhcpSvrEnable object enables the switch's internal DHCP Server. It is defined as:

Object Identifier (OID)	1.3.6.1.4.1.388.14.2.3.5.1.3
Parent Object	wsDhcpSvrGlobal
Object Number	3
Type	TruthValue
Access	Read-Write
Status	Current
Description	Enable the switch's internal DHCP Server.

9.10.2.4 wsSwDhcpSvrRestart

The wsSwDhcpSvrRestart object set the values for restarting the DHCP Server. It is defined as:

Object Identifier (OID)	1.3.6.1.4.1.388.14.2.3.5.1.4
Parent Object	wsDhcpSvrGlobal
Object Number	4

Type	Integer Array. Defined as:
	{
	restart(1),
	idle(2)
	}

Access	Read-Write
Status	Current
Description	Defines the OID for the time interval before the DHCP Server restarts

9.10.3 wsSwDhcpSvrExcludeTable

This OID defines the table that stores IP addresses unavailable to the DHCP Server when assigning IP addresses.

The wsSwDhcpSvrExcludeTable is described as:

Object Identifier (OID)	1.3.6.1.4.1.388.14.2.3.5.2
Parent Object	wsSwDhcpServerModule
Object Number	2
Type	Conceptual Table made up of a sequence of WsSwDhcpSvrExcludeEntry objects
Access	Not accessible
Status	Current
Description	This OID defines the table that stores IP addresses unavailable to the DHCP Server when assigning IP addresses.

The wsSwDhcpSvrExcludeTable is made up of a sequence of WsSwDhcpSvrExcludeEntry objects. The WsSwDhcpSvrExcludeEntry is a sequence of these objects:

- wsSwDhcpSvrExcludeLowIpAddr
- wsSwDhcpSvrExcludeHighIpAddr
- wsSwDhcpSvrExcludeRowStatus

9.10.3.1 wsSwDhcpSvrExcludeEntry

The object wsSwDhcpSvrExcludeEntry defines the OID for the contents of the wsSwDhcpSvrExcludeTable object. It is defined as:

Object Identifier (OID)	1.3.6.1.4.1.388.14.2.3.5.2.1
Parent Object	wsSwDhcpSvrExcludeTable
Object Number	1

Type	WsSwDhcpSvrExcludeEntry object definition
Access	Not accessible
Status	Current
Index	wsSwDhcpSvrExcludeLowIpAddr, wsSwDhcpSvrExcludeHighIpAddr
Description	Defines the IP addresses excluded from assignmnet by the DHCP server.

9.10.3.2 wsSwDhcpSvrExcludeLowIpAddr

The object wsSwDhcpSvrExcludeLowIpAddr defines the OID for the low IP address excluded from assignment by the DHCP server. It is defined as:

Object Identifier (OID)	1.3.6.1.4.1.388.14.2.3.5.2.1.1
Parent Object	wsSwDhcpSvrExcludeEntry
Object Number	1
Type	IP Address
Access	Read-Only
Status	Current
Description	Defines the OID for the low IP address excluded from assignment by the DHCP server.

9.10.3.3 wsSwDhcpSvrExcludeHighIpAddr

The object wsSwDhcpSvrExcludeHighIpAddr defines the OID for the high IP address excluded from assignment by the DHCP server.. It is defined as:

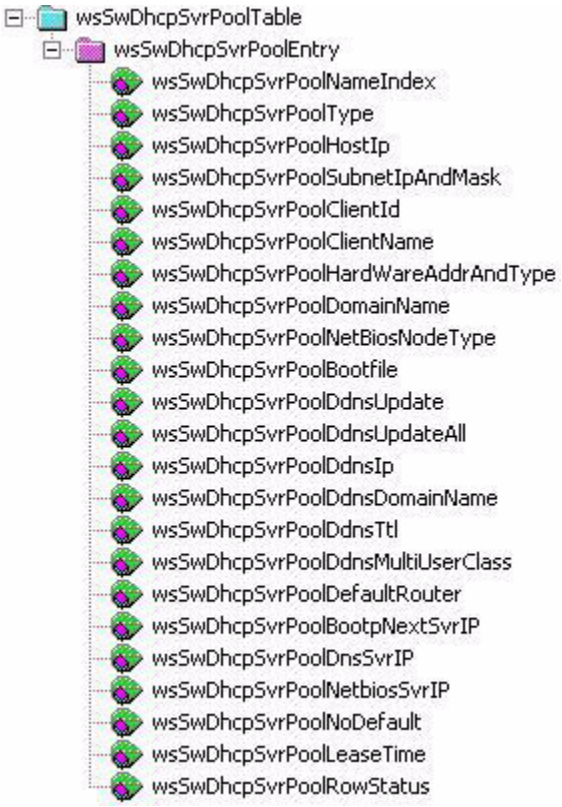
Object Identifier (OID)	1.3.6.1.4.1.388.14.2.3.5.2.1.2
Parent Object	wsSwDhcpSvrExcludeEntry
Object Number	2
Type	Display String
Access	Read-Only
Status	Current
Description	Excluded High Address

9.10.3.4 wsSwDhcpSvrExcludeRowStatus

The object wsSwDhcpSvrExcludeRowStatus defines the OID for row status for the excluded entry. It is defined as:

Object Identifier (OID)	1.3.6.1.4.1.388.14.2.3.5.2.1.3
Parent Object	wsSwDhcpSvrExcludeEntry
Object Number	3
Type	Row Status
Access	Read-Create
Status	Current
Description	Status of the row for the wsSwDhcpSvrExcludeEntry object

9.10.4 wsSwDhcpSvrPoolTable



The wsSwDhcpSvrPoolTable is described as:

Object Identifier (OID)	1.3.6.1.4.1.388.14.2.3.5.3
Parent Object	wsSwDhcpServerModule
Object Number	3
Type	Conceptual Table made up of a sequence of WsSwDhcpSvrPoolEntry objects
Access	Not accessible
Status	Current

The wsSwDhcpSvrPoolTable is made up of a sequence of WsSwDhcpSvrPoolEntry objects. The WsSwDhcpSvrPoolEntry is a sequence of these objects:

- wsSwDhcpSvrPoolNameIndex
- wsSwDhcpSvrPoolType
- wsSwDhcpSvrPoolHostIp
- wsSwDhcpSvrPoolSubnetIpAndMask
- wsSwDhcpSvrPoolClientId
- wsSwDhcpSvrPoolClientName
- wsSwDhcpSvrPoolHardWareAddrAndType
- wsSwDhcpSvrPoolDomainName
- wsSwDhcpSvrPoolNetBiosNodeType

- wsSwDhcpSvrPoolBootfile
- wsSwDhcpSvrPoolDdnsUpdate
- wsSwDhcpSvrPoolDdnsUpdateAll
- wsSwDhcpSvrPoolDdnsIp
- wsSwDhcpSvrPoolDdnsDomainName
- wsSwDhcpSvrPoolDdnsTtl
- wsSwDhcpSvrPoolDdnsMultiUserClass
- wsSwDhcpSvrPoolDefaultRouter
- wsSwDhcpSvrPoolBootpNextSvrIp
- wsSwDhcpSvrPoolDnsSvrIp
- wsSwDhcpSvrPoolNetbiosSvrIp
- wsSwDhcpSvrPoolNoDefault
- wsSwDhcpSvrPoolLeaseTime
- wsSwDhcpSvrPoolRowStatus

9.10.4.1 wsSwDhcpSvrPoolEntry

The object wsSwDhcpSvrPoolEntry defines the OID for the contents of the wsSwDhcpSvrPoolTable object. It is defined as:

Object Identifier (OID)	1.3.6.1.4.1.388.14.2.3.5.3.1
Parent Object	wsSwDhcpSvrPoolTable
Object Number	1
Type	WsSwDhcpSvrPoolEntry object definition
Access	Not accessible
Status	Current
Index	wsSwDhcpSvrPoolNameIndex
Description	Defines the name of a new DHCP pool entry.

9.10.4.2 wsSwDhcpSvrPoolNameIndex

The object wsSwDhcpSvrPoolNameIndex defines the OID for the index value for unique identification of each row in the wsSwDhcpSvrPoolTable. It is defined as:

Object Identifier (OID)	1.3.6.1.4.1.388.14.2.3.5.3.1.1
Parent Object	wsSwDhcpSvrPoolEntry
Object Number	1
Type	Display String
Access	Read-Only
Status	Current
Description	Index entry for the wsSwDhcpSvrPoolEntry object in the wsSwDhcpSvrPoolTable

9.10.4.3 wsSwDhcpSvrPoolType

The object wsSwDhcpSvrPoolType defines the OID for the type of DHCP pool used. It is defined as:

Object Identifier (OID)	1.3.6.1.4.1.388.14.2.3.5.3.1.2
Parent Object	wsSwDhcpSvrPoolEntry
Object Number	2

Type	Index with the syntax
	{
	unDefined(0),
	network(1),
	host(2)
	}

Access	Read-Only
Status	Current
Description	Defines the OID for the type of DHCP pool used.

9.10.4.4 wsSwDhcpSvrPoolHostIp

The object wsSwDhcpSvrPoolHostIp defines the OID for host pool IP address. It is defined as:

Object Identifier (OID)	1.3.6.1.4.1.388.14.2.3.5.3.1.3
Parent Object	wsSwDhcpSvrPoolEntry
Object Number	3
Type	IP Address
Access	Read-Create
Status	Current
Description	Defines the OID for host pool IP address.

9.10.4.5 wsSwDhcpSvrPoolSubnetIpAndMask

The object wsSwDhcpSvrPoolSubnetIpAndMask defines the OID for the Subnet IP address and the Subnet Mask used. It is defined as:

Object Identifier (OID)	1.3.6.1.4.1.388.14.2.3.5.3.1.4
Parent Object	wsSwDhcpSvrPoolEntry
Object Number	4
Type	Display String
Access	Read-Create
Status	Current
Description	Defines the OID for the Subnet IP address and the Subnet Mask used

9.10.4.6 wsSwDhcpSvrPoolClientId

The object wsSwDhcpSvrPoolClientId defines the OID for the Client Identifier. It is defined as:

Object Identifier (OID)	1.3.6.1.4.1.388.14.2.3.5.3.1.5

Parent Object	wsSwDhcpSvrPoolEntry
Object Number	5
Type	Octet String
Access	Read-Create
Status	Current
Description	Defines the OID for the Client Identifier

9.10.4.7 wsSwDhcpSvrPoolClientName

The object wsSwDhcpSvrPoolHostIp defines the OID for the name of the client requesting DHCP Server support over this interface. It is defined as:

Object Identifier (OID)	1.3.6.1.4.1.388.14.2.3.5.3.1.6
Parent Object	wsSwDhcpSvrPoolEntry
Object Number	6
Type	Display String
Access	Read-Create
Status	Current
Description	Defines the name of the client requesting DHCP Server support over this interface.

