Cambium Networks™

User Guide

cnMatrix Web GUI Configuration
Software Version 2.0.5

Table of Contents

1 Getting Started

1.1 Interfaces

1.1.1 WEB

WEB

This section describes the configuration of cnMatrix using the WEB interface.

The WEB can be used to configure, show the configuration, monitor statistics and troubleshoot the switch. You can access the WEB interface by typing the user name and password in the authentication window.

The following tabs are available in the WEB interface:

System Tab

The following options are available in the **System** tab:

System Information

General information about the switch is available in this tab, such as Hardware Version, Software Version and System Name. Here you can configure global information such as the System Name, System Time, as well as the System Time and Telnet Server Status.

Field	Description
Hardware Version	Displays the hardware version number of the system.
Firmware Version	Displays the firmware version number of the system.
CNS Software Version	Displays the Cambium networking switch version.
Hardware Part Number	Displays the hardware part number of the system.
Software Serial Number	Displays the software serial number of the system.
System Description	Displays the model name.
System Name	The name for identifying the device.
System Contact	The contact person details for this managed node.
System Location	The physical location of this node.
Device Up Time	Displays the time from which the device is up.
System Time	The current date and time
Login Authentication Mode	The login authentication mode.
Configuration Save Status	Displays the configuration save status.
Remote Save Status	Displays the remote save status.
Configuration Restore Status	Displays the configuration restoration status.
Telnet Status	The status of TELNET in the system.

System Resources

System Temperature, CPU and RAM and Flash Memory Usage are available in this tab.

Thresholds can be configured for these values, so that SYSLOG messages can be generated when they are reached.

The following fields are available in the **System Resources** window:

Field	Description
CurrentTemperature(celsius)	The current temperature of the switch in Celsius.

CPU Threshold(%)	The maximum CPU usage of the switch in percentage
Current CPUUsage(%)	Displays the current CPU usage of the switch in percentage.
RAM Threshold(%)	The maximum RAM usage of the switch in percentage.
Current RAMUsage(%)	Displays the current RAM usage of the switch in percentage.
Flash Treshold(%)	The maximum Flash usage of the switch in percentage
Current Flash Usage(%)	Displays the current Flash usage of Switch in percentage.

The following fields are available in the **Fan Details** window:

Field	Description
Fan No	Displays the Fan number in the Switch.
Fan Status	Displays the Fan status in the Switch.

The EX2028-P switch is the only model that has a fan included.

Save and Restore

The configuration files can be uploaded or downloaded to/from the switch's Flash memory. Files can also be erased form the Flash using this tab, including the startup config file, or even the entire contents of the Flash memory.

The following fields are available in the **Save Configuration** window:

Field	Description
Save Option	Specifies the save option to be used for the Switch.
Transfer Mode	Specifies the transfer mechanism to save the Switch configurations in the remotesystem.
Address Type	The IP Address type of the remote system in which the Switch configurationsare to be saved.
IP Address	The IP Address of the remote system in which the Switch configurations are tobe saved.
SFTP User Name	The user name required for saving the Switch configurations to the remotesystem in SFTP mode.
SFTP Password	The password required for saving the Switch configurations on to the remotesystem in SFTP mode.
File Name	The name of the file in which the Switch configurations are to be saved.

The following fields are available in the **Restore Configuration** window:

Field	Description
Restore Option	Specifies whether the Switch configurations have to be restored.

The following fields are available in the **Erase Configuration** window:

Field	Description
Erase Option	Specifies the erase or delete configuration or file.
File Name	The configuration file name to be erased.

Image Download

A software image upgrade can be performed via this tab. The switch will connect to a TFTP or SFTP server, will download the specified upgrade file and will program it on the box. A reboot is needed to run the new software.

Field	Description
Upgrade From	The type of server from which the image is to be down-loaded.
Address Type	The IP Address type of the machine from which the image is to be downloaded.
Server IP Address	The IP address of the machine from which the image is to be downloaded.
SFTP User Name	The user name required for downloading the image from SFTP server.
SFTP Password	The password required for downloading the image from SFTP server.
File Name	The name of the image to be downloaded from the remote system.

File Transfer

The custom files can be uploaded or downloaded to/from the switch's Flash memory.

The following fields are available in the **File Upload** window:

Field	Description
Transfer Protocol	The transfer mode for uploading file to the remote system.
Address Type	The transfer mode for uploading file to the remote system.
Server IP Address	IP Address Enter the IP address of the machine to which the file is to be uploaded.
SFTP User Name	The user name required for uploading file in SFTP mode.
Remote File Name	The filename or filename with path to which the local file need to be copied in the remote system.
Source File Name	The filename or filename with path from which the local file need to be copied in the remote.

The following fields are available in the **File Download** window:

Field	Description
Transfer Protocol	The transfer mode for downloading file from the remote system.
Address Type	The IP Address of machine to which the log file is to be downloaded.
Server IP Address	The IP address of the machine to which the file is to be downloaded.
SFTP User Name	The user name required for downloading file in SFTP mode.
SFTP Password	The password, required for downloading the file in SFTP mode
File Name	The name of the file to be downloaded from the remote system.

For more information, see Save/ Restore/Erase/ Download Configurations in WEB Interface.

SNTP

Simple Network Time Protocol can be configured using this tab. SNTP is disabled by default. Configuration options are available for:

- SNTP Scalars Configuration
- SNTP Unicast Table Configuration
- SNTP Broadcast Configuration
- SNTP Multicast Configuration
- SNTP Manycast Configuration

For more information, see SNTP Tab Fields.

SSH

Secure Shell can be enabled or disabled via this page. Supported ciphers and HMAC types can be configured. SSH server is enabled by default.

The following fields are available in the **SSH Global Settings** window:

Field	Description
SSH Status	The status of the SSH module
SSH Version Compatibility	The version of the SSH..
SSH Cipher List	The Cipher-List. The cipher list takes values as bit mask.
SSH HMAC List	The hash message authentication code.
Max Packet size	The maximum number of bytes allowed in an SSH transport connection.

SSL

The HTTP Secure Server can be enabled and configured. A SSL certificate can be uploaded, or one can be generated on request.

The following fields are available in the **SSL Global Settings** window:

Field	Description
HTTP Secure Server	The status of the HTTP secure server.
SSL Version	The protocols to configure the SSL version.
HTTP Secure Ciphersuite	The cipher suite from the list for providing the input.

The following fields are available in the **SSL Digital Certificate** window:

Field	Description
Generate CertificateSigning Request	Used to generate certificate based on the RSA key size and common name.
RSA Key Size	The desired Key size.
Common Name	The details of the user requesting for the Digital Certificate.

SNMP

The Simple Network Management Protocol can be configured. The protocol is enabled by default. Configuration options are available for:

- SNMP Community Settings
- SNMP GROUP Settings
- SNMP Group Access Settings
- SNMP Target Address Settings
- SNMP Target Parameter Settings
- SNMP Security Settings

- SNMP Trap Settings
- SNMP Filter Settings
- SNMP Basic Settings

For more information, see SNMP Tab Fields.

Attention: "private" and "public" community names must be changed from their defaults. Running SNMP with the default cmmunity names is a a major security issue.

Layer2 Management Tab

The following options are available in the **Layer 2 Management** tab:

Port Manager

The Port Interfaces can be administratively enabled or disabled. Port settings such as speed, duplex, auto-negotiation mode can be viewed and configured here.

The following fields are available in the **Port Basic Settings** window:

Field	Description
Select	The port for which the configuration needs to be done.
Port	Displays the port, which is a combination of interface type and interface ID.
Link Status	Displays the status of the link using graphics.
Administrative State	The desired state of the port.
Default User Priority	The default ingress user priority for the port.
Switch Port Mode	The mode of operation for the switch port.
MTU	The maximum transmission unit frame size MTU for the interface.
Link Up/Down Trap	Select whether the linkUp / linkDown trap should be generated for the interface.
Port Type	The port type to operate the port as an L2 port or as an L3 port.
MAC Address	The unicast MAC address of the interface.
Description *Starting with version 2.0.5*	Free flow text entry box to store port description.

The following fields are available in the **Port Control** window:

Field	Description
Select Port	The port for which the configuration needs to be done. Port Displays the port, which is a combination of interface type and interface ID.
Mode	The mode of negotiation for the port.
Duplex	The duplex mode that represents the flow of data through the port.
Speed	The speed of the interface.
FlowControl Admin Status	The default administrative PAUSE mode for the interface.
FlowControl Oper Status	Displays the PAUSE mode currently used in the interface.
HOL-Block Prevention	Select whether the Head-Of-Line (HOL) blocking should be prevented on a port.
Pause High Water Mark	The ingress rate equal to or above which PAUSE frames are

(kbps)	transmitted.
Pause Low Water Mark (kbps)	The ingress rate below which transmission of PAUSE frames are stopped.
Auto MDI/MDIX Capability	The Auto - MDIX mode for the interface.
Description *Starting with version 2.0.5*	Displays port description.

VLAN

The VLAN interfaces can be created and removed. Per-port VLAN settings such as PVIDm Ingress/Egress VLAN TPIDs can also be configured. You can decide on a per-port basis which frame type the port should accept: **All, Tagged or UnTagged**, depending on the role the port has in the network. VLAN Port configurations include:

- VLAN Basic Settings
- VLAN Port Settings
- Static VLAN Configuration
- VLAN Protocol Group Settings
- Port VLAN Protocol Settings
- FDB Flush

For more information, see VLAN Tab Fields.

Protocol VLANs are also supported in the Layer2 Management Tab.

MSTP, PVRST and RSTP

The respective spanning tree protocols can be configured. RSTP is enabled by default. To enable a different spanning tree protocol, configure “System Control” for the other two as “Shutdown”, and for the desired one as “Start”. MSTP, PVRST and RSTP configuration options include:

- Global Configuration
- Instance Bridge Configuration
- Instance Port Configurations
- Instance Port Status

For more information see MSTP Tab Fields, RSTP Tab Fields, PVRST Tab Fields.

Link Aggregation

The LACP protocol on the switch can be configured: you can create or destroy Aggregators and configure LACP-related settings on a per-port or per-LAG basis. Load balancing mode can also be configured here.

To configure an aggregator, first configure a “Port Channel ID” as UP, then assign ports to it in the “Port Channels Settings” page (gi0/1, gi0/2, etc.) and choose a mode (LACP or manual). In the port group page you can configure the per-port LACP settings such as Timeout and LACP mode (Active or Passive). Link Aggregation configuration options include:

- LA Basic Settings
- PortChannel Interface Basic Settings
- LA Port Channel Settings
- LA Port Settings
- LA Port StateMachine Information

For more information ,see Link Aggregation Tab Fields.

LLDP

Link-Layer Discovery protocol is globally enabled by default and set to transmit/receive frames on all ports. Various global timers can be configured. Transmitting and receiving LLDPDUs are configurable on a per-port basis. LLDP Configuration options include:

- LLDP Global Configuration
- Interface Settings
- Neighbor Information

For more information, see LLDP Tab Fields.

Layer3 Management Tab

The following options are available in the **Layer 3 Management** tab:

IP

IP interfaces can be configured on VLANs. The “Get IP Address Mode” can be configured either as “manual” or “DHCP” for each interface.

The following fields are available in the **VLAN Interface Basic Settings** window:

Field	Description
VLAN Interface	The VLAN/VFI Id for the Interface to be created. The value ranges from 1 to 65535.
Admin State	The Admin Status of the VLAN interface. The default option is Down.
IPv4 Enabled State	The status of IPv4 on the interface. The default option is UP.
Proxy ARP	The Proxy ARP admin status for the interface. The default option is Disabled.
MTU	The Maximum Transmission Unit (MTU). The MTU for the interface as shown to the higher interface sub-layer (this value should not include the encapsulation or header added by the interface).

LLDP additiona configuration options include:

- IPv4 Interface Settings
- IP Route Configuration
- IP Information
- ARP ENTRY

For more information, see IP Tab Fields.

IPv6

The IPv6 Interface can be configured using this option. Before configuring the IPv6 interface, first you have to create a VLAN IP interface in the VLAN Interface Basic Settings window.