9.10.4.8 wsSwDhcpSvrPoolHardWareAddrAndType

The object wsSwDhcpSvrPoolHardWareAddrAndType defines the OID for Hardware Address and its type. It is defined as:

Object Identifier (OID)	1.3.6.1.4.1.388.14.2.3.5.3.1.7
Parent Object	wsSwDhcpSvrPoolEntry
Object Number	7
Type	Display String
Access	Read-Create
Status	Current
Description	Defines the OID for the Hardware address and the Hardware type. Entry should be in the format: • XX:XX:XX:XX:XX:XX, ethernet • XX:XX:XX:XX:XX:XX, token-ring

9.10.4.9 wsSwDhcpSvrPoolDomainName

The object wsSwDhcpSvrPoolDomainName defines the OID for the Domain Name. It is defined as:

Object Identifier (OID)	1.3.6.1.4.1.388.14.2.3.5.3.1.8
Parent Object	wsSwDhcpSvrPoolEntry
Object Number	8
Type	Display String
Access	Read-Create

Status	Current
Description	Defines the OID for the Domain Name

9.10.4.10 wsSwDhcpSvrPoolNetBiosNodeType

The object wsSwDhcpSvrPoolNetBiosNodeType defines the OID for the Netbios node type. It is defined as:

Object Identifier (OID)	1.3.6.1.4.1.388.14.2.3.5.3.1.9
Parent Object	wsSwDhcpSvrPoolEntry
Object Number	9

Type	Integer with the syntax
	{
	undefined(0),
	nodeB(1),
	nodeP(2),
	nodeM(4),
	nodeH(8),
	}

Access	Read-Create
Status	Current
Description	Defines the OID for the Netbios node type

9.10.4.11 wsSwDhcpSvrPoolBootfile

The object wsSwDhcpSvrPoolDomainName defines the OID for the boot file name. It is defined as:

Object Identifier (OID)	1.3.6.1.4.1.388.14.2.3.5.3.1.10
Parent Object	wsSwDhcpSvrPoolEntry
Object Number	10
Type	Display String
Access	Read-Create
Status	Current
Description	Defines the OID for the name of the boot file in use

9.10.4.12 wsSwDhcpSvrPoolDdnsUpdate

The object wsSwDhcpSvrPoolDdnsUpdate defines the OID for the DDNS updates. It is defined as:

Object Identifier (OID)	1.3.6.1.4.1.388.14.2.3.5.3.1.11
Parent Object	wsSwDhcpSvrPoolEntry
Object Number	11

Type	Integer with the syntax
	{
	noUpdate(0),
	serverUpdate(1),
	clientUpdate(2)
	}

Access	Read-Create
Status	Current
Description	Defines the OID for the DDNS updates

9.10.4.13 wsSwDhcpSvrPoolDdnsUpdateAll

The object wsSwDhcpSvrPoolDdnsUpdateAll defines the OID for updating DDNS server settings used with the DHCP server. It is defined as:

Object Identifier (OID)	1.3.6.1.4.1.388.14.2.3.5.3.1.12
Parent Object	wsSwDhcpSvrPoolEntry
Object Number	12

Type	Integer with the syntax
	{
	updateAll(1),
	idle(2)
	}

Access	Read-Create
Status	Current
Description	Defines the settings used by the mobility domain to pass layer 2 and layer 3 traffic amongst peer switches.

9.10.4.14 wsSwDhcpSvrPoolDdnsIp

The object wsSwDhcpSvrPoolDdnsIp defines the OID for the DDNS Ip addresses. This OID can take a maximum of two (2) IP addresses. It is defined as:

Object Identifier (OID)	1.3.6.1.4.1.388.14.2.3.5.3.1.13
Parent Object	wsSwDhcpSvrPoolEntry
Object Number	13
Type	Display String
Access	Read-Create
Status	Current
Description	Defines the OID for the DDNS Ip addresses. This OID takes two IPs in the format IP1, IP2 To remove IP1 and retain IP2 use the syntax , IP2 or 0.0.0.0, IP2 To remove IP2 and retain IP1 use the syntax IP1, or IP1, 0.0.0.0 To remove both IP1 and IP2 use the syntax , or “” (empty string)

9.10.4.15 wsSwDhcpSvrPoolDdnsDomainName

The object wsSwDhcpSvrPoolDdnsUpdateAll defines the OID for the DDNS domain name. It is defined as:

Object Identifier (OID)	1.3.6.1.4.1.388.14.2.3.5.3.1.14

Parent Object	wsSwDhcpSvrPoolEntry
Object Number	14
Type	Display String
Access	Read-Create
Status	Current
Description	Defines the OID for the DDNS domain name

9.10.4.16 wsSwDhcpSvrPoolDdnsTtl

The object wsSwDhcpSvrPoolDdnsTtl defines the OID for the DDNS TTL (Time To Live) value. It is defined as:

Object Identifier (OID)	1.3.6.1.4.1.388.14.2.3.5.3.1.15
Parent Object	wsSwDhcpSvrPoolEntry
Object Number	15
Type	Integer with values between 0 and 65535 (both inclusive)
Access	Read-Create
Status	Current
Description	Defines the OID for the DDND TTL (Time To Live) value

9.10.4.17 wsSwDhcpSvrPoolDdnsMultiUserClass

The object wsSwDhcpSvrPoolDdnsMultiUserClass defines the OID for enabling the DDNS multi user class. It is defined as:

Object Identifier (OID)	1.3.6.1.4.1.388.14.2.3.5.3.1.16
Parent Object	wsSwDhcpSvrPoolEntry
Object Number	16
Type	Truth Value
Access	Read-Create
Status	Current
Description	Defines the OID for enabling the DDNS multi user class

9.10.4.18 wsSwDhcpSvrPoolDefaultRouter

The object wsSwDhcpSvrPoolDefaultRouter defines the OID for the default router. It is defined as:

Object Identifier (OID)	1.3.6.1.4.1.388.14.2.3.5.3.1.17
Parent Object	wsSwDhcpSvrPoolEntry
Object Number	17
Type	Display String
Access	Read-Create
Status	Current
Description	Defines the OID for the address of the default router. The values have to be in the format xxx.xxx.xxx.xxx, yyy.yyy.yyy.yyy The maximum number of entries is 8

9.10.4.19 wsSwDhcpSvrPoolBootpNextSvrIP

The object wsSwDhcpSvrPoolBootpNextSvrIP defines the OID for the address of the next Bootp Server. It is defined as:

Object Identifier (OID)	1.3.6.1.4.1.388.14.2.3.5.3.1.18
Parent Object	wsSwDhcpSvrPoolEntry
Object Number	18
Type	IP Address
Access	Read-Create
Status	Current
Description	Defines the OID for the address of the next Bootp Server. Setting this value to 0.0.0.0 indicates that there is no bootp next server address.

9.10.4.20 wsSwDhcpSvrPoolDnsSvrIP

The object wsSwDhcpSvrPoolDnsSvrIP defines the OID for DNS Server address. It is defined as:

Object Identifier (OID)	1.3.6.1.4.1.388.14.2.3.5.3.1.19
Parent Object	wsSwDhcpSvrPoolEntry
Object Number	19
Type	Display String
Access	Read-Create
Status	Current
Description	Defines the OID for the address for the DNS Server. The values have to be in the format xxx.xxx.xxx.xxx, yyy.yyy.yyy.yyy The maximum number of entries is 8

9.10.4.21 wsSwDhcpSvrPoolNetbiosSvrIP

The object wsSwDhcpSvrPoolNetbiosSvrIP defines the OID for Netbios Server address. It is defined as:

Object Identifier (OID)	1.3.6.1.4.1.388.14.2.3.5.3.1.20
Parent Object	wsSwDhcpSvrPoolEntry
Object Number	20
Type	Display String
Access	Read-Create
Status	Current
Description	Defines the OID for the address for the Netbios Server. The values have to be in the format xxx.xxx.xxx.xxx, yyy.yyy.yyy.yyy The maximum number of entries is 8

9.10.4.22 wsSwDhcpSvrPoolNoDefault

The object wsSwDhcpSvrPoolNoDefault defines the OID for No Default. It is defined as:

Object Identifier (OID)	1.3.6.1.4.1.388.14.2.3.5.3.1.21

Parent Object	wsSwDhcpSvrPoolEntry
Object Number	21

Type	Integer with the syntax
	{
	noDefaultRouter(1),
	noDnsSvrIP(2),
	noNetbiosSvrIP(3),
	idle(4)
	}

Access	Read-Create
Status	Current
Description	Defines the OID for the No Default values

9.10.4.23 wsSwDhcpSvrPoolLeaseTime

The object wsSwDhcpSvrPoolLeaseTime defines the OID for lease time for the DHCP Server Pool. It is defined as:

Object Identifier (OID)	1.3.6.1.4.1.388.14.2.3.5.3.1.22
Parent Object	wsSwDhcpSvrPoolEntry
Object Number	22
Type	Display String
Access	Read-Create
Status	Current
Description	Defines the OID for the lease time for the DHCP Server Pool. The values have to be in the format DD:HH:MM - represents days:hours:minutes 00:00:00 indicates infinite lease value.

9.10.4.24 wsSwDhcpSvrPoolRowStatus

The object wsSwDhcpSvrPoolRowStatus defines the OID for row status for the Server Pool entry. It is defined as:

Object Identifier (OID)	1.3.6.1.4.1.388.14.2.3.5.3.1.23
Parent Object	wsSwDhcpSvrPoolEntry
Object Number	23
Type	Row Status
Access	Read-Create
Status	Current
Description	Status of the row for the wsSwDhcpSvrPoolEntry object

9.10.5 wsSwDhcpSvrIncludeTable

This OID defines the table that stores the included IP address information.

The wsSwDhcpSvrIncludeTable is described as:

Object Identifier (OID)	1.3.6.1.4.1.388.14.2.3.5.4
Parent Object	wsSwDhcpServerModule
Object Number	4
Type	Conceptual Table made up of a sequence of WsSwDhcpSvrIncludeEntry objects
Access	Not accessible
Status	Current
Description	Stores the included IP address information

The wsSwDhcpSvrIncludeTable is made up of a sequence of WsSwDhcpSvrIncludeEntry objects. The WsSwDhcpSvrIncludeEntry is a sequence of these objects:

- wsSwDhcpSvrIncludeLowIP
- wsSwDhcpSvrIncludeHighIP
- wsSwDhcpSvrIncludeRowStatus

9.10.5.1 wsSwDhcpSvrIncludeEntry

The object wsSwDhcpSvrIncludeEntry defines the OID for the contents of the wsSwDhcpSvrIncludeTable object. It is defined as:

Object Identifier (OID)	1.3.6.1.4.1.388.14.2.3.5.4.1
Parent Object	wsSwDhcpSvrIncludeTable
Object Number	1
Type	WsSwDhcpSvrIncludeEntry object definition
Access	Not accessible
Status	Current
Index	wsSwDhcpSvrPoolNameIndex, wsSwDhcpSvrIncludeLowIP, wsSwDhcpSvrIncludeHighIP
Description	Displays included DHCP IP address information.

9.10.5.2 wsSwDhcpSvrIncludeLowIP

The object wsSwDhcpSvrIncludeLowIP defines the OID for the included low address. It is defined as:

Object Identifier (OID)	1.3.6.1.4.1.388.14.2.3.5.4.1.1
Parent Object	wsSwDhcpSvrIncludeEntry

Object Number	1
Type	IP Address
Access	Read-Only
Status	Current
Description	Defines the OID for the Included Low Address

9.10.5.3 wsSwDhcpSvrIncludeHighIP

The object wsSwDhcpSvrIncludeHighIP defines the OID for the included high address. It is defined as:

Object Identifier (OID)	1.3.6.1.4.1.388.14.2.3.5.4.1.2
Parent Object	wsSwDhcpSvrIncludeEntry
Object Number	2
Type	Display String
Access	Read-Only
Status	Current
Description	Defines the OID for the Included High Address

9.10.5.4 wsSwDhcpSvrIncludeRowStatus

The object wsSwDhcpSvrIncludeRowStatus defines the OID for row status for the included entry. It is defined as:

Object Identifier (OID)	1.3.6.1.4.1.388.14.2.3.5.4.1.3
Parent Object	wsSwDhcpSvrIncludeEntry
Object Number	3
Type	Row Status
Access	Read-Create
Status	Current
Description	Status of the row for the wsSwDhcpSvrIncludeEntry object

9.10.6 wsSwDhcpSvrPoolOptionTable

The wsSwDhcpSvrPoolOptionTable is described as:

Object Identifier (OID)	1.3.6.1.4.1.388.14.2.3.5.5
Parent Object	wsSwDhcpServerModule
Object Number	5
Type	Conceptual Table made up of a sequence of WsSwDhcpSvrPoolOptionEntry objects
Access	Not accessible
Status	Current

The wsSwDhcpSvrPoolOptionTable is made up of a sequence of WsSwDhcpSvrPoolOptionEntry objects. The WsSwDhcpSvrPoolOptionEntry is a sequence of these objects:

- wsSwDhcpSvrPoolOptionName
- wsSwDhcpSvrPoolOptionValue
- wsSwDhcpSvrPoolOptionRowStatus

9.10.6.1 wsSwDhcpSvrPoolOptionEntry

The object wsSwDhcpSvrPoolOptionEntry defines the OID for the contents of the wsSwDhcpSvrPoolOptionTable object. It is defined as:

Object Identifier (OID)	1.3.6.1.4.1.388.14.2.3.5.5.1
Parent Object	wsSwDhcpSvrPoolOptionTable
Object Number	1
Type	WsSwDhcpSvrPoolOptionEntry object definition
Access	Not accessible
Status	Current
Index	wsSwDhcpSvrPoolNameIndex, wsSwDhcpSvrPoolOptionName, wsSwDhcpSvrPoolOptionValue
Description	Defines tyhe bDHCP server pool option.

9.10.6.2 wsSwDhcpSvrPoolOptionName

The object wsSwDhcpSvrPoolOptionName defines the OID for the pool option name. It is defined as:

Object Identifier (OID)	1.3.6.1.4.1.388.14.2.3.5.5.1.1
Parent Object	wsSwDhcpSvrPoolOptionEntry
Object Number	1

Type	Display String
Access	Read-Only
Status	Current
Description	Defines the OID for the pool option name

9.10.6.3 wsSwDhcpSvrPoolOptionValue

The object wsSwDhcpSvrPoolOptionValue defines the OID for the value for the pool option. It is defined as:

Object Identifier (OID)	1.3.6.1.4.1.388.14.2.3.5.5.1.2
Parent Object	wsSwDhcpSvrPoolOptionEntry
Object Number	2
Type	Display String
Access	Read-Only
Status	Current
Description	Defines the OID for the value of the pool option

9.10.6.4 wsSwDhcpSvrPoolOptionRowStatus

The object wsSwDhcpSvrPoolOptionRowStatus defines the OID for row status for the PoolOption entry. It is defined as:

Object Identifier (OID)	1.3.6.1.4.1.388.14.2.3.5.5.1.3
Parent Object	wsSwDhcpSvrPoolOptionEntry
Object Number	3
Type	Row Status
Access	Read-Create
Status	Current
Description	Status of the row for the wsSwDhcpSvrPoolOptionEntry object

9.10.7 wsSwDhcpBindingStatusTable

The wsSwDhcpBindingStatusTable is described as:

Object Identifier (OID)	1.3.6.1.4.1.388.14.2.3.5.6
Parent Object	wsSwDhcpServerModule
Object Number	6
Type	Conceptual Table made up of a sequence of WsSwDhcpBindingStatusEntry objects
Access	Not accessible
Status	Current

The wsSwDhcpBindingStatusTable is made up of a sequence of WsSwDhcpBindingStatusEntry objects. The WsSwDhcpBindingStatusEntry is a sequence of these objects:

- wsSwDhcpBindingStatusIp
- wsSwDhcpBindingStatusHardwareAddr
- wsSwDhcpBindingStatusClientID
- wsSwDhcpBindingStatusLeaseExpired
- wsSwDhcpBindingStatusLeaseType
- wsSwDhcpBindingStatusRowStatus

9.10.7.1 wsSwDhcpBindingStatusEntry

The object wsSwDhcpBindingStatusEntry defines the OID for the contents of the wsSwDhcpBindingStatusTable object. It is defined as:

Object Identifier (OID)	1.3.6.1.4.1.388.14.2.3.5.6.1
Parent Object	wsSwDhcpBindingStatusTable
Object Number	1
Type	WsSwDhcpBindingStatusEntry object definition
Access	Not accessible
Status	Current
Index	wsSwDhcpBindingStatusIp
Description	Defines the IP address for the client with the MAC Address listed in the MAC Address/ Client ID column.

9.10.7.2 wsSwDhcpBindingStatusIp

The object wsSwDhcpBindingStatusIp defines the OID for the IP address used for binding. It is defined as:

Object Identifier (OID)	1.3.6.1.4.1.388.14.2.3.5.6.1.1

Parent Object	wsSwDhcpBindingStatusEntry
Object Number	1
Type	IP Address
Access	Read-Only
Status	Current
Description	Defines the OID for the IP address used for binding

9.10.7.3 wsSwDhcpBindingStatusHardwareAddr

The object wsSwDhcpBindingStatusHardwareAddr defines the OID for the hardware address used while binding. It is defined as:

Object Identifier (OID)	1.3.6.1.4.1.388.14.2.3.5.6.1.2
Parent Object	wsSwDhcpBindingStatusEntry
Object Number	2
Type	Display String
Access	Read-Only
Status	Current
Description	Defines the OID for the hardware address used for binding

9.10.7.4 wsSwDhcpBindingStatusClientID

The object wsSwDhcpBindingStatusClientID defines the OID for the ID of the client for the binding table entry. It is defined as:

Object Identifier (OID)	1.3.6.1.4.1.388.14.2.3.5.6.1.3
Parent Object	wsSwDhcpBindingStatusEntry
Object Number	3
Type	Display String
Access	Read-Only
Status	Current
Description	Defines the the MAC address (client ID) of the client using the switch's DHCP Server to access switch resources. The MAC address is readonly and cannot be modified.

9.10.7.5 wsSwDhcpBindingStatusLeaseExpired

The object wsSwDhcpBindingStatusLeaseExpired defines the OID for the Lease Expired value for the Binding Table. It is defined as:

Object Identifier (OID)	1.3.6.1.4.1.388.14.2.3.5.6.1.4
Parent Object	wsSwDhcpBindingStatusEntry
Object Number	4
Type	Display String
Access	Read-Only
Status	Current

Description	Defines the OID for the Lease Expired status

9.10.7.6 wsSwDhcpBindingStatusLeaseType

The object wsSwDhcpBindingStatusLeaseType defines the lease type used with the DHCP server. It is defined as:

Object Identifier (OID)	1.3.6.1.4.1.388.14.2.3.5.6.1.5
Parent Object	wsSwDhcpBindingStatusEntry
Object Number	5

Type	Integer with the syntax
	{
	automatic(0),
	manual(1)
	}

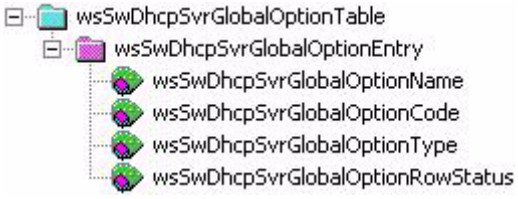
Access	Read-Only
Status	Current

9.10.7.7 wsSwDhcpBindingStatusRowStatus

The object wsSwDhcpBindingStatusRowStatus defines the OID for row status for the Binding Status entry. It is defined as:

Object Identifier (OID)	1.3.6.1.4.1.388.14.2.3.5.6.1.6
Parent Object	wsSwDhcpBindingStatusEntry
Object Number	6
Type	Row Status
Access	Read-Create
Status	Current
Description	Status of the row for the wsSwDhcpBindingStatusEntry object

9.10.8 wsSwDhcpSvrGlobalOptionTable



The wsSwDhcpSvrGlobalOptionTable is described as:

Object Identifier (OID)	1.3.6.1.4.1.388.14.2.3.5.7
Parent Object	wsSwDhcpServerModule
Object Number	7

Type	Conceptual Table made up of a sequence of WsSwDhcpSvrGlobalOptionEntry objects
Access	Not accessible
Status	Current

The wsSwDhcpSvrGlobalOptionTable is made up of a sequence of WsSwDhcpSvrGlobalOptionEntry objects. The WsSwDhcpSvrGlobalOptionEntry is a sequence of these objects:

- wsSwDhcpSvrGlobalOptionName
- wsSwDhcpSvrGlobalOptionCode
- wsSwDhcpSvrGlobalOptionType
- wsSwDhcpSvrGlobalOptionRowStatus

9.10.8.1 wsSwDhcpSvrGlobalOptionEntry

The object wsSwDhcpSvrGlobalOptionEntry defines the OID for the contents of the wsSwDhcpSvrGlobalOptionTable object. It is defined as:

Object Identifier (OID)	1.3.6.1.4.1.388.14.2.3.5.7.1
Parent Object	wsSwDhcpSvrGlobalOptionTable
Object Number	1
Type	WsSwDhcpSvrGlobalOptionEntry object definition
Access	Not accessible
Status	Current
Index	wsSwDhcpSvrGlobalOptionName, wsSwDhcpSvrGlobalOptionCode, wsSwDhcpSvrGlobalOptionType
Description	Defines the DHCP server global option.

9.10.8.2 wsSwDhcpSvrGlobalOptionName

The object wsSwDhcpSvrGlobalOptionName defines the OID for the DHCP server global option name. It is defined as:

Object Identifier (OID)	1.3.6.1.4.1.388.14.2.3.5.7.1.1
Parent Object	wsSwDhcpSvrGlobalOptionEntry
Object Number	1
Type	Display String
Access	Read-Only
Status	Current
Description	Defines the DHCP server global option name.

9.10.8.3 wsSwDhcpSvrGlobalOptionCode

The object wsSwDhcpSvrGlobalOptionCode defines the OID for the DHCP server global option code. It is defined as:

Object Identifier (OID)	1.3.6.1.4.1.388.14.2.3.5.7.1.2
Parent Object	wsSwDhcpSvrGlobalOptionEntry

Object Number	2
Type	Unsigned 32-Bit integer with values between 0 and 255 (both inclusive)
Access	Read-Create
Status	Current
Description	Defines the OID for the DHCP server global option code.

9.10.8.4 wsSwDhcpSvrGlobalOptionType

The object wsSwDhcpSvrGlobalOptionType defines the OID for the DHCP global option type. It is defined as:

Object Identifier (OID)	1.3.6.1.4.1.388.14.2.3.5.7.1.3
Parent Object	wsSwDhcpSvrGlobalOptionEntry
Object Number	3

Type	Integer with the syntax
	{
	ipAddress(0),
	text(1)
	}

Access	Read-Create
Status	Current
Description	Defines the DHCP server global options type.