The following fields are available in the **Address Settings** window:

Field	Description
Interface	The index, which uniquely identifies the IPv6 interface on which the IPv6 address entry exists from the list already configured in the system.
Address	The IPv6 address to which the entry’s addressing information pertains.
Prefix Length	The length of the prefix (in bits) associated with the entry’s IPv6 address.
Address Type	The type of address. The default option is Unicast.

Address Profile ID	The index for the IPv6 Address Profile Table.

DHCP Server

The switch can run a DHCP server application that will offer IP addresses to DHCP clients.

To offer this service to a network, first create an IP interface on a VLAN by using the **VLAN Interface Basic Settings** window, then create a DHCP pool on the same subnet as the configured VLAN IP interface.

The following fields are available in the **DHCP Basic Settings** window:

Field	Description
DHCP Server	The DHCP server status in the router. The default option is Disabled.
Blocked IP Address Reuse Timer (seconds)	The reuse timeout value used by DHCP in seconds.
ICMP Echo	The status of ICMP (Internet Control Message Protocol) Echo feature for the DHCP server.

Various DHCP options can be configured for each pool in the **DHCP Pool Option Settings** window or for any particular host in the **DHCP Host Option** window. A specific hosts identified by its MAC address can be associated to a specific IP address in a pool in the **DHCP Host IP Settings** window.

For more on these additional options, see DHCP Server Tab Fields.

DHCP Relay

DHCP Relay agent is used to forward the DHCP packets between client and server when they are not in the same subnets. The relay receives packets from the client and inserts certain information like the network in which the packet is removed and then forwards it to the server. The server identifies the client's network from this information and allocates IP accordingly, then sends the reply to the relay. The relay strips the information inserted and broadcasts the packets into the client's network.

The following fields are available in the **DHCP Relay Configuration** window:

Field	Description
DHCP Relay Service	The Service DHCP relay status in the switch. The default option is Disabled.
IP DHCP Relay Information Option	The controlling status of the processing related to the Relay Agent Information options.
DHCP Server Address	The IP address of the DHCP Server to which the Relay Agent needs to forward the packets from the client. A maximum of 5 servers can be configured.

For more on additional options, see DHCP Relay Tab Fields.

DHCP Client

DHCP client uses DHCP to temporarily receive a unique IP address for it from the DHCP server. It also receives other network configuration information such as default gateway, from the DHCP server.

The following fields are available in the **DHCP Option Type Settings** window:

Field	Description
Interface Name	Used to select an interface for which DHCP option type settings to be configured from the list of vlan interfaces already created in the system.
Option Type	The DHCP Client Option Type for the specified interface created in the system.
Option Code	Displays the Option code for the specified interface created in the system.

Option Value	Enter a value to identify the octets of data, of length specified by length for that entry. This value will be taken from DHCP ACK message which is sent from server to client.

The following fields are available in the **DHCP Client Identifier Settings** window:

Field	Description
Interface Name	Used to select an interface for which DHCP option type settings to be configured from the list of vlan interfaces already created in the system.
Client Identifier	The unique identifier of DHCP client for the specified interface created in the system

DHCPv6-Client

DHCPv6 client is a node that initiates requests on a link to obtain configuration parameters, such as the list of available DNS (Domain Name Server) servers, from DHCPv6 servers. It transmits and receives DHCP messages using link-local address or addresses determined through other mechanisms.

The following fields are available in the **DHCPv6 Client Basic Settings** window:

Field	Description
Trap Administrative Control	Specifies the transmission status of SNMP TRAP notification messages for the DHCPv6 client. The default option is None.
Source Port	The UDP (User Datagram Protocol) listen port number to be provided in UDP header of the information-request message. The default value is 546.
Destination Port	Specifies the UDP destination port number to be provided in UDP header of the information-request message. The default value is 547.

The following fields are available in the **DHCPv6 Client Interface Configuration** window:

Field	Description
Interface	Used to select the interface index of the entry in DHCPv6 Client Counter Interface table from the list which are already configured.

Multicast Tab

The following options are available in the **Multicast** tab:

IGMP Snooping

You can enable IGMP snooping globally, and then you can enable it on any existing VLAN. Per-VLAN settings include “Operating Version”, “Querier Status”, and various timers. Router Ports can also be configured in this tab including:

- IGMP Snooping Configuration
- IGMP Snooping Timer Configuration
- IGMP Snooping Vlan Configuration
- IGMP Snooping Interface Configuration
- IGMP Snooping Vlan Router Port Configuration
- IGMP Snooping VLAN Router Ports
- IP Based Multicast Forwarding Table

For more information, see IGMP Snooping Tab Fields.

TAC

Transmission and Admission Control module allows the network administrator to filter IGMP reports based on their group or source IP addresses. Filtered groups are not registered on the switch.

The following fields are available in the **TAC Profile Configuration** window:

Field	Description
Profile ID	The unique identifier for a multicast profile entry.

The following fields are available in the **TAC Profile Filter Configuration** window:

Field	Description
Profile ID	The unique identifier for each multicast profile entry.
Group Start Address	The multicast group address, which is the start of multicast group address range.
Group End Address	The multicast group address, which is the end of multicast group address range.
Source Start Address	The multicast source address, which is the start of multicast group address range.
Source End Address	The multicast source address, which is the end of multicast group address.

RMON Tab

The following options are available in the **RMON** tab:

RMON

You can configure various alarms that are triggered when certain SNMP object values reach a threshold.

The following fields are available in the **RMON Basic Settings** window:

Field	Description
RMON Status	The status of RMON on the switch.

Additional configuration options include:

- RMON Alarm Configuration.
- Ethernet Statistics Configuration.
- Event Configuration.
- History Control Configuration.

For more information, see RMON Tab Fields

WEB

Policy Based Automation Tab

The following options are available in the **Policy Based Automation** tab:

In the **Auto Attach Basic Settings** window, you can control global Auto-Attach settings, such as:

- Enabling/disabling the feature in the **Auto Attach Global Status** field.
- Setting the string comparison mode in the **String Comparison** field .

In the **Auto Attach Interface Settings** window, the current state of the Auto Attach feature on all system ports is displayed.

In the **Auto Attach Rule Settings** window, you can define new Auto Attach rules or delete rules that are not referenced by an Auto Attach policy.

In the **Auto Attach Action Settings** window, you can define Auto Attach Actions or delete existing actions.

In the **Auto Attach Policy Settings** window, you can define Auto Attach policies or delete existing policies that are not currently active.

In the **Auto Attach Script Settings** window, you can define Auto Attach scripts or delete existing scripts that are not currently active

The following fields are available in the **Auto Attach Basic Settings** window:

Field	Description
Auto Attach Global Status	The global status of the Auto Attach feature.
String Comparison	The string comparison method used fior device identification.

The following fields are displayed in the **Auto Attach Interface Settings** window:

Field	Description
Select	Select the port for which the Auto Attach parameters will be configured.
Port	Displays the port, which is a combination of interface type and interface ID.
Administrative State	Enables/Disables the administrative state of the port.
Message Authentication Status	Controls the current Auto Attach message authentication status for the associated interface.
Policies Applied	Displays the number of times a policy has been applied to the port.
Policies Expired	Displays the number of times a policy has expired on the port.
Policy Errors	Displays the number of times an error has been detected during application/expiration on the port.
Active Policy	The name of the policy specification that is currently applied to the port.
Description *Starting with version 2.0.5*	Displays port description.

The following fields are displayed in the **Auto Attach Rule Settings** window:

Field	Description
Rule Name	The name for the rule specification.
Rule Type	The Auto Attach rule type to determine how a device is identified using data associated with the device.
Device Data	The Auto Attach device data to specify the data that is used to identify a device.

The following fields are displayed in the **Auto Attach Action Settings** window:

Field	Description
Action Name	The name for the action specification.
VLAN Data	VLAN IDs to be associated with an interface.

Native VLAN	The native VLAN ID for an interface.
Switch Port Mode	The port mode for an interface.

The following fields are displayed in the **Auto Attach Policy Settings** window:

Field	Description
Policy Name	The name for the policy specification.
Status	Select the status of the policy to be applied.
Precedence	Enter the precedence value. Note: A policy with a lower precendence value is applied before a policy with a higher value.
Rule Name	The name of the rule specification that is referenced by the policy.
Rule Type	Select he rule type to determine how a device is associated with the device (e.g. using exported LLDP TLV data).
Rule Device Data	Specifies the data used to identify a device (depends on the associated rule type).
Action Name	The name of the action specification that is referenced by the policy.
Action VLAN Data	Specifies the VLAN IDs (maximum 20) to be associated with an interface.
Action Native VLAN	The native VLAN ID for an interface.
Action Switch Port Mode	The switch port mode for an interface.

The following fields are displayed in the **Auto Attach Script Settings** window:

Field	Description
Cambium Device Name	The Cambium product name used by Auto Attach feature to set up automatic device detection rules. Note: Only **cnPilot** Cambium product is currently supported.
VLAN Data	VLAN IDs to be associated with an interface.
Native VLAN	The native VLAN ID for an interface.

Clock Tab

The following options are available in the **Clock** tab:

Clock Interactions

This option enables you to set the time source of the system clock and maintains the information about the clock quality such as clock accuracy, class, and variance.

The following fields are available in the **Clock Interaction Settings** window:

Field	Description
Clock Variance	The variance of the primary clock. This object reflects the value provisioned by the external source (NTP/SNTP/GPS) that synchronizes the system clock.
Clock Class	The class of the primary clock. This object reflects the value provisioned by the external source (NTP/SNTP/GPS) that synchronizes the system clock.
Clock Accuracy	The accuracy of the primary clock. Clock accuracy is the mean of the time or frequency error between the clock under test and a perfect reference clock, over an ensemble of

	measurements.
Clock Time Source	The time source of the primary clock. The system clock is synchronized only through the specified source. The default option is PTP.
Clock UTC Offset	The current UTC (Coordinated Universal Time) offset in scaled nanoseconds with respect to the system time.
Hold Over Mode	The option to specify whether the system clock is in Hold Over Mode.

Statistics Tab

The statistics for various applications are displayed.

1.1.2 cnMaestro

cnMaestro is a cloud-based or on-premises platform specialized for secure, end-to-end network lifecycle management: inventory management, device onboarding, daily operations, and maintenance and is recommended for managing **cnMatrix** switches based networks.

The **cnMaestro** network manager simplifies device management by offering full network visbility. Network operators can have a real-time view of their complete end-to-end network and perform a full suite of network management functions to optimize system availability, maximize throughput and meet emerging needs of business and residential customers.

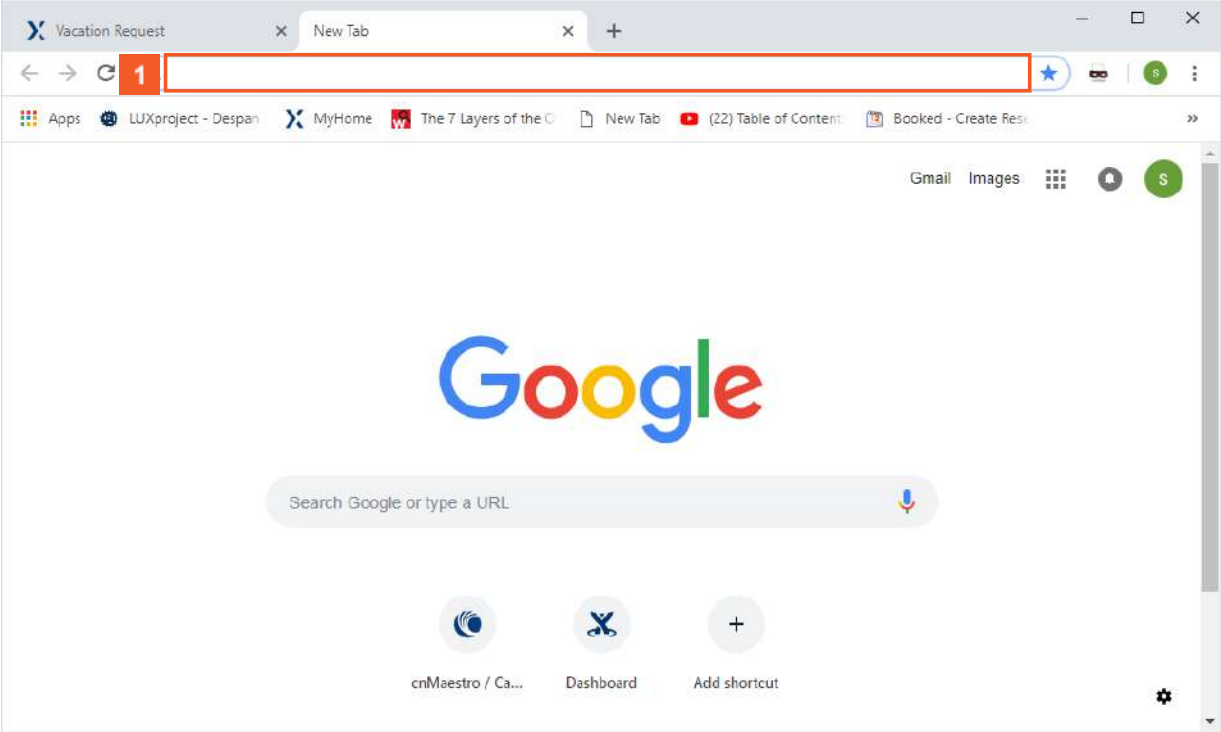
Starting with 2.0.3, cnMaestro Cloud supports cnMatrix devices with minimum 2.0.3-r4 build. You should manually upgrade your cnMatrix switch to version 2.0.3–r4.