9.10.8.5 wsSwDhcpSvrGlobalOptionRowStatus

The object wsSwDhcpSvrGlobalOptionRowStatus defines the OID for row status for the Global Option Table entry. It is defined as:

Object Identifier (OID)	1.3.6.1.4.1.388.14.2.3.5.7.1.4
Parent Object	wsSwDhcpSvrGlobalOptionEntry
Object Number	4
Type	Row Status
Access	Read-Create
Status	Current
Description	Status of the row for the wsSwDhcpSvrGlobalOptionEntry object.

9.10.9 wsSwDhcpRelayTable

The wsSwDhcpRelayTable is described as:

Object Identifier (OID)	1.3.6.1.4.1.388.14.2.3.5.8
Parent Object	wsSwDhcpServerModule
Object Number	8
Type	Conceptual Table made up of a sequence of WsSwDhcpRelayEntry objects
Access	Not accessible
Status	Current
Description	Defines the DHCP interfaces used with the DHCP server.

The wsSwDhcpRelayTable is made up of a sequence of WsSwDhcpRelayEntry objects. The WsSwDhcpRelayEntry is a sequence of these objects:

- wsSwDhcpRelayInteface
- wsSwDhcpRelayTarget
- wsSwDhcpRelayTargetSet
- wsSwDhcpRelayRowStatus

9.10.9.1 wsSwDhcpRelayEntry

The object wsSwDhcpRelayEntry defines the OID for the contents of the wsSwDhcpRelayTable object. It is defined as:

Object Identifier (OID)	1.3.6.1.4.1.388.14.2.3.5.8.1
Parent Object	wsSwDhcpRelayTable
Object Number	1
Type	WsSwDhcpRelayEntry object definition
Access	Not accessible
Status	Current
Index	wsSwDhcpRelayInterface
Description	Adds a relay entry to the Intrfaces table.

9.10.9.2 wsSwDhcpRelayInterface

The object wsSwDhcpRelayInterface defines the OID for DHCP relay interface. It is defined as:

Object Identifier (OID)	1.3.6.1.4.1.388.14.2.3.5.8.1.1

Parent Object	wsSwDhcpRelayEntry
Object Number	1
Type	Dispay String
Access	Read-Only
Status	Current
Description	Defines the OID for the DHCP relay interface

9.10.9.3 wsSwDhcpRelayTarget

The object wsSwDhcpRelayTarget defines the OID for DHCP relay targets. A maximum of 4 targets can be specified. It is defined as:

Object Identifier (OID)	1.3.6.1.4.1.388.14.2.3.5.8.1.2
Parent Object	wsSwDhcpRelayEntry
Object Number	2
Type	Dispay String
Access	Read-Only
Status	Current
Description	Defines the OID for the DHCP relay targets. Targets are declared in the format IP, interface; IP, interface A maximum of 4 targets can be specified.

9.10.9.4 wsSwDhcpRelayTargetSet

The object wsSwDhcpRelayTargetSet defines the OID for DHCP relay target in use. It is defined as:

Object Identifier (OID)	1.3.6.1.4.1.388.14.2.3.5.8.1.3
Parent Object	wsSwDhcpRelayEntry
Object Number	3
Type	Dispay String
Access	Read-Only
Status	Current
Description	Defines the OID for the DHCP relay target. The relay target set is declared in the format IP, interface where IP indicates the IP address to which the DHCP packets have to be relayed and interface indicates the interface name on which the response from the relayed DHCP server is recieved.

9.10.9.5 wsSwDhcpRelayRowStatus

The object wsSwDhcpRelayRowStatus defines the OID for row status for the DHCP Relay entry. It is defined as:

Object Identifier (OID)	1.3.6.1.4.1.388.14.2.3.5.8.1.4
Parent Object	wsSwDhcpRelayEntry
Object Number	4
Type	Row Status

Access	Read-Create
Status	Current
Description	Status of the row for the wsSwDhcpRelayEntry object.

10 Syslog

10.1 Overview

This chapter introduces the different software module messages used in the WS5100 Series Switch. Messages are used by the software to indicate that an issue has occurred on the device. They are classified based on the severity of the issue occurring on the device. The following topics are covered in this chapter:

10.1.1 Syslog Severity Levels

Messages are generated along with their severity levels. Severity levels enable you to decide to take action on the issue that caused the syslog message to be generated. WS5100 Series Switch modules generate syslog messages with severity as listed in *Table 10.1*.

Table 10.1 Syslog Severity Levels

Mnemonic	Severity Level	Description
LOG_EMERG	0	An emergency condition. The system is unusable
LOG_ALERT	1	This message warrants an immediate action
LOG_CRIT	2	Critical Condition
LOG_ERR	3	Error
LOG_WARNING	4	Warning
LOG_NOTICE	5	Normal but a significant condition
LOG_INFO	6	Information only
LOG_DEBUG	7	This message appears only during debug mode

10.1.2 Variables in Messages

Messages use variables to provide pertinent information about a specific issue. The following variables are used in message portion.

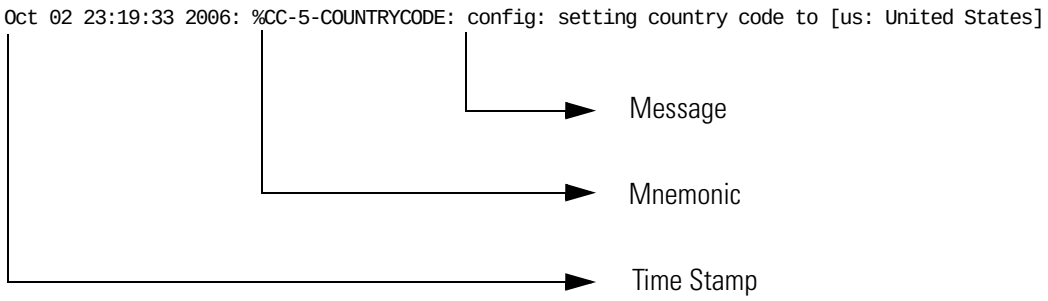
lists the different variables used in the messages.

Table 10.2 Variables used

Variable	Description
[str]	String
[ip]	IP address
[mac]	MAC address
[uint]	Unsigned integer
[INT]	Signed integer
[dec2]	Integer with 2 decimals

10.1.3 Message Prototype

Messages are generated with the following protoype.



As seen above, each message can be distinctly classified as:

- Message
- Mnemonic
- Time Stamp

The Message part provides human readable information about the issue that is being reported.

The Mnemonic identifies the following:

- Module - The name of the module where this issue occurs
- Severity - The severity level of the issue
- Mnemonic - The mnemonic for the issue and which is used by the error daemon

For more information on severity level refer *Syslog Severity Levels on page 10-2*.

The Time Stamp provides the exact time when the issue was logged.

10.2 Auto Install Messages

Auto Install feature provides facility to install or upgrade the current image for the device. This feature is used to keep the device updated with the latest releases of the software. The following are the messages that indicate issues that occur when Auto Install is being done.

All messages are classified based on the severity of the messages.

10.2.1 Severity 0 Messages

There are no severity 0 messages for Auto Install feature.

10.2.2 Severity 1 Messages

These messages are with severity 1 and action need to be taken on these messages immediately. *Table 10.3* lists the severity 1 messages for Auto Install feature.

Table 10.3 List of Severity 1 Messages for Auto Install feature

Mnemonic	Description
CFGINSTFAIL	Failed downloading configuration file - running with factory default configuration
INSTCSUM	Configuration file on server [ip] has wrong MD5 checksum - running with factory default configuration
IMGINSTFAIL	Auto-install of image [str] failed
IMGINSTSTALL	Auto Install feature of image [str] failed
INSTIFDOWN	Management interface [str] is down - can not start auto-install
INSTBADIP	Update server's IP address [ip] is invalid - can not start auto-install
INSTUNREACH	Update server is unreachable - can not start auto-install
INSTBADPATH	Image location on the update server is invalid - can not start auto-install

10.2.3 Severity 2 Messages

There are no severity 2 messages for Auto Install feature.

10.2.4 Severity 3 Messages

These messages are with severity 3 and indicate an error condition. *Table 10.4* lists the severity 3 messages for the Auto Install feature.

Table 10.4 List of Severity 3 Messages for Auto Install feature

Mnemonic	Description
saveconfig	Could not save UPD server configuration.

10.2.5 Severity 4 Messages

There are no severity 4 messages for Auto Install feature.

10.2.6 Severity 5 Messages

These messages are with severity 5 and indicate a normal but significant condition. *Table 10.5* lists the severity 5 messages for Auto Install feature.

Table 10.5 List of Severity 5 Messages for Auto Install feature

Mnemonic	Description
espdelcksum	Deleting startup configuration. Local configuration checksum =\"[str]\", does not match expected checksum = \"[str]\"
ESPDELCONFUPD	Deleting startup configuration. Initiating configuration update
ESPDELIMGUPD	Deleting startup configuration. Initiating image update
ESPDELCONFIG	Deleting startup configuration. Received empty configuration. Going to factory default
INSTLREQ	Local img ver = \"[str]\" does not match expected image version = \"[str]\". Auto-install required
ESPDLOADFAIL	Update server unreachable, IP address = [ip], configuration file download failed
ESPFILECKSUMMISM	Update server unreachable, IP address = [ip], upd-server has the wrong configuration file
ESPIMGUPDFAIL	Update server unreachable, IP address = [ip], image update failed
ESPIMGUPDSTALL	Update server unreachable, IP address = [ip], image update stalled
ESPSNMPSET	Update server unreachable, IP address = [ip], set by SNMP user
CFGEMPTY	Configuration received from chassis is empty
IMGINSTOK	Image [str] was installed successfully
CFGINSTOK	Configuration was installed successfully

10.2.7 Severity 6 Messages

There are no severity 6 messages.

10.2.8 Severity 7 Messages

There are no severity 7 messages.

10.3 Cell Controller

The *Cell Controller* (CC) module provides all wireless features for the switch. The following are the messages that indicate issues the status of connectivity between the APs and the switches. The CC also configures and controls the APs. It also provides facilities for the MUs to associate and authenticate themselves with the network.

All messages are classified based on the severity of the messages.

10.3.1 Severity 0 Messages

There are no severity 0 messages for Cell Controller.

10.3.2 Severity 1 Messages

There are no severity 1 messages for Cell Controller.

10.3.3 Severity 2 Messages

There are no severity 2 messages for Cell Controller.

10.3.4 Severity 3 Messages

There are no severity 3 messages for Cell Controller.

10.3.5 Severity 4 Messages

These messages are with severity 4 and are a warning that an issue has occurred. *Table 10.6* lists the severity 4 messages for Cell Controller.