For more information about cnMaestro, please visit cnMaestro Online Help.

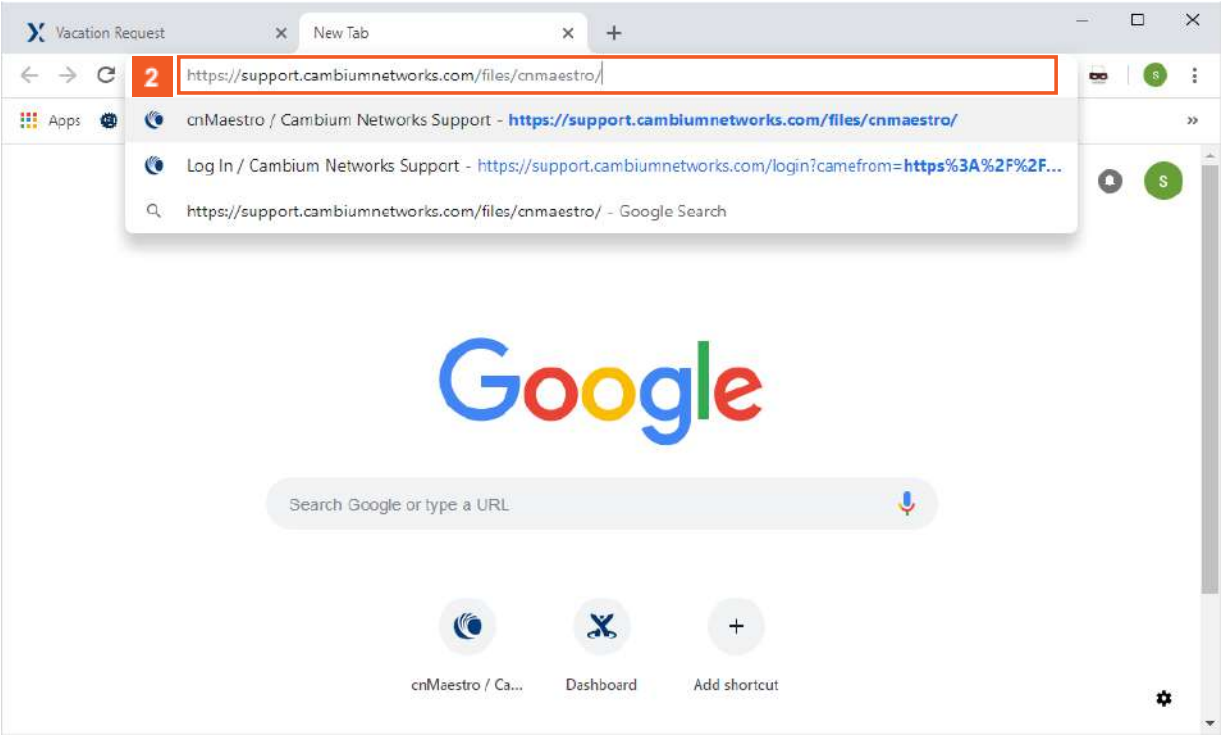
The cnMatrix switches with 2.0.1 version will be automatically upgraded during the onboarding process.

1.2 Configuring Web and cnMaestro

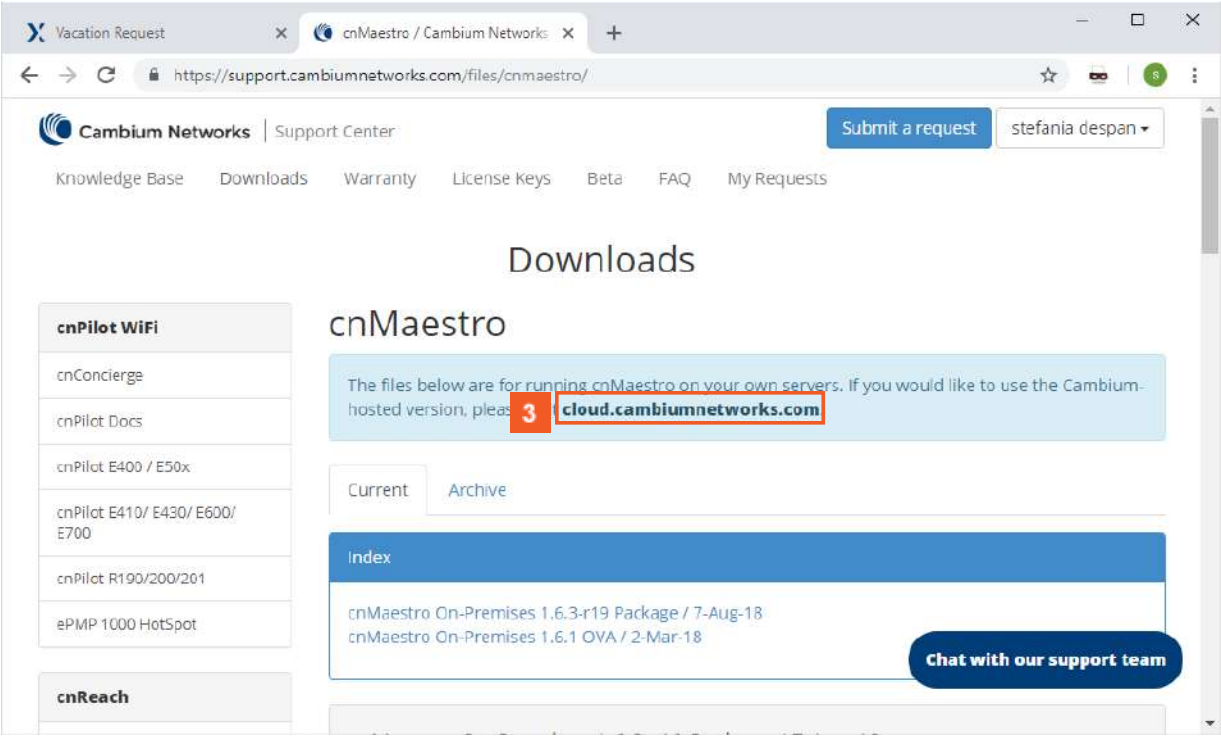
1.2.1 Accessing cnMaestro WEB



1 Enter **https://support.cambiumnetworks.com/files/cnmaestro/** into the **Address and search bar** field.



2 Press the Enter key.



3 Click the **cloud.cambiumnetworks.com** hyperlink.

For more information, see [How to Create a Cloud Account](#).

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1.3 How to Change the Password in WEB Interface

2 L2 Features

2.1 VLAN

2.1.1 VLAN in WEB interface

2.1.1.1 Managing VLAN

1.1.1.1.1 Feature Description

Feature Overview

The **VLAN** feature represents a group of devices on one or more LANs that are configured to communicate with each other as a whole, even if they are located on different LAN segments. The VLAN feature segments a broadcast domain in multiple broadcast domains and allows network administrators to group hosts together even if those hosts are not connected to the same switch.

Standards

- IEEE 802.1Q – defines a system of VLAN tagging for Ethernet frames.
- 802.1Q is the IEEE standard for tagging frames and supports up to 4096 VLANs. In 802.1Q, the trunking device inserts a 4-byte tag into the original frame and recomputes the frame check sequence (FCS) before the device sends the frame over the trunk link. At the receiving end, the tag is removed and the frame is forwarded to the assigned VLAN.

Scaling Numbers

- A maximum of 4066 series can be created.

Limitations

- A maximum of 32 VLANs can be configured in PVRST mode.

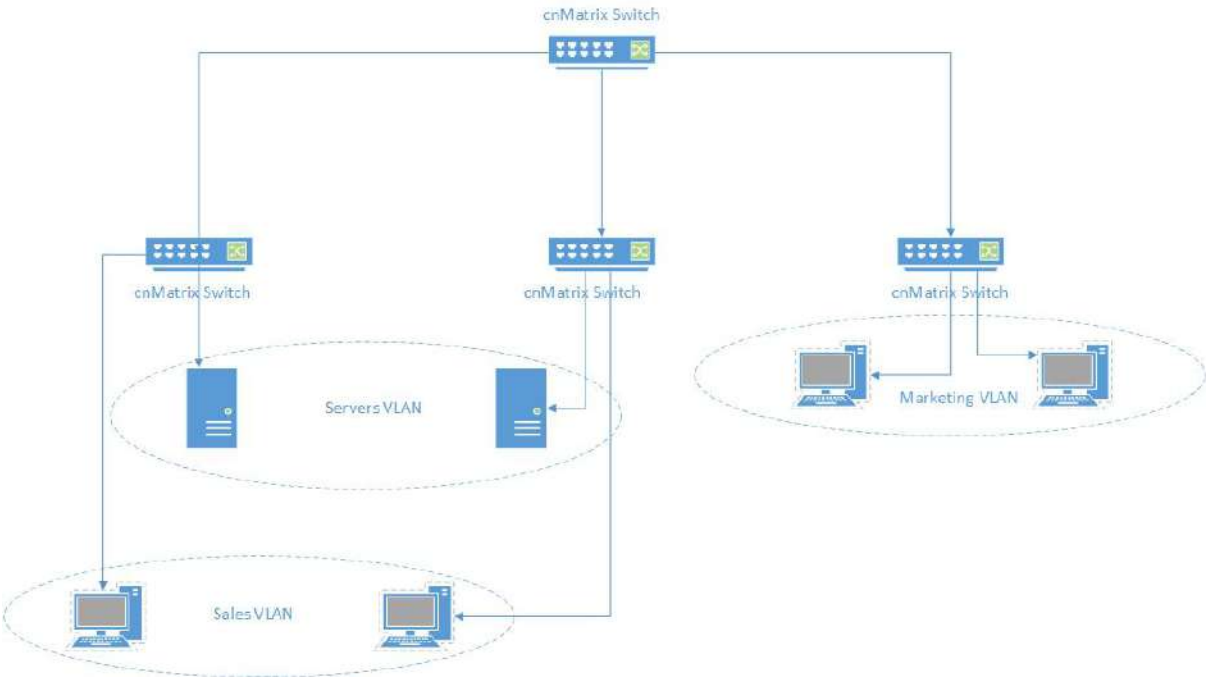
Default Values

- VLAN switching feature is started and enabled in the switch.
- VLAN 1 is created by default.
- All ports available in the switch are configured as member ports and untagged ports of the default VLAN (VLAN 1) and the default operation mode for all ports is hybrid.

The static MAC address of a specific VLAN will be removed after deleting the VLAN.

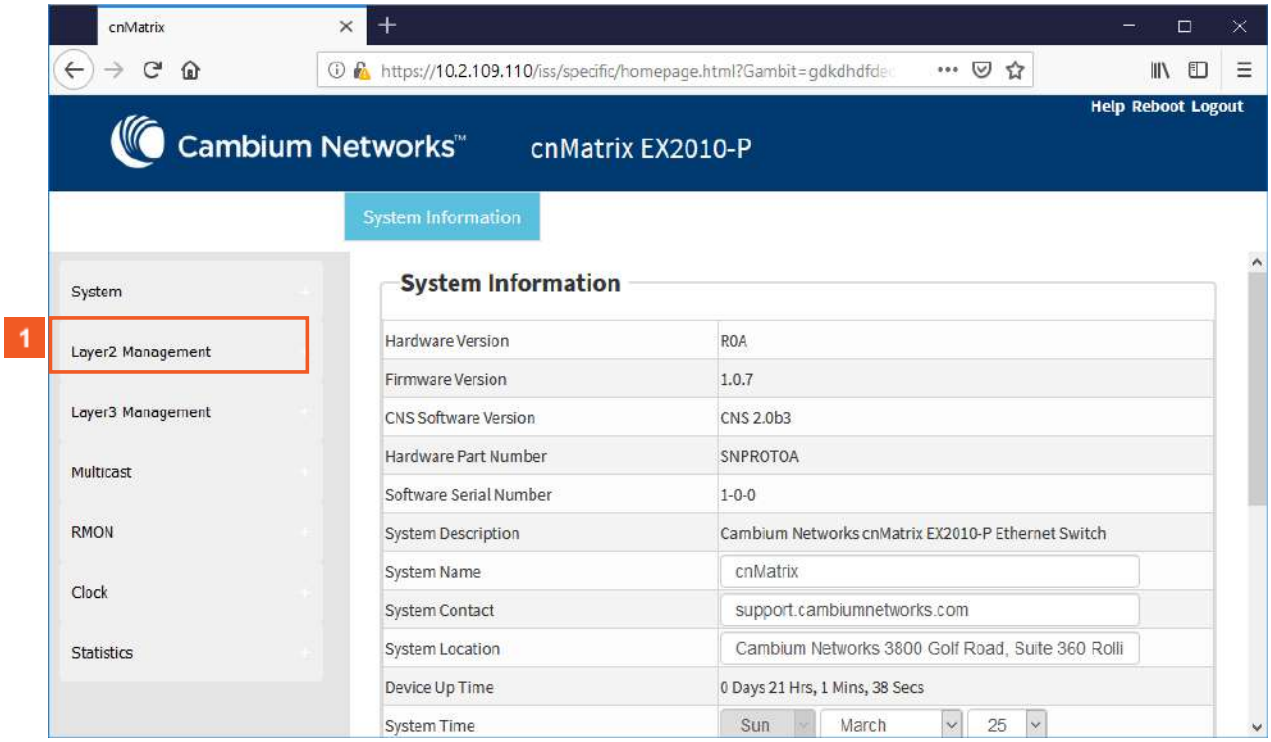
The static ARP will be removed after deleting the VLAN interface.

VLAN 1 cannot be deleted using the no form of the command: no vlan <vlan-id>.

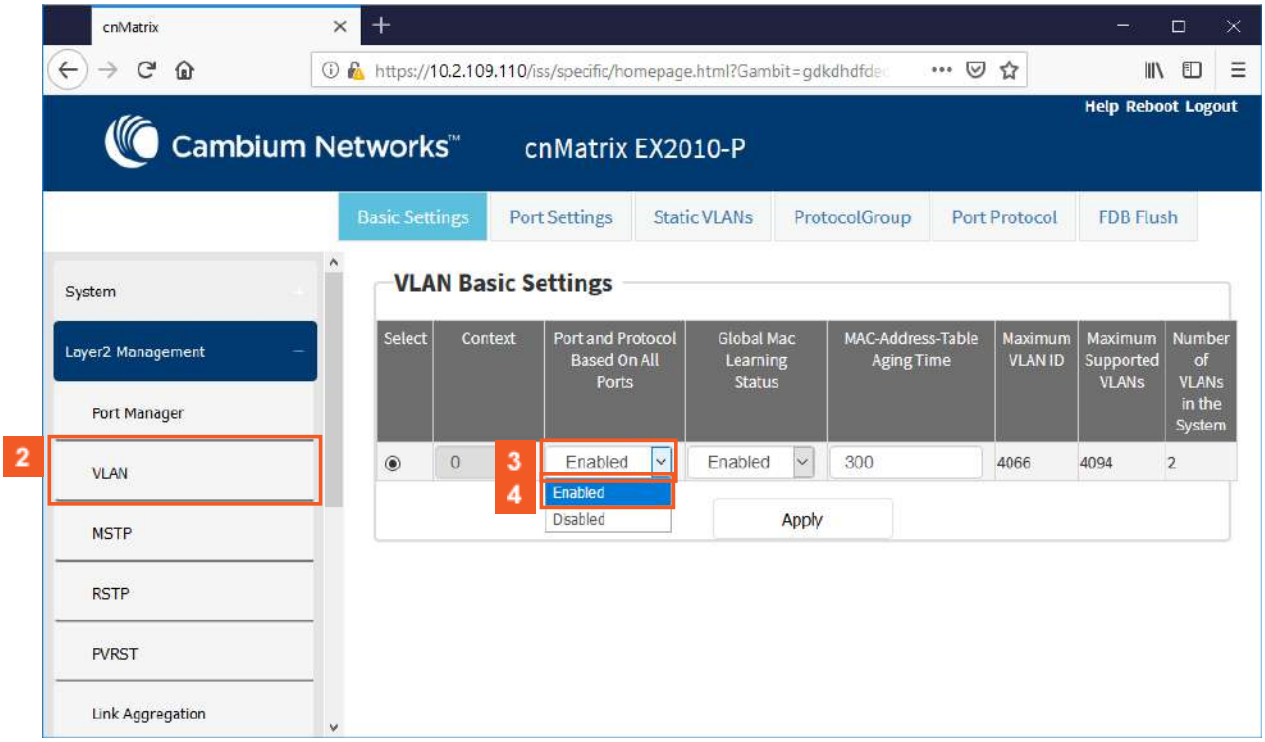


1.1.1.1.2 Network Diagram

2.1.1.2 Configuring VLAN Web



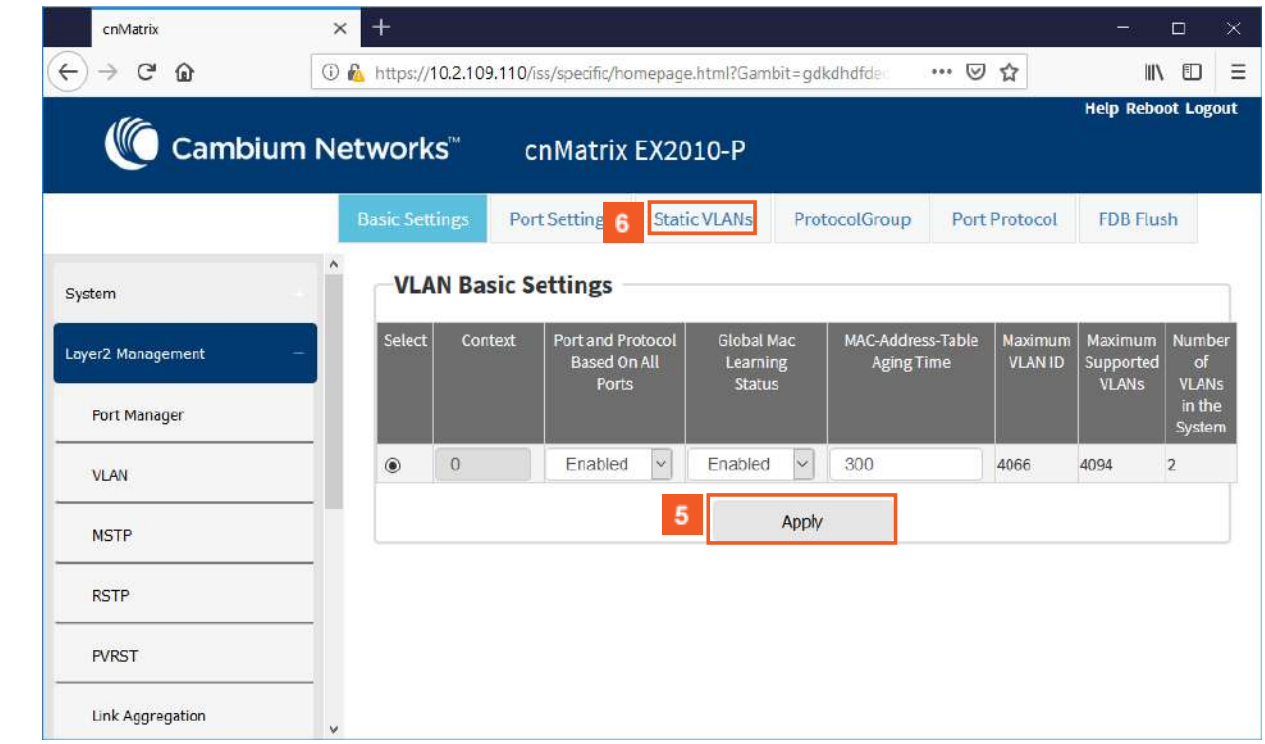
1 Click the **Layer2 Management** menu item. The **L2 Features** are displayed.



2 Click the **VLAN** menu item.

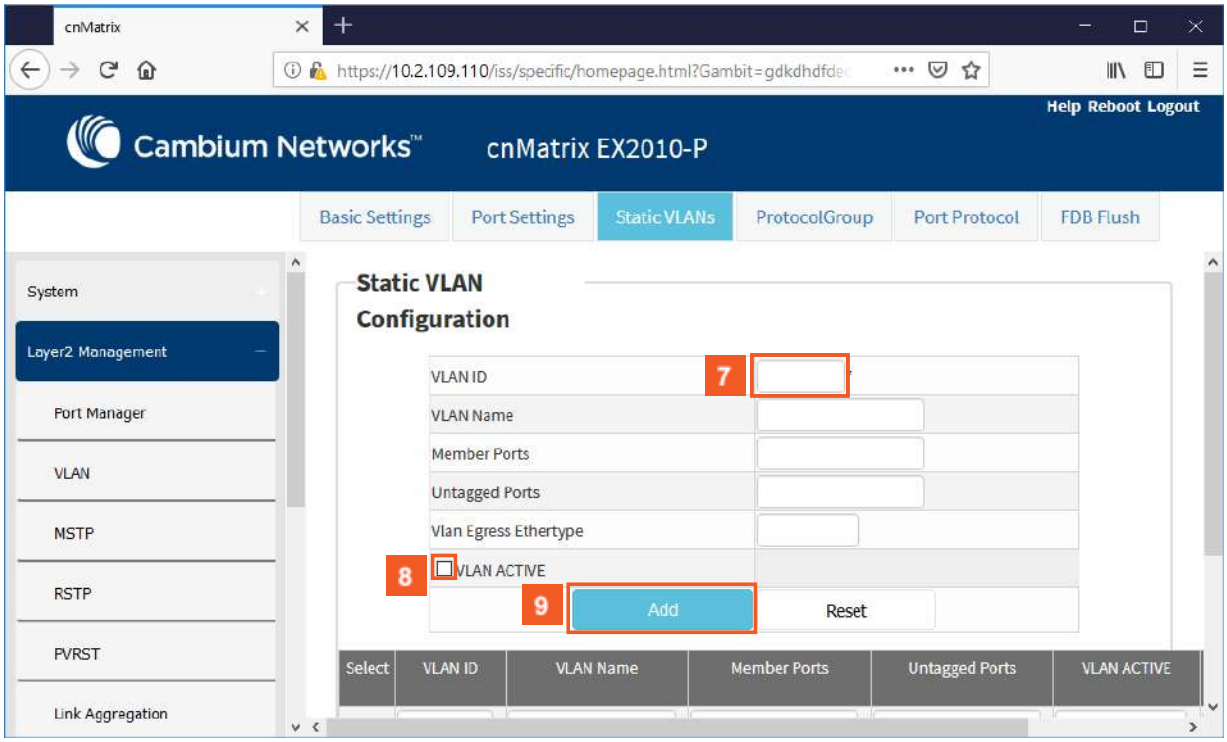
3 Click the **Enabled** combobox. Select whether the classification of VLAN membership should be done based on port and protocol on the selected port.