Table 10.6 List of Severity 4 Messages for Cell Controller

Mnemonic	Description
STATIONCAPERR	Station [mac] denied association to radio [uint] : 802.11 capability field unsupported
STATIONSHORTPREAM	Station [mac] denied association to radio [uint] : Station does not support short preamble
STATIONSPECMISSING	Station [mac] denied association to radio [uint] : Station missing spectrum management capability
STATIONLENGTHERR	Station [mac] denied association to radio [uint] : Malformed request, element length exceeds packet size
STATIONSSIDERR	Station [mac] denied association to radio [uint] : [str]
STATIONWLANER	Station [mac] denied association to radio [uint] : WLAN not specified by station

Table 10.6 List of Severity 4 Messages for Cell Controller

Mnemonic	Description
STATIONTXRATES	Station [mac] denied association to radio [uint] : TX rates specified by MU are not supported
STATION11IMISSING	Station [mac] denied association to radio [uint] : Security (Keyguard/ WPA/WPA2) info element in association request was missing/ invalid
STATIONNOTINACL	Station [mac] denied association due to ACL/MAC-Auth-Local to radio [uint]
STATIONRADIOLIMIT	Station [mac] denied association to radio [uint] : maximum Stations per radio [uint] reached
TKIPCNTRMEASSTART	TKIP countermeasures started on wlan [uint]
TKIPCNTRMEASEND	TKIP countermeasures ended on wlan [uint]
STATIONDENIEDAUTH	Station [mac] denied authentication : unsupported authentication method
STATIONAUTHSEQINVAL	Station [mac] denied authentication : invalid auth sequence number
STATIONTOTALLIMIT	Station [mac] denied authentication : max supported stations limit reached
RADIORADARDETECT	[str] radio on AP [mac] found radar on channel [uint]
UNAPPROVEDAPDETECT	AP [uint] detected Unapproved AP : [mac]
UNAPPROVEDAPREMOVE	Removing Unapproved AP [mac] : Last detected detected by AP [uint] with signal strength [int] dBm
EXCESSPROBES	MU [mac] tx [uint] in detect-window, filtering for [int] seconds
EXCESSAUTHSASSOCS	MU [mac] tx [uint] in detect-window, filtering for [int] seconds
EXCESSDISASSOCS	MU [mac] tx [uint] in detect-window, filtering for [int] seconds
EXCESSAUTHFAILS	MU [mac] tx [uint] in detect-window, filtering for [int] seconds
EXCESS80211REPLAY	MU [mac] tx [uint] in detect-window, filtering for [int] seconds
EXCESSCRYPTOREPLAY	MU [mac] tx [uint] in detect-window, filtering for [int] seconds
EXCESSDECRYPTFAILS	MU [mac] tx [uint] in detect-window, filtering for [int] seconds
IDSNULLADDR	MU [mac]. Filtering for [int] seconds
IDSSAMEADDR	MU [mac]. Filtering for [int] seconds
IDSMCASTSRC	MU [mac]. Filtering for [int] seconds
IDSWEAKWEPIV	MU [mac]. Filtering for [int] seconds
IDSCNTRMEAS	MU [mac]. Filtering for [int] seconds
IDSEVENTRADIO	MU [mac]. Filtering for [int] seconds
SHEALRADIODOWN	MU [mac]. Filtering for [int] seconds
TKIPMICCHECKFAIL	TKIP message integrity check failed in frame on wlan [uint]
TKIPMICFAILRPT	Station [mac] reported a TKIP message integrity check fail on wlan [uint]

Table 10.6 List of Severity 4 Messages for Cell Controller

Mnemonic	Description
DISKFULL	Flash Disk Full, [str]
RADIUSPOLICYFAIL	Unable to apply Radius server specified parameters to Station [mac] on wlan [uint]
EXCESSUNASSOCTRAF	MU [mac] tx [uint] in detect-window, filtering for [int] seconds
EXCESSEAPSTART	MU [mac] tx [uint] in detect-window, filtering for [int] seconds
IDSINVALIDLENGTH	MU [mac]. Filtering for [int] seconds
IDSEVENTSWITCH	IDS event [str] detected on switch
MAXAPCAPACITY	Max APs capacity reached: [int]

10.3.6 Severity 5 Messages

These messages are with severity 5 and indicate a normal but significant condition. *Table 10.7* lists the severity 5 messages for Cell Controller.

Table 10.7 List of Severity 5 Messages for Cell Controller

Mnemonic	Description
COUNTRYCODE	config: setting country code to [str]
RADIOADOPTED	[str] radio on AP [mac] adopted
RADIOUNADOPTED	{str] radio on AP [mac] un-adopted
SHEALACTIONTAKEN	Radio [uint] took self healing action to cover for down neighbor
SHEALACTIONTAKEN	Radio [uint] has returned to normal operation
SHEALACSRERUN	Auto Channel Select was re-run for radio [uint] due to retry threshold being crossed

10.3.7 Severity 6 Messages

These messages are with severity 6 and are for information only. *Table 10.8* lists the severity 6 messages for Cell Controller.

Table 10.8 List of Severity 6 Messages for Cell Controller

Mnemonic	Description
STATIONASSOC	Station [mac] associated to radio [uint] wlan [uint]
STATIONUNASSOC	Station [mac] un-associated from radio [uint]
WLANKERBAUTH	WLAN [uint] authenticated with KDC [str], ticket valid for [uint] hr [uint] min [uint] sec
WLANKERBCFGCHG	WLAN [uint] de-authenticated, configuration changed
WLANKERBTKTEXP	WLAN [uint] de-authenticated, ticket could not be renewed

Table 10.8 List of Severity 6 Messages for Cell Controller

Mnemonic	Description
STATIONKERBAUTH	Station [mac] authenticated, ticket valid for [uint] hr [uint] min [uint] sec
STATIONKERBIDCHG	Station [mac] de-authenticated, station identity changed
STATIONKERBTKTEXP	Station [mac] de-authenticated, session ticket expired
DOT11IFAILURE	Station [mac] failed dot11i (tkip/ccmp) handshake on wlan [uint]
DOT11ISUCCESS	Station [mac] completed dot11i (tkip/ccmp) handshake on wlan [uint]
EAPAUTHFAILED	Station [mac] failed eap (802.1x) authentication on wlan [uint]
EAPAUTHSTATIMEOUT	Station [mac] eap (802.1x) authentication station timed-out on wlan [uint]
EAPAUTHSERVERTIMEOUT	Station [mac] eap (802.1x) authentication server timed-out on wlan [uint]
EAPAUTHSUCCESS	Station [mac] eap (802.1x) authentication success on wlan [uint]
MACAUTHFAILED	Station [mac] failed Radius MAC authentication on wlan [uint]
MACAUTHTIMEOUT	Station [mac] MAC authentication timedout on wlan [uint]
MACAUTHSUCCESS	Station [mac] MAC authentication success on wlan [uint]
WEBAUTHFAILED	Station [mac] failed web authentication on wlan [uint]
WEBAUTHDISC	Station [mac] has disconnected wlan [uint]
WEBAUTHSUCCESS	Station [mac] web authentication success on wlan [uint]
RADIODFSSTART	Radio [uint] starting a DFS scan on channel [uint] - [uint] MHz
RADIODFSEND	Radio [uint] has completed a DFS scan on channel [uint]
RADIOACSSTART	Radio [uint] starting auto channel selection scan
RADIOACSEND	Radio [uint] has completed an auto channel selection scan. Channel selected: [uint]
RADIUSRXCOAREQ	Received Radius Change-Of-Authorization Request from [ip]
RADIUSTXCOAACK	Sending Radius Change-Of-Authorization ACK to [ip]
RADIUSTXCOANACK	Sending Radius Change-Of-Authorization NACK to [ip]
RADIUSDISCREQ	Received Radius Disconnect Request from [ip]
RADIUSDISCACK	Sending Radius Disconnect ACK to [ip]
RADIUSDISCNACK	Sending Radius Disconnect NACK to [ip]
RADIUSVLANUPDATE	Assigning Radius Server specified vlan [uint] to station [mac] on wlan [uint]
DOT11IKEYROTN	Rotating dot11i (tkip/ccmp) keys on wlan [uint]
DFSMOVECHANNEL	Radio [uint] move to channel [uint] - [uint] MHz
DFSNOVALIDHANNEL	Radio [uint] unable to get a valid channel, configuration deferred

10.3.8 Severity 7 Messages

There are no severity 7 messages for Cell Controller.

10.4 Cell Controlller Statistics Module Messages

The Cell Controller Statistics module is a peer to the Cell Controller module and collects and maintains the RF statistics for the switch. The following messages that indicate user configured thresholds being exceeded.

All messages are classified based on the severity of the messages.

10.4.1 Severity 0 Messages

There are no severity 0 messages for Cell Controller Statistics module.

10.4.2 Severity 1 Messages

There are no severity 1 messages for Cell Controller Statistics module.

10.4.3 Severity 2 Messages

There are no severity 2 messages for Cell Controller Statistics module.

10.4.4 Severity 3 Messages

There are no severity 3 messages for Cell Controller Statistics module.

10.4.5 Severity 4 Messages

These messages are with severity 4 and are a warning that an issue has occurred. *Table 10.9* lists the severity 4 messages for Cell Controller Statistics module.

Table 10.9 List of Severity 4 Messages for Cell Controller Statistics module

Mnemonic	Description
STATSSTATION	Threshold reached, [str] is [str] [str] for MU# [mac]
STATSRADIO	Threshold reached, [str] is [str] [str] for radio# [str]
STATSMODULE	Threshold reached, [str] is [str] [str]
STATSWLAN	Threshold reached, [str] is [str] [str] for WLAN# [str]

10.4.6 Severity 5 Messages

There are no severity 5 messages for Cell Controller Statistics module.

10.4.7 Severity 6 Messages

There are no severity 6 messages for Cell Controller Statistics module.

10.4.8 Severity 7 Messages

There are no severity 7 messages for Cell Controller Statistics module.

10.5 Certificate Manager API Messages

The Certificate Manager manages the certificates used in the network. The Certificate Manager APIs provide functions to manage these certificates. These messages indicate the status of the certificates and the Certificate Manager.

All messages are classified based on the severity of the messages.

10.5.1 Severity 0 Messages

There are no severity 0 messages for Certificate Manager APIs.

10.5.2 Severity 1 Messages

There are no severity 1 messages for Certificate Manager APIs.

10.5.3 Severity 2 Messages

There are no severity 2 messages for Certificate Manager APIs.

10.5.4 Severity 3 Messages

There are no severity 3 messages for Certificate Manager APIs.

10.5.5 Severity 4 Messages

There are no severity 4 messages for Certificate Manager APIs.

10.5.6 Severity 5 Messages

These messages are with severity 5 and are a warning that an issue has occurred. *Table 10.10* lists the severity 5 messages for Certificate Manager APIs.

Table 10.10 List of Severity 5 Messages for Certificate Manager APIs

Mnemonic	Description
INVALIDCACERT	CA Certificate imported for the trustpoint [str] is invalid
INVALIDSERVCERT	Server Certificate imported for the trustpoint [str] is invalid
CERTEXPIRED	[str] Certificate of trustpoint [str] is expired
LOGINVALIDPRIVKEY	Rsakey imported is not valid

10.5.7 Severity 6 Messages

There are no severity 6 messages for Certificate Manager APIs.

10.5.8 Severity 7 Messages

There are no severity 7 messages for Certificate Manager APIs.

10.6 Certificate Manager Messages

The Certificate Manager manages the certificates used in the network. These messages indicate the status of the certificates and the Certificate Manager.

All messages are classified based on the severity of the messages.

10.6.1 Severity 0 Messages

There are no severity 0 messages for Certificate Manager module.

10.6.2 Severity 1 Messages

There are no severity 1 messages for Certificate Manager module.

10.6.3 Severity 2 Messages

There are no severity 2 messages for Certificate Manager module.

10.6.4 Severity 3 Messages

There are no severity 3 messages for Certificate Manager module.

10.6.5 Severity 4 Messages

These messages are with severity 4 and are a warning that an issue has occurred. *Table 10.11* lists the severity 4 messages for Certificate Manager module.

Table 10.11 List of Severity 4 Messages for Certificate Manager

Mnemonic	Description
KEYDECRYPTFAILE	Rsakey cannot be decrypted with the password provided

10.6.6 Severity 5 Messages

These messages are with severity 5 and indicate a normal but significant condition. *Table 10.12* lists the severity 5 messages for Certificate Manager module.

Table 10.12 List of Severity 5 Messages for Certificate Manager

Mnemonic	Description
INVALIDCACERT	CA Certificate imported for the trustpoint [str] is invalid
INVALIDSERVCERT	Server Certificate imported for the trustpoint [str] is invalid
INVALIDCERTCRL	Certificate Crl Imported for trustpoint [str] is invalid
CERTEXPIRED	[str] Certificate of trustpoint [str] is expired
INVALIDCERTKEY	Private key imported for trustpoint [str] is not valid
INVALIDRSAKEY	Rsakey imported with the name [str] is invalid
ERROR	[str]

10.6.7 Severity 6 Messages

These messages are with severity 6 and are for information only. *Table 10.13* lists the severity 6 messages for Certificate Manager module.

Table 10.13 List of Severity 6 Messages for Certificate Manager

Mnemonic	Description
CERTIMPORTED	[str] Certificate imported for the trustpoint [str]
CERTKEYIMPORTED	Private key imported for the trustpoint [str]
RSAKEYIMPORTED	Rsakey imported with the name [str]
DELETETRUSTPOINT	Trustpoint [str] is deleted
DELETERSAKEY	Rsakey [str] is deleted
CERTREQUESTGEN	Certificate request generated for the trustpoint [str]
CERTSELFSIGNEDGEN	Selfsigned certificate generated for the trustpoint [str]
RSAKEYGEN	Rsa key [str] generated

10.6.8 Severity 7 Messages

There are no severity 7 messages for Certificate Manager module.

10.7 DHCP Server Messages

The main purpose of DHCP Server is to assign IP addresses to hosts and provide a method by which clients can request IP addresses and other configuration information. These messages indicate the state of the DHCP Server.

All messages are classified based on the severity of the messages.

10.7.1 Severity 0 Messages

There are no severity 0 messages for DHCP Server.

10.7.2 Severity 1 Messages

There are no severity 1 messages for DHCP Server.

10.7.3 Severity 2 Messages

There are no severity 2 messages for DHCP Server.

10.7.4 Severity 3 Messages

There are no severity 3 messages for DHCP Server.

10.7.5 Severity 4 Messages

These messages are with severity 4 and are a warning that an issue has occurred. *Table 10.14* lists the severity 4 messages for DHCP Server.

Table 10.14 List of Severity 4 Messages for DHCP Server

Mnemonic	Description
DHCPRANGE	Include range is not configured for pool [str]

10.7.6 Severity 5 Messages

There are no severity 5 messages for DHCP Server.

10.7.7 Severity 6 Messages

There are no severity 6 messages for DHCP Server.

10.7.8 Severity 7 Messages

There are no severity 7 messages for DHCP Server.

10.8 Diagnostic Messages

The purpose of the Diagnostic subsystem is to regularly monitor parameters of the system software and hardware environment to provide early warning of impending failure. These messages indicate the status of the different hardware and software parameters being monitored.

All messages are classified based on the severity of the messages.

10.8.1 Severity 0 Messages

These messages are with severity 0 and are for emergency condition. It indicates the system has become unstable and action must be taken immediately. *Table 10.15* lists the severity 0 messages for Diagnostics.

Table 10.15 List of Severity 0 Messages for Diagnostics

Mnemonic	Description
OVERTEMP	Temp sensor [str] [dec2]C over maximum limit [dec2]C. Shutdown switch!

10.8.2 Severity 1 Messages

There are no severity 1 messages for Diagnostics.

10.8.3 Severity 2 Messages

There are no severity 2 messages for Diagnostics.

10.8.4 Severity 3 Messages

There are no severity 3 messages for Diagnostics.

10.8.5 Severity 4 Messages

These messages are with severity 4 and are a warning that an issue has occurred. *Table 10.16* lists the severity 4 messages for Diagnostics.

Table 10.16 List of Severity 4 Messages for Diagnostics

Mnemonic	Description
FANUNDERSPEED	Fan [str] under speed: [uint] RPM is under limit [uint] RPM
UNDERVOLTAGE	Voltage [dec2]V under low limit [dec2]V
OVERVOLTAGE	Voltage [dec2]V over high limit [dec2]V
HIGHTEMP	Temp sensor [str] [dec2]C over high limit [dec2]C
CPULOAD	[str] minute average load limit exceeded, value is [dec2]% limit is [dec2]% (top process [str] [dec2]%)
FREEFLASHINODES	[uint] Free INodes on [str] file system is less than limit [uint]
FREENVRAMINODES	[uint] Free INodes on [str] file system is less than limit [uint]
FREERAMINODES	[uint] Free INodes on [str] file system is less than limit [uint]
FDCOUNT 4	FD Usage [uint] is over limit [uint]

10.8.6 Severity 5 Messages

There are no severity 5 messages for Diagnostics.

10.8.7 Severity 6 Messages

These messages are with severity 6 and are for information only. *Table 10.17* lists the severity 6 messages for Diagnostics.

Table 10.17 List of Severity 6 Messages for Diagnostics

Mnemonic	Description
LOWTEMP	Temp sensor [str] [dec2]C under low limit [dec2]C
RAMUSAGE	[str], pid [uint], has exceeded ram usage limit [uint].[uint]%, now using [uint].[uint]%
BUFUSAGE	[uint] byte buffer usage greater than expected, [uint] used, warning level [uint]
HEADCACHEUSAGE	socket buffer head cache usage is greater than expected, usage [uint], warning level [uint]
IPDESTUSAGE	IP destination cache usage is greater than expected, usage [uint], warning level [uint]
FREERAM	Free RAM, [dec2]% is less than limit [dec2]%
FREEFLASHDISK	Free [str] file system space, [dec2]% is less than limit [dec2]%
FREENVRAMDISK	Free [str] file system space, [dec2]% is less than limit [dec2]%

Table 10.17 List of Severity 6 Messages for Diagnostics

Mnemonic	Description
FREERAMDISK	Free [str] file system space, [dec2]% is less than limit [dec2]%

10.8.8 Severity 7 Messages

There are no severity 7 messages for Diagnostics.

10.9 File Management Messages

The purpose of the File Management is to regularly monitor parameters of the file management environment to provide early warning of an impending failure.

All messages are classified based on the severity of the messages.

10.9.1 Severity 0 Messages

There are no severity 0 messages for File Management.

10.9.2 Severity 1 Messages

There are no severity 1 messages for File Management.

10.9.3 Severity 2 Messages

There are no severity 2 messages for File Management.

10.9.4 Severity 3 Messages

There are no severity 3 messages for File Management.

10.9.5 Severity 4 Messages

These messages are with severity 4 and are a warning that an issue has occurred. *Table 10.18* lists the severity 4 messages for File Management.

Table 10.18 List of Severity 4 Messages for File Management

Mnemonic	Description
KEYDELETED	Rsakey [str] associated with ssh is deleted so ssh is restarted with default rsa key
TRUSTPOINTDELETED	Trustpoint [str] associated with https is deleted so https is restarted with default trustpoint

10.9.6 Severity 5 Messages

There are no severity 5 messages for File Management.

10.9.7 Severity 6 Messages

There are no severity 6 messages for File Management.

10.9.8 Severity 7 Messages

There are no severity 7 messages for File Management.

10.10 Firmware Update Messages

This section provides information for messages that relate to *Firmware Update* (FWU). All messages are classified based on the severity of the messages.

10.10.1 Severity 0 Messages

There are no severity 0 messages for FWU.

10.10.2 Severity 1 Messages

There are no severity 1 messages for FWU.

10.10.3 Severity 2 Messages

There are no severity 2 messages for FWU.

10.10.4 Severity 3 Messages

These messages are with severity 3 and indicate an error condition. *Table 10.19* lists the severity 3 messages for FWU.

Table 10.19 List of Severity 3 Messages for FWU

Mnemonic	Description
FWUSYSERR	Firmware update unsuccessful, system cmd [str] failed
FWUBADCONFIG	Firmware update unsuccessful, unable to read configuration file
FWUSERVERUNDEF	Firmware update unsuccessful, update server undefined
FWUFILEUNDEF	Firmware update unsuccessful, update file undefined
FWUSERVERUNREACHABLE	Firmware update unsuccessful, server [str] unreachable

Table 10.19 List of Severity 3 Messages for FWU

Mnemonic	Description
FWUCOULDNTGETFILE	Firmware update unsuccessful, couldn't get file, [str]
FWUVERMISMATCH	Firmware update unsuccessful, version mismatch, expected [str], actual [str]
FWUPRODMISMATCH	Firmware update unsuccessful, product mismatch, expected [str], actual [str]
FWUCORRUPTEDFILE	Firmware update unsuccessful, corrupted firmware file
FWUSIGNMISMATCH	Firmware update unsuccessful, signature mismatch, [str]

10.10.5 Severity 4 Messages

There are no severity 4 messages for FWU.

10.10.6 Severity 5 Messages

There are no severity 5 messages for FWU.

10.10.7 Severity 6 Messages

These messages are with severity 6 and are for information only. *Table 10.20* lists the severity 6 messages for FWU.

Table 10.20 List of Severity 6 Messages for FWU

Mnemonic	Description
FWUDONE	Firmware update successful, new version is [str]
FWUABORTED	Firmware update aborted
FWUNONEED	Firmware update not required, running and update versions same [str]

10.10.8 Severity 7 Messages

There are no severity 7 messages for FWU.

10.11 IMI Messages

This section defines the IMI messgaes and events posted by the switch. All messages are classified based on the severity of the messages.

10.11.1 Severity 0 Messages

There are no severity 0 messages for IMI.

10.11.2 Severity 1 Messages

There are no severity 1 messages for IMI.

10.11.3 Severity 2 Messages

There are no severity 2 messages for IMI.

10.11.4 Severity 3 Messages

There are no severity 3 messages for IMI.

10.11.5 Severity 4 Messages

These messages are with severity 4 and are a warning that an issue has occurred. *Table 10.21* lists the severity 4 messages for IMI.

Table 10.21 List of Severity 4 Messages for IMI

Mnemonic	Description
BADCMD	Command Execution Failed, Invalid Command: <[str]>
AMBIGUOUSCMD	Command Execution Failed, Ambiguous Command: <[str]>
INCOMPLETECMD	Command Execution Failed, Incomplete Command: <[str]>

10.11.6 Severity 5 Messages

These messages are with severity 5 and indicate a normal but significant condition. *Table 10.22* lists the severity 5 messages for IMI.

Table 10.22 List of Severity 5 Messages for IMI

Mnemonic	Description
USERAUTHSUCCESS	User '[str]' logged in with role of '[str]' from auth source '[str]'
USERDELETE	User '[str]' deleted
AUTHNOTIFY	Radius server secret not configured or server not reachable. Hence trying next auth method

10.11.7 Severity 6 Messages

These messages are with severity 6 and are for information only. *Table 10.23* lists the severity 6 messages for IMI.

Table 10.23 List of Severity 6 Messages for IMI

Mnemonic	Description
USERUPDATE	User '[str]' updated with use roles of '[str]' and allowed access from '[str]'

10.11.8 Severity 7 Messages

There are no severity 7 messages for IMI.

10.12 IMI Shell Messages

This section defines the IMI shell messgaes and events posted by the switch. All messages are classified based on the severity of the messages..