4 Click the **Enabled** list item.



5 Click the **Apply** button.

6 Click the **Static VLANs** tab.



7 Enter **3** into the **VLAN ID** field.

> Number **3** represents the VLAN ID that uniquely identifies a specific VLAN. The maximum value for VLAN ID is: 4066.

8 Click the **VLAN ACTIVE** checkbox. The configured VLAN becomes active on your switch.

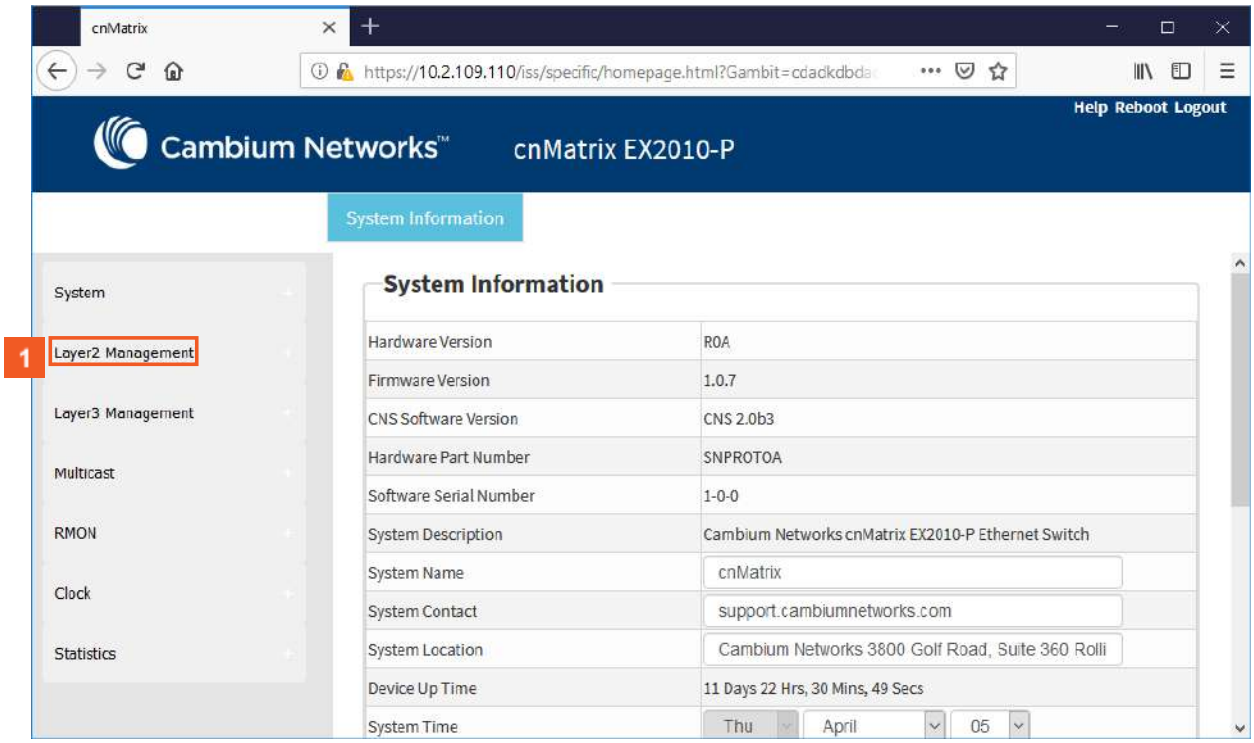
9 Click the **Add** button.