10.12.1 Severity 0 Messages

There are no severity 0 messages for IMI Shell.

10.12.2 Severity 1 Messages

There are no severity 1 messages for IMI Shell.

10.12.3 Severity 2 Messages

There are no severity 2 messages for IMI Shell.

10.12.4 Severity 3 Messages

These messages are with severity 3 and indicate an error condition. *Table 10.24* lists the severity 3 messages for IMI Shell.

Table 10.24 List of Severity 3 Messages for IMI Shell

Mnemonic	Description
USERAUTHFAIL	User '[str]' can not be authenticated

10.12.5 Severity 4 Messages

There are no severity 4 messages for IMI Shell.

10.12.6 Severity 5 Messages

There are no severity 5 messages for IMI Shell.

10.12.7 Severity 6 Messages

These messages are with severity 6 and are for information only. *Table 10.25* lists the severity 6 messages for IMI Shell.

Table 10.25 List of Severity 6 Messages for IMI Shell

Mnemonic	Description
DIAGSHELL	Diag shell started with parameter [int] [str]

10.12.8 Severity 7 Messages

There are no severity 7 messages for IMI Shell.

10.13 License Manager Messages

The license manager provides a common point for the reading and serving of license information. Licenses may be provided by various current and future means, this module is responsible for reading license information from whatever source is appropriate and then serving the license information to the other subsystems and management systems in a common format. These messages are for the License Manager.

10.13.1 Severity 0 Messages

There are no severity 0 messages for License Manager.

10.13.2 Severity 1 Messages

There are no severity 1 messages for License Manager.

10.13.3 Severity 2 Messages

There are no severity 2 messages for License Manager.

10.13.4 Severity 3 Messages

There are no severity 3 messages for License Manager.

10.13.5 Severity 4 Messages

There are no severity 4 messages for License Manager.

10.13.6 Severity 5 Messages

There are no severity 5 messages for License Manager.

10.13.7 Severity 6 Messages

These messages are with severity 6 and are for information only. *Table 10.26* lists the severity 6 messages for License Manager.

Table 10.26 List of Severity 6 Messages for License Manager

Mnemonic	Description
NEWLICENSE	Licensed AP count changed to [uint]

10.13.8 Severity 7 Messages

There are no severity 7 messages for License Manager.

10.14 Mobility Messages

These massages are used to indicate the status of the Mobility (MOB) feature on the WIOS. All messages are classified based on the severity of the messages.

10.14.1 Severity 0 Messages

There are no severity 0 messages for MOB.

10.14.2 Severity 1 Messages

There are no severity 1 messages for MOB.

10.14.3 Severity 2 Messages

There are no severity 2 messages for MOB.

10.14.4 Severity 3 Messages

There are no severity 3 messages for MOB.

10.14.5 Severity 4 Messages

These messages are with severity 4 and are a warning that an issue has occurred. *Table 10.27* lists the severity 4 messages for MOB.

Table 10.27 List of Severity 4 Messages for MOB

Mnemonic	Description
PEERUP	Peer [ip] is UP
CCCONNDOWN	cc-server connection is DOWN
MUCONFLICT	Station [mac]: Conflict in Database state

10.14.6 Severity 5 Messages

These messages are with severity 5 and indicate a normal but significant condition. *Table 10.28* lists the severity 5 messages for MOB.

Table 10.28 List of Severity 5 Messages for MOB

Mnemonic	Description
PEERDOWN	Peer [ip] is DOWN

10.14.7 Severity 6 Messages

These messages are with severity 6 and are for information only. *Table 10.29* lists the severity 6 messages for MOB.

Table 10.29 List of Severity 6 Messages for MOB

Mnemonic	Description
OPERUP	Mobility is Operationally UP
OPERDOWN	Mobility is Operationally DOWN
CCCONNUP	cc-server connection is UP
MUADD	Station [mac]: Added to Mobility Database
MUDEL	Station [mac]: Deleted from Mobility Database
MUJOIN	Station [mac]: JOIN received from peer [ip]
MUL3ROAM	Station [mac]: L3-ROAM received from peer [ip]
MUREHOME	Station [mac]: REHOME received from peer [ip]
MULEAVE	Station [mac]: LEAVE received from peer [ip]

10.14.8 Severity 7 Messages

There are no severity 7 messages for MOB.

10.15 MONAUTOI Messages

All messages are classified based on the severity of the messages.

10.15.1 Severity 0 Messages

There are no severity 0 messages for MONAUTOI.

10.15.2 Severity 1 Messages

There are no severity 1 messages for MONAUTOI.

10.15.3 Severity 2 Messages

There are no severity 2 messages for MONAUTOI.

10.15.4 Severity 3 Messages

There are no severity 3 messages for MONAUTOI.

10.15.5 Severity 4 Messages

These messages are with severity 4 and are a warning that an issue has occurred. *Table 10.30* lists the severity 4 messages for MONAUTOI.

Table 10.30 List of Severity 4 Messages for MONAUTOI

Mnemonic	Description
AUTOUPCONFIG	Loaded new startup config
AUTONOUPCONFIG	Available config is same as last loaded
AUTOUPCLCONFIG	Loaded new cluster config

10.15.6 Severity 5 Messages

These messages are with severity 5 and indicate a normal but significant condition. *Table 10.31* lists the severity 5 messages for MONAUTOI.

Table 10.31 List of Severity 5 Messages for MONAUTOI

Mnemonic	Description
AUTOUPNOCLCONFIG	Available cluster config is same as last loaded
AUTOIMAGEUPODATE	Attempting to load requested image
AUTONOIMAGEUPODATE	Requested image matches running image

Table 10.31 List of Severity 5 Messages for MONAUTOI

Mnemonic	Description
AUTOCONFDISAB	Autoinstall of startup configuration is disabled
AUTOCLCONFDISAB	Autoinstall of cluster configuration is disabled
AUTOIMAGEDISAB	Autoinstall of image upgrade is disabled
AUTOINSTNODHCP	DHCP did not provide any configuration information

10.15.7 Severity 6 Messages

These messages are with severity 6 and are for information only. *Table 10.32* lists the severity 6 messages for MONAUTOI.

Table 10.32 List of Severity 6 Messages for MONAUTOI

Mnemonic	Description
AUTOINSTSTART	Autoinstall triggered
AUTOINSTTOOLATE	Too late for DHCP triggered autoinstall
AUTOINSTNOSIGWCCP	Could not signal WCCP daemon

10.15.8 Severity 7 Messages

These messages are with severity 7 and are for debug purposes only. *Table 10.33* lists the severity 7 messages for MONAUTOI

Table 10.33 List of Severity 6 Messages for MONAUTOI

Mnemonic	Description
AUTOINSTSIGWCCP	Changed cluster config - signalling WCCP daemon pid [int]
AUTOINSTNOCHANGE	Config update was enabled but there was no new config
AUTOINSTCLCFGNOREAD	Could not read the cluster config file [str]

10.16 Network Service Manager Messages

The *Network Services Manager* (NSM) provides the core services of Interface Management, Route Table Management, Kernel communication to propagate interface, DHCP, DNS, Arp Table Management, and route and VLAN assignment. These messages indicate the state of the NSM interface.

All messages are classified based on the severity of the messages.

10.16.1 Severity 0 Messages

There are no severity 0 messages for NSM.

10.16.2 Severity 1 Messages

There are no severity 1 messages for NSM.

10.16.3 Severity 2 Messages

There are no severity 2 messages for NSM.

10.16.4 Severity 3 Messages

There are no severity 3 messages for NSM.

10.16.5 Severity 4 Messages

These messages are with severity 4 and are a warning that an issue has occurred. *Table 10.34* lists the severity 4 messages for NSM.

Table 10.34 List of Severity 4 Messages for NSM

Mnemonic	Description
IFDOWN	Interface [str] is down

10.16.6 Severity 5 Messages

These messages are with severity 5 and indicate a normal but significant condition. *Table 10.35* lists the severity 5 messages for NSM.

Table 10.35 List of Severity 5 Messages for NSM

Mnemonic	Description
DHCPIPCHG	Interface [str] changed DHCP IP - old IP: [ip]/[uint], new IP: [ip]/[uint]
DHCPNODEFRT	Interface [str] lost its DHCP default route

10.16.7 Severity 6 Messages

These messages are with severity 6 and are for information only. *Table 10.36* lists the severity 6 messages for NSM.

Table 10.36 List of Severity 6 Messages for NSM

Mnemonic	Description
IFUP	Interface [str] is up
DHCPIP	Interface [str] acquired IP address [ip]/[uint] via DHCP
DHCPDEFRT	Default route with gateway [ip] learnt via DHCP

10.16.8 Severity 7 Messages

There are no severity 7 messages for NSM.

10.17 Panic Messages

Panic message is used to indicate that a switch restart was due to a kernel crash. All messages are classified based on the severity of the messages.

10.17.1 Severity 0 Messages

There are no severity 0 messages for Panic.

10.17.2 Severity 1 Messages

There are no severity 1 messages for Panic.

10.17.3 Severity 2 Messages

There are no severity 2 messages for Panic.

10.17.4 Severity 3 Messages

There are no severity 3 messages for Panic.

10.17.5 Severity 4 Messages

There are no severity 4 messages for Panic.

10.17.6 Severity 5 Messages

These messages are with severity 5 and indicate a normal but significant condition. *Table 10.37* lists the severity 5 messages for Panic.

Table 10.37 List of Severity 5 Messages for Panic

Mnemonic	Description
PANIC	Last reboot was caused by a panic

10.17.7 Severity 6 Messages

There are no severity 6 messages for Panic.

10.17.8 Severity 7 Messages

There are no severity 7messages for Panic.

10.18 Process Management Daemon

This chapter provides information on messages that are for the *Process Management Daemon* (PMD). The Process Management Daemon takes care of handling all process that are running on the device. Processes must be managed without causing major impact on the overall system behavior. The PMD takes care of starting, stopping, and restarting processes on the device. These messages indicate the different states of a process and issues relating to their states.

All messages are classified based on the severity of the messages.

10.18.1 Severity 0 Messages

These messages are with severity 0 and are for emergency condition. It indicates the system has become unstable and action must be taken immediately. *Table 10.38* lists the severity 0 messages for Process Management Daemon.

Table 10.38 List of Severity 0 Messages for Process Management Daemon

Mnemonic	Description
PROCSYSRSTRT	Process "[str]" reached its maximum number of allowed restarts. Rebooting the system

10.18.2 Severity 1 Messages

These messages are with severity 1 and action need to be taken on these messages immediately. *Table 10.39* lists the severity 1 messages for Process Management Daemon.

Table 10.39 List of Severity 1 Messages for Process Management Daemon

Mnemonic	Description
PROCMAXRSTRT	Process "[str]" reached its maximum number of allowed restarts

10.18.3 Severity 2 Messages

There are no severity 2 messages for Process Management Daemon.

10.18.4 Severity 3 Messages

These messages are with severity 3 and indicate an error condition. *Table 10.40* lists the severity 3 messages for Process Management Daemon.

Table 10.40 List of Severity 3 Messages for Process Management Daemon

Mnemonic	Description
PROCRSTRT	Process "[str]" is not responding. Restarting process

10.18.5 Severity 4 Messages

These messages are with severity 4 and are a warning that an issue has occurred. *Table 10.41* lists the severity 4 messages for Process Management Daemon.

Table 10.41 List of Severity 4 Messages for Process Management Daemon

Mnemonic	Description
PROCNORESP	Process "[str]" is not responding

10.18.6 Severity 5 Messages

These messages are with severity 5 and indicate a normal but significant condition. *Table 10.42* lists the severity 5 messages for Process Management Daemon.

Table 10.42 List of Severity 5 Messages for Process Management Daemon

Mnemonic	Description
PROCSTOP	Process "[str]" has been stopped
PROCID	Process "[str]" changed its PID from [int] to [int]
STARTUPCOMPLETE	System startup complete

10.18.7 Severity 6 Messages

These messages are with severity 6 and are for information only. *Table 10.43* lists the severity 6 messages for Process Management Daemon.

Table 10.43 List of Severity 6 Messages for Process Management Daemon

Mnemonic	Description
PROCSTART	Starting process "[str]"

10.18.8 Severity 7 Messages

There are no severity 7 messages for Process Management Daemon.

10.19 WCCPD (Redundancy) Message

This chapter provides information on messages that are for the *Wireless Cluster Control Protocol Daemon* (WCCPD) (Redundancy). The WCCP provides facility to minimize service interruption when a switch fails and when another switch takes its place to adopt the access ports of the failed switch. These messages are specific to the WCCP Daemon and provide information on the state of the failover mechanism.

All messages are classified based on the severity of the messages.

10.19.1 Severity 0 Messages

There are no severity 0 messages for WCCPD (Redundancy).

10.19.2 Severity 1 Messages

These messages are with severity 1 and action need to be taken on these messages immediately. *Table 10.44* lists the severity 1 messages for WCCPD (Redundancy).

Table 10.44 List of Severity 1 Messages for WCCPD (Redundancy)

Mnemonic	Description
PEERACTIVEINVLCONF	Peer [ip], with group ID [uint] in active mode has detected with invalid configuration
PEERSTAINVLCONF	Peer [ip], with group ID [uint] in standby mode has detected with invalid configuration
AUTHORIZATIONCHNGD	Redundancy group authorization level changed to [uint]

10.19.3 Severity 2 Messages

There are no severity 2 messages for WCCPD (Redundancy).

10.19.4 Severity 3 Messages

There are no severity 3 messages for WCCPD (Redundancy).

10.19.5 Severity 4 Messages

These messages are with severity 4 and are a warning that an issue has occurred. *Table 10.45* lists the severity 4 messages for WCCPD (Redundancy).

Table 10.45 List of Severity 4 Messages for WCCPD (Redundancy)

Mnemonic	Description
PEERACTIVEDOWN	Peer [ip], with group ID [uint] in active mode is down
PEERSTADOWN	Peer [ip], with group ID [uint] in standby mode is down

Table 10.45 List of Severity 4 Messages for WCCPD (Redundancy)

Mnemonic	Description
ADOPTEXCEED	Total APs adoption exceeded redundancy group authorization level in group [uint], adoption count: [uint], group authorization level: [uint]

10.19.6 Severity 5 Messages

These messages are with severity 5 and indicate a normal but significant condition. *Table 10.46*lists the severity 5 messages for WCCPD (Redundancy).

Table 10.46 List of Severity 5 Messages for WCCPD (Redundancy)

Mnemonic	Description
PEERACTIVEUP	Heartbeats getting exchanged with peer [ip], group ID [uint] in active ode
PEERSTAUP	Heartbeats getting exchanged with peer [ip], group ID [uint] in standby mode
PEERACTIVEOPER	Peer [ip], with group ID [uint] in active mode is fully operational
PEERSTAOPER	Peer [ip], with group ID [uint] in standby mode is fully operational
REDUNDANCYDISABLED	Redundancy protocol disabled
REDUNDANCYENABLED	Redundancy protocol enabled

10.19.7 Severity 6 Messages

These messages are with severity 6 and are for information only. *Table 10.47* lists the severity 6 messages for WCCPD (Redundancy).

Table 10.47 List of Severity 6 Messages for WCCPD (Redundancy)

Mnemonic	Description
STATEDISABLED	The wireless module has changed its redundancy state to disabled
STATESTARTUP	The wireless module has changed its redundancy state to startup
STATEDISCOVERY	The wireless module has started discovering other members in the redundancy group
STATEONLINE	The wireless module has started adopting radio ports actively

10.19.8 Severity 7 Messages

There are no severity 7 messages for WCCPD (Redundancy).

10.20 Test Module Messages

This chapter provides information on messages that are for the Test Module. All messages are classified based on the severity of the messages.

10.20.1 Severity 0 Messages

These messages are with severity 0 and are for emergency condition. It indicates the system has become unstable and action must be taken immediately. *Table 10.48* lists the severity 0 messages for Test Module.

Table 10.48 List of Severity 0 Messages for Test Module

Mnemonic	Description
TESTEMERG	Emergency test message

10.20.2 Severity 1 Messages

These messages are with severity 1 and action need to be taken on these messages immediately. *Table 10.49* lists the severity 1 messages for Test Module.

Table 10.49 List of Severity 1 Messages for Test Module

Mnemonic	Description
TESTALERT	Alert test message

10.20.3 Severity 2 Messages

These messages are with severity 2 and indicate a critical condition. *Table 10.50* lists the severity 2 messages for Test Module.

Table 10.50 List of Severity 2 Messages for Test Module

Mnemonic	Description
TESTCRIT	Critical test message

10.20.4 Severity 3 Messages

These messages are with severity 3 and indicate an error condition. *Table 10.51*lists the severity 3 messages for Test Module.

Table 10.51 List of Severity 3 Messages for Test Module

Mnemonic	Description
TESTERR	Error test message

10.20.5 Severity 4 Messages

These messages are with severity 4 and are a warning that an issue has occurred. *Table 10.52* lists the severity 4 messages for Test Module.

Table 10.52 List of Severity 4 Messages for Test Module

Mnemonic	Description
TESTWARN	Warning test message

10.20.6 Severity 5 Messages

These messages are with severity 5 and indicate a normal but significant condition. *Table 10.53* lists the severity 5 messages for Test Module.

Table 10.53 List of Severity 5 Messages for Test Module

Mnemonic	Description
TESTNOTICE	Notice test message

10.20.7 Severity 6 Messages

These messages are with severity 6 and are for information only. *Table 10.54* lists the severity 6 messages for Test Module.

Table 10.54 List of Severity 6 Messages for Test Module

Mnemonic	Description
TESTINFO	Informational test message

10.20.8 Severity 7 Messages

These messages are with severity 7 and are for debug purposes only. *Table 10.55* lists the severity 7 messages for Test Module

Table 10.55 List of Severity 6 Messages for Test Module

Mnemonic	Description
TESTDEBUG	Debug test message
TESTARGS	Integer: [int], Unsigned Integer: [uint], String: [str], Hex: [hex2] [hex4] [hex8], IP: [ip], MAC: [mac], Decimal: [dec2]

10.21 Update Server Messages

This chapter provides information on messages that are for the Update Server. All messages are classified based on the severity of the messages.

10.21.1 Severity 0 Messages

There are no severity 0 messages for Update Server

10.21.2 Severity 1 Messages

These messages are with severity 1 and action need to be taken on these messages immediately. *Table 10.56* lists the severity 1 messages for Update Server.

Table 10.56 List of Severity 1 Messages for Update Server

Mnemonic	Description
CFGINSTFAIL	Failed downloading configuration file - running with factory default configuration
INSTCSUM	Configuration file on server [ip] has a wrong MD5 checksum - running with factory default configuration
IMGINSTFAIL	Auto-install of image [str] failed
IMGINSTSTALL	Auto-install of image [str] stalled
INSTIFDOWN	Management interface [str] is down - can not start auto-install
INSTBADIP	Update server's IP address [ip] is invalid - can not start auto-install
INSTUNREACH	Update server is unreachable - can not start auto-install
INSTBADPATH	Image location on the update server is invalid - can not start auto-install

10.21.3 Severity 2 Messages

There are no severity 2 messages for Update Server.

10.21.4 Severity 3 Messages

These messages are with severity 3 and indicate an error condition. *Table 10.57*lists the severity 3 messages for Update Server.

Table 10.57 List of Severity 3 Messages for Update Server

Mnemonic	Description
SAVECONFIG	Could not save upd-server configuration on chassis. Communication failure between WLAN module and chassis

10.21.5 Severity 4 Messages

There are no several 4 messages for Update Server.

10.21.6 Severity 5 Messages

These messages are with severity 5 and indicate a normal but significant condition. *Table 10.58* lists the severity 5 messages for Update Server.

Table 10.58 List of Severity 5 Messages for Update Server

Mnemonic	Description
ESPDELCKSUM	Deleting startup configuration. Local configuration checksum =\"[str]\", does not match chassis checksum = \"[str]\"
ESPDELCONFUPD	Deleting startup configuration. Initiating configuration update
ESPDELIMGUPD	Deleting startup configuration. Initiating image update
ESPDELCONFIG	Deleting startup configuration. Received empty chassis configuration. Going to factory default
INSTLREQ	Local img ver = \"[str]\" does not match expected image version = \"[str]\". Auto-install required
ESPDLOADFAIL	Update server unreachable, IP address = [ip], configuration file download failed
ESPFILECKSUMMISM	Update server unreachable, IP address = [ip], upd-server has the wrong configuration file
ESPIMGUPDFAIL	Update server unreachable, IP address = [ip], image update failed
ESPIMGUPDSTALL	Update server unreachable, IP address = [ip], image update stalled
ESPSNMPSET	Update server unreachable, IP address = [ip], set by SNMP user
CFGEMPTY	Configuration received from chassis is empty
IMGINSTOK	Image [str] was installed successfully
CFGINSTOK	Configuration was installed successfully

10.21.7 Severity 6 Messages

There are no severity 6 messages for Update Server.

10.21.8 Severity 7 Messages

There are no several 7 messages for Update Server.

Appendix A

Customer Support

Symbol Technologies provides its customers with prompt and accurate customer support. Use the Symbol Support Center as the primary contact for any technical problem, question or support issue involving Symbol products.

If the Symbol Customer Support specialists cannot solve a problem, access to all technical disciplines within Symbol becomes available for further assistance and support. Symbol Customer Support responds to calls by email, telephone or fax within the time limits set forth in individual contractual agreements.

When contacting Symbol Customer Support, please provide the following information:

- serial number of unit
- model number or product name
- software type and version number.

North American Contacts

Inside North America:

Symbol Technologies, Inc.
One Symbol Plaza Holtsville, New York 11742-1300
Telephone: 1-631-738-2400/1-800-SCAN 234
Fax: 1-631-738-5990

Symbol Support Center (for warranty and service information):

telephone: 1-800-653-5350
fax: (631) 738-5410
Email: *support@symbol.com*

International Contacts

Outside North America:

Symbol Technologies
Symbol Place
Winnersh Triangle, Berkshire, RG41 5TP
United Kingdom
0800-328-2424 (Inside UK)
+44 118 945 7529 (Outside UK)

Web Support Sites

MySymbolCare

http://www.symbol.com/services/msc/msc.html

Symbol Services Homepage

http://symbol.com/services

Symbol WS5100 Manuals

http://www.symbol.com/legacy_manuals/wire/ws5100.html

Symbol Developer Program

http://devzone.symbol.com

Additional Information

Obtain additional information by contacting Symbol at:

1-800-722-6234, inside North America

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