2.2 STP

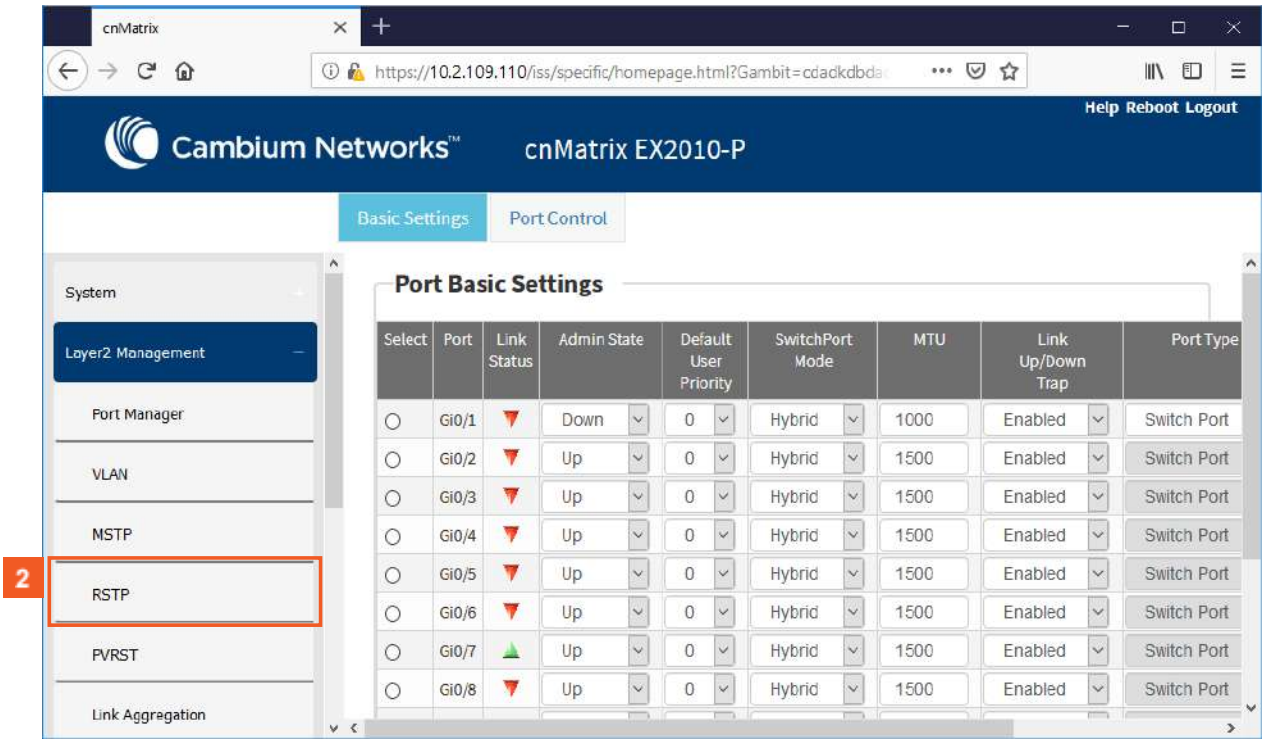
2.2.1 STP in WEB interface

2.2.1.1 Managing RSTP

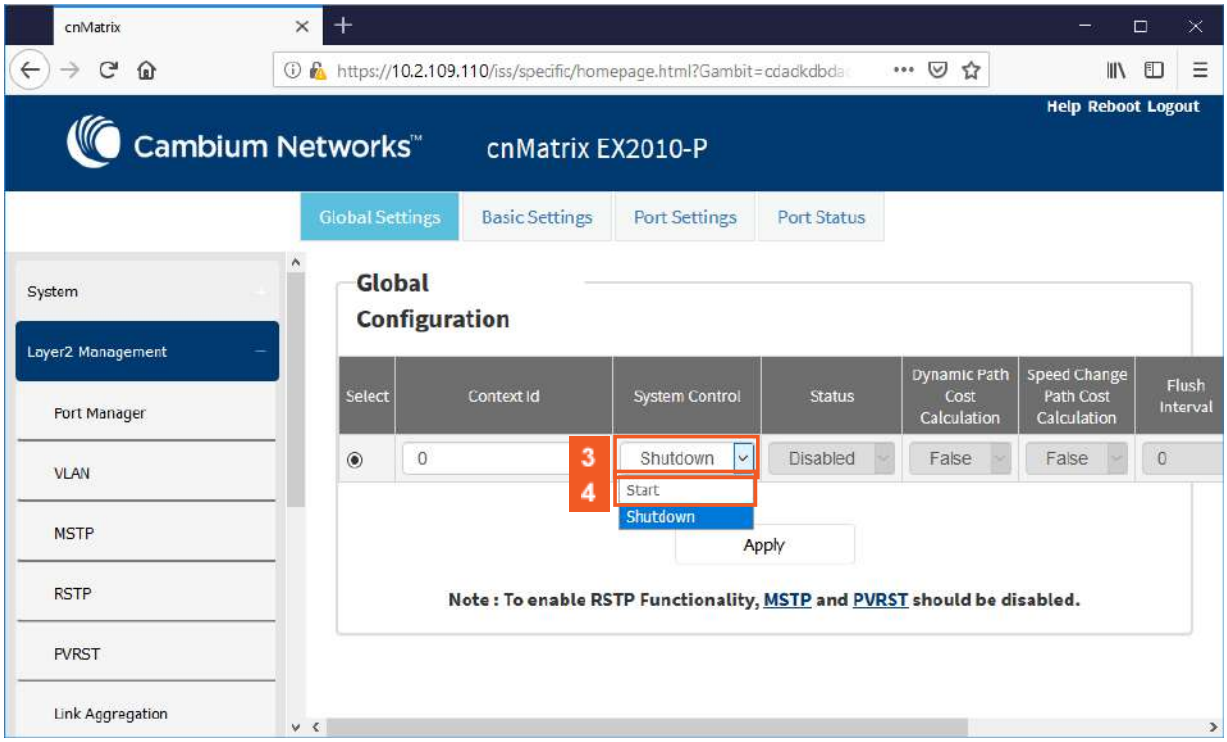
2.2.1.2 Configuring RSTP



1 Click the **Layer2 Management** menu item. The **L2 Features** are displayed.

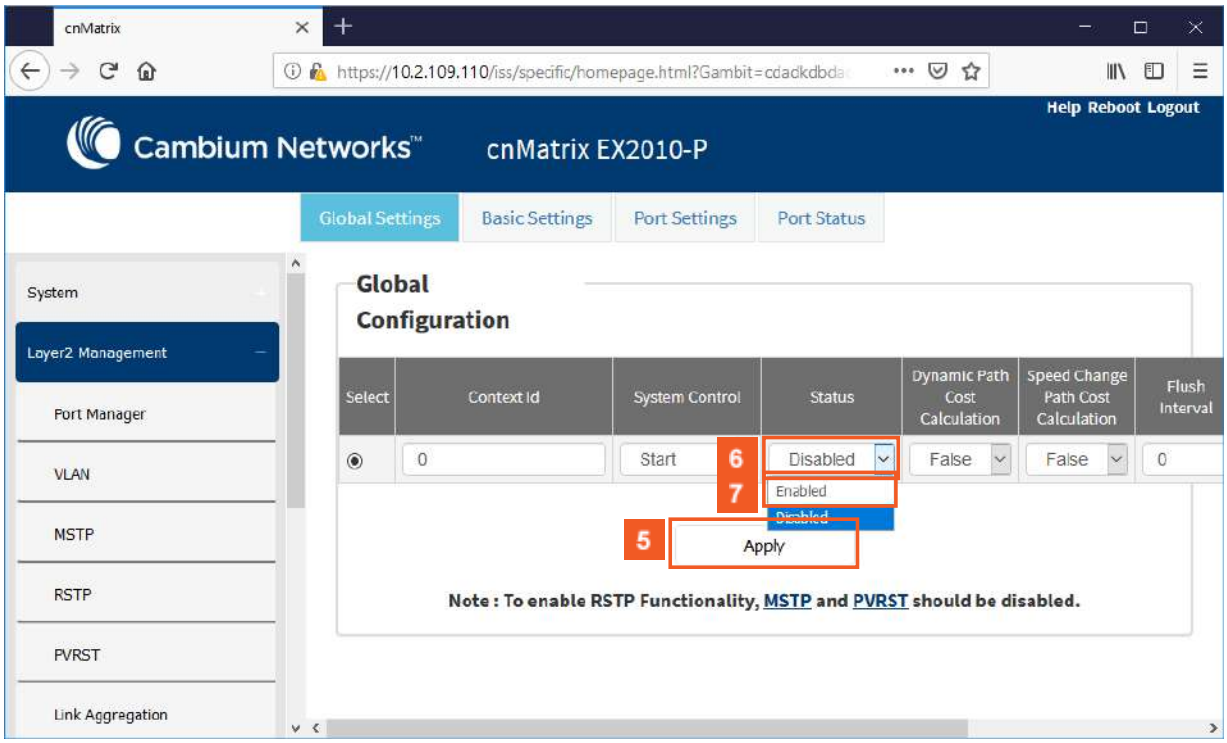


2 Click the **RSTP** menu item.



3 In the **System Control** column, select the administrative system control status for the RSTP feature.

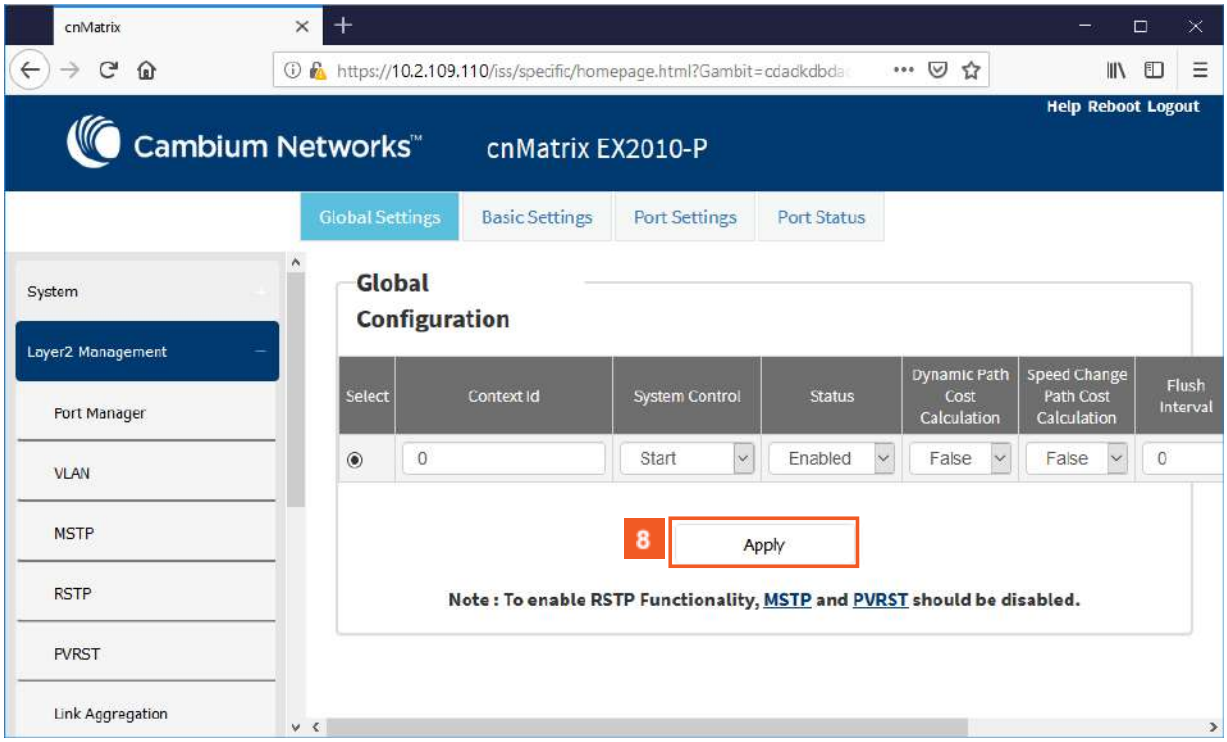
4 Select the **Start** list item.



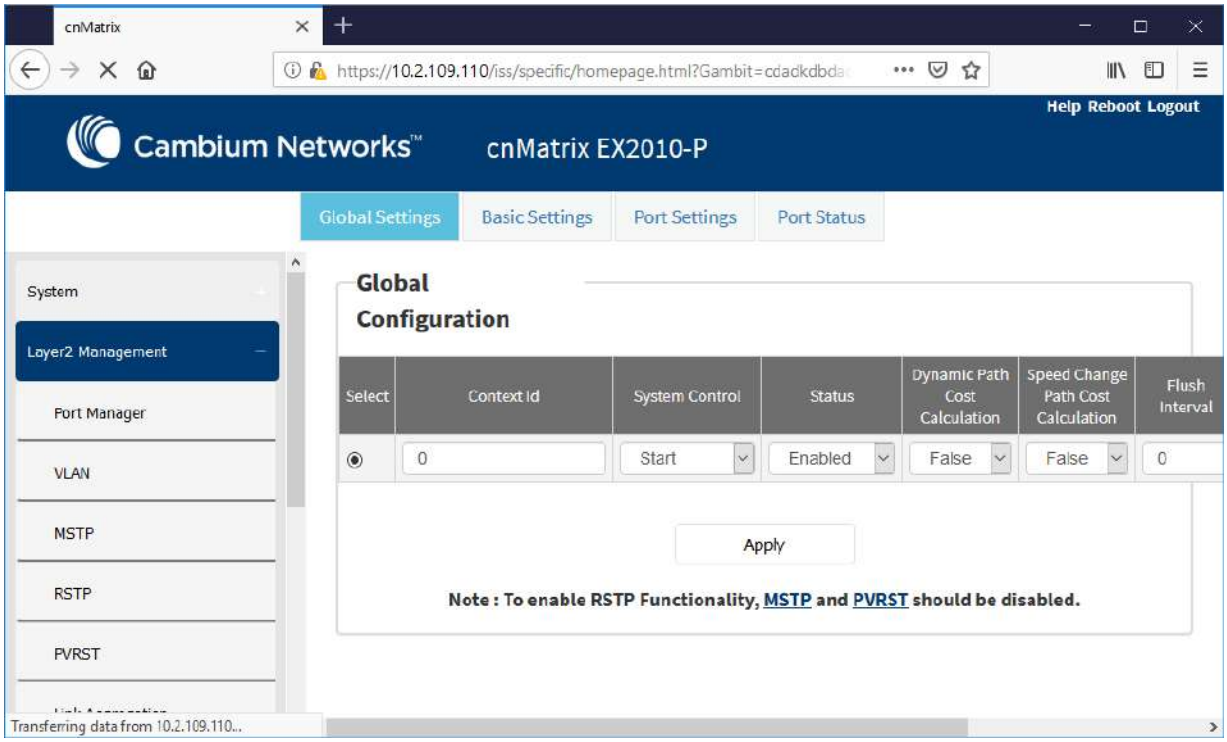
5 Click the **Apply** button.

6 In the **Status** column, select the administrative module status for the RSTP feature.

7 Click the **Enabled** list item.



8 Click the **Apply** button.



To enable the RSTP feature, make sure that the MSTP and PVRST feature are disabled.

2.2.1.3 Managing MSTP

1.1.1.1.3 Feature Description

To enable the MSTP functionality, RSTP and PVRST should be disabled.

Feature Overview

The **MSTP** feature enables VLANs to be grouped into spanning-tree instances, with each instance having a spanning-tree topology independent of other spanning-tree instances.

The **MSTP** feature enables the VLAN bridges to use multiple spanning trees, providing traffic belonging to different VLANs to flow over potentially different paths within the virtual bridged LAN.

Standards

- 802.1s

Scaling Numbers

- Up to 8 MSTP instances.

Limitations

N/A

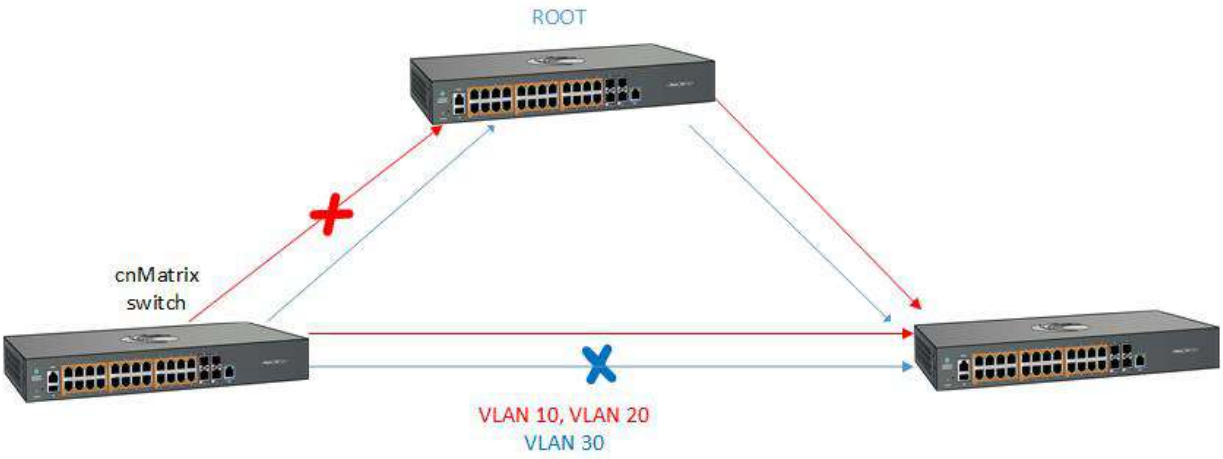
Default Values

- The default value for the forward time of the spanning tree: 15 seconds.
- The default value for the max-age timer of the spanning tree: 20 seconds.
- The default value for the revision number for the MST region: 0.
- The MST instance 0 is created and mapped with all VLANs.
- The default spanning tree hello time: 2 seconds.

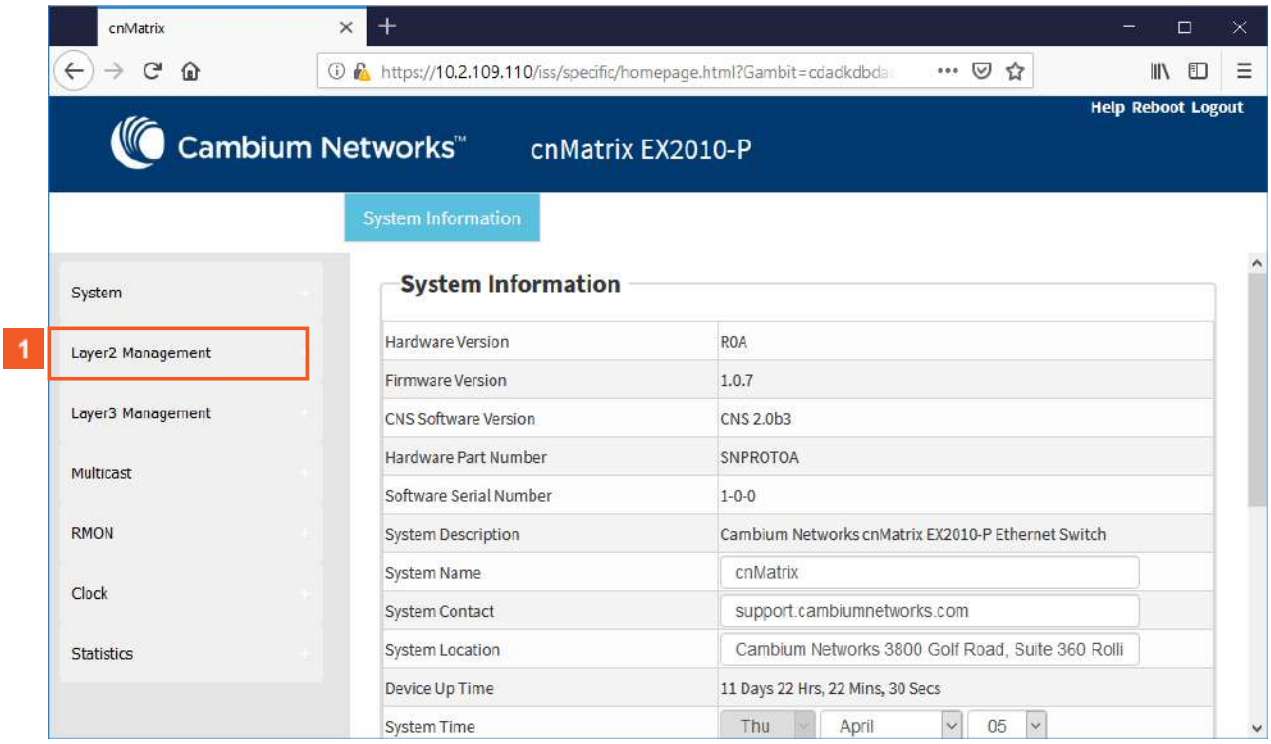
Prerequisites

- spanning-tree mode mst – enables the spanning tree operating mode.

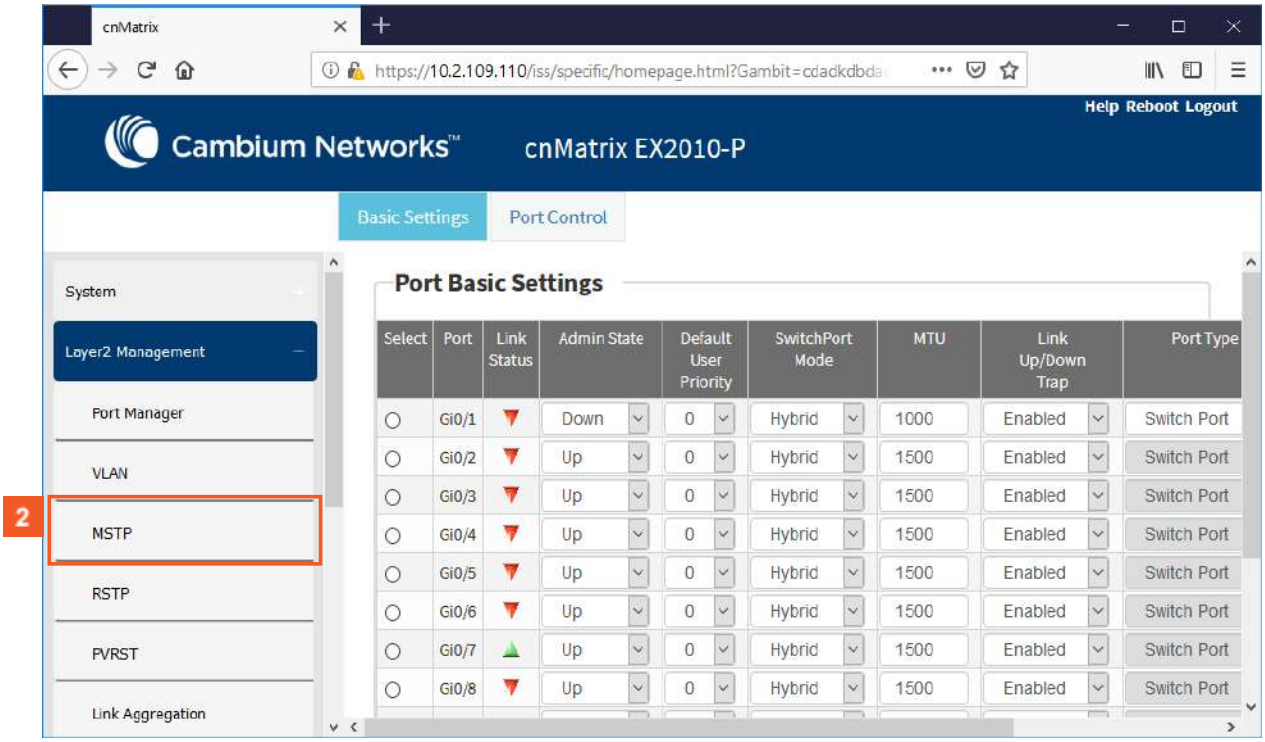
1.1.1.1.4 Network Diagram



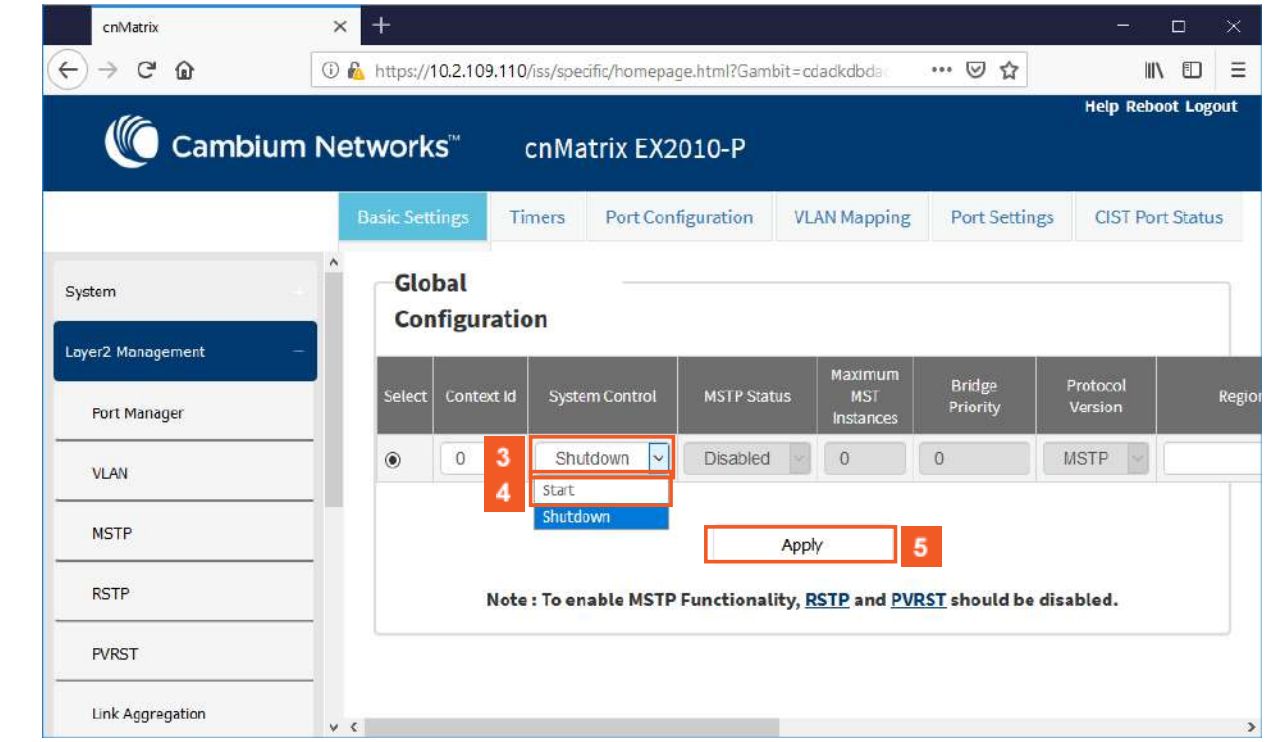
2.2.1.4 Configuring MSTP



1 Click the **Layer2 Management** button. The **L2 Features** are displayed.



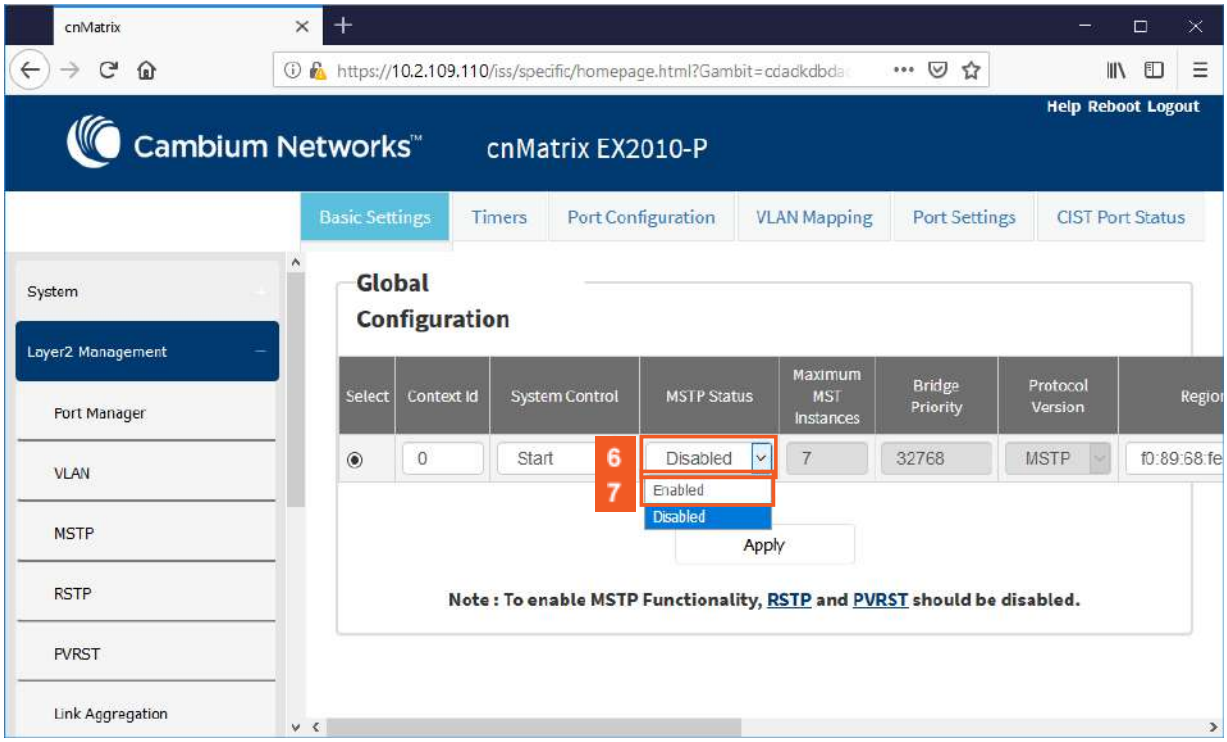
2 Click the **MSTP** menu item.



3 In the **System Control** column, select from the drop-down list the administrative shutdown status for the MSTP module.

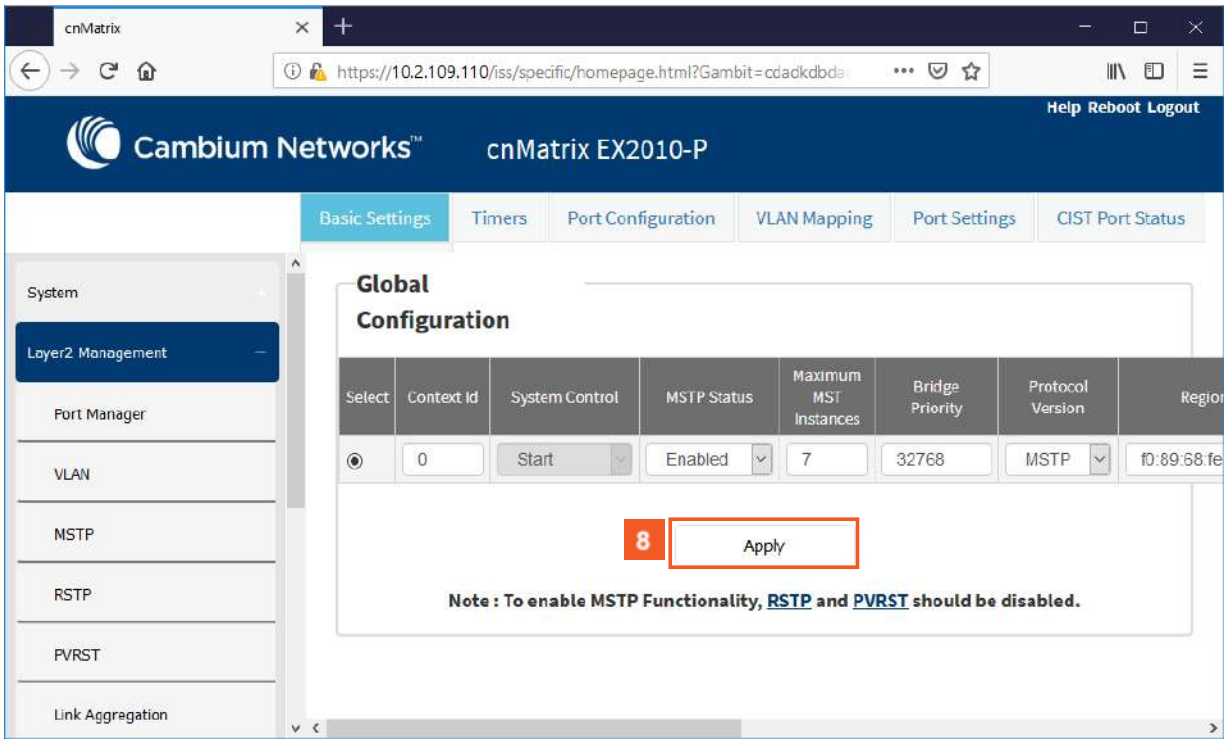
4 Select the **Start** list item.

5 Click the **Apply** button.



6 In the **MSTP Status** column, select from the drop-down list the administrative status for the MSTP feature.

7 Select the **Enabled** list item.



8 Click the **Apply** button.

To enable the MSTP feature, make sure that the RSTP and PVRST features are disabled.

2.2.1.5 Managing PVRST

1.1.1.1.5 Feature Description

Feature Overview

The **PVRST** feature provides better control traffic in the network and enables the RSTP feature to work in conjunction with VLAN in order to provide better control traffic in the network.

Standards

N/A

Scaling Numbers

- Up to 32 PVRST instances.

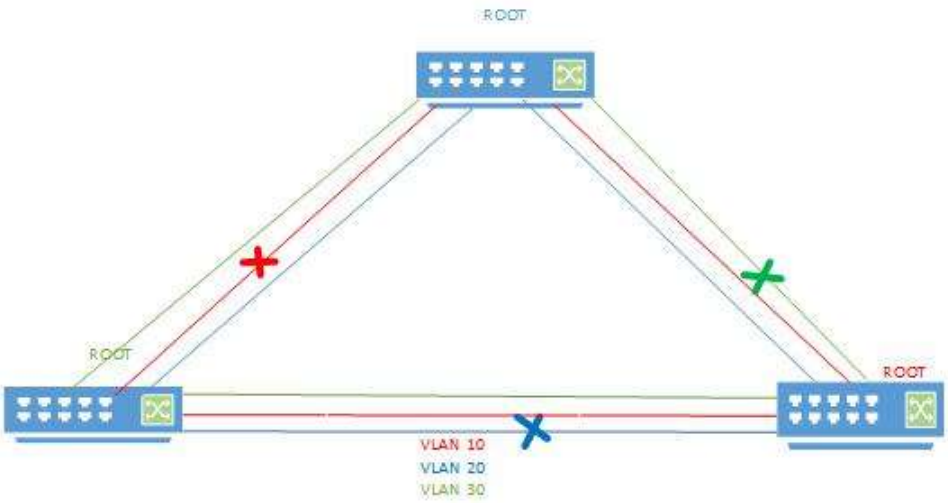
Default Values

- The default value for the forward time of the spanning tree: 15 seconds.
- The default value for the max-age timer of the spanning tree: 20 seconds.
- The default value for the revision number for the PVRST region: 0.
- The PVRST instance 0 is created and mapped with all VLANs.
- The default spanning tree hello time: 2 seconds.

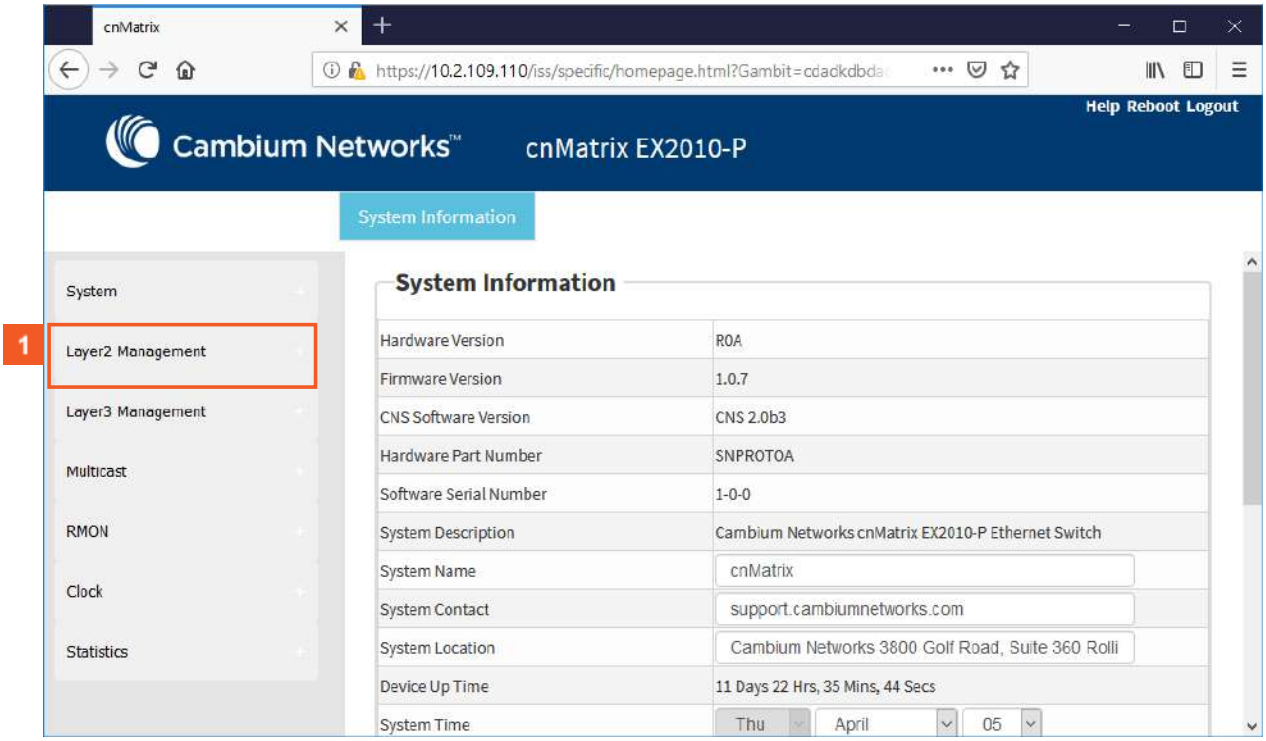
Prerequisites

- To enable the PVRST Functionality, MSTP and RSTP should be disabled.

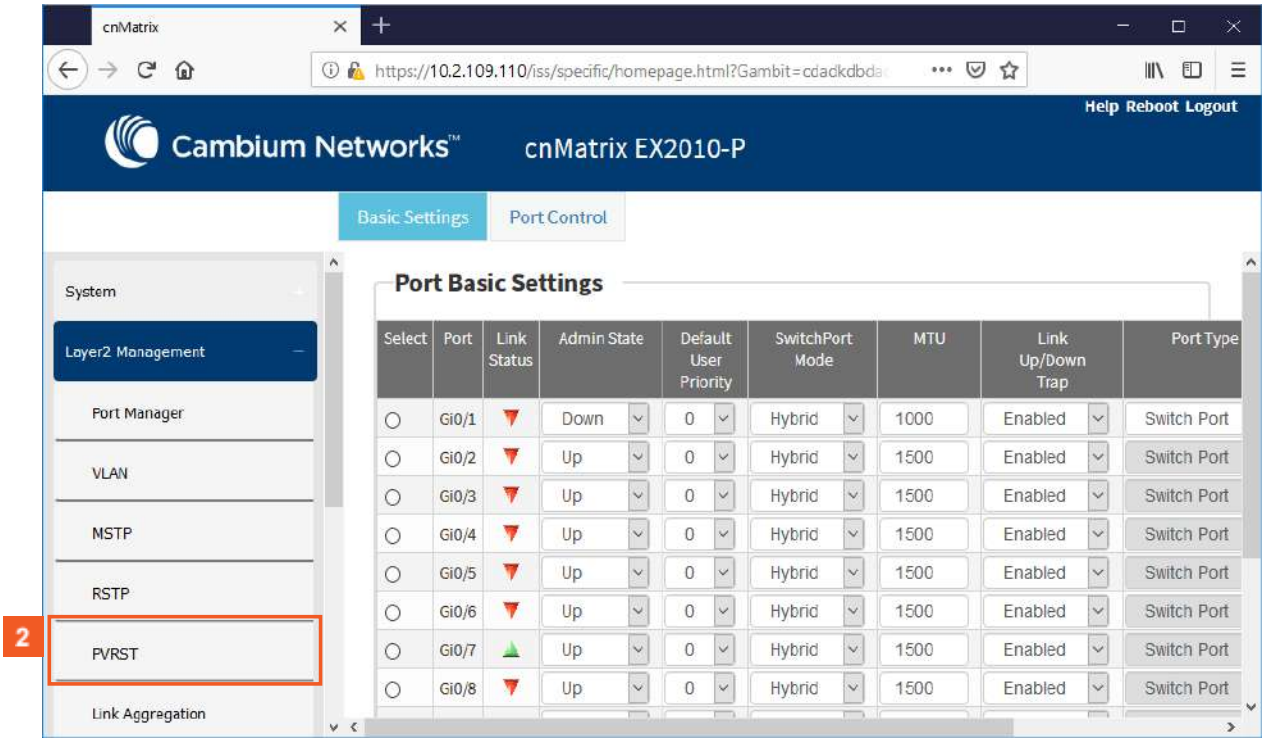
1.1.1.1.6 Network Diagram



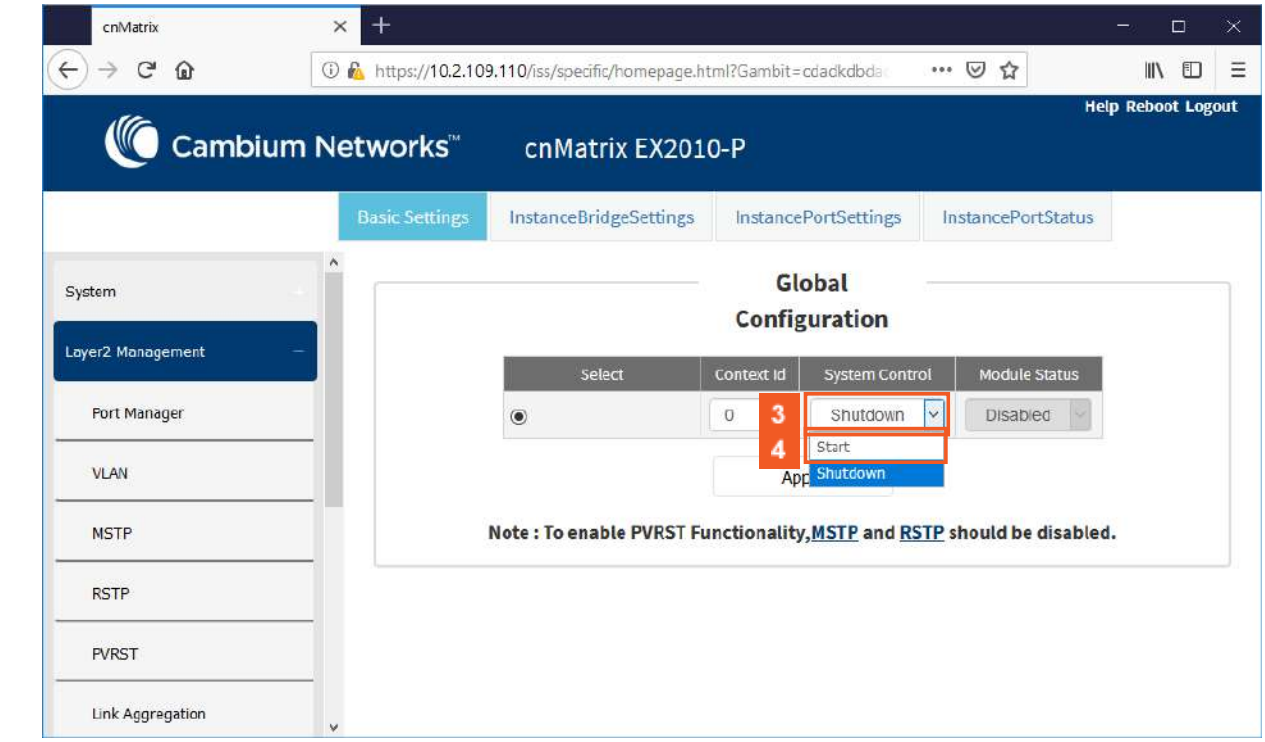
2.2.1.6 Configuring PVRST



1 Click the **Layer2 Management** menu item. The **L2 Features** are displayed.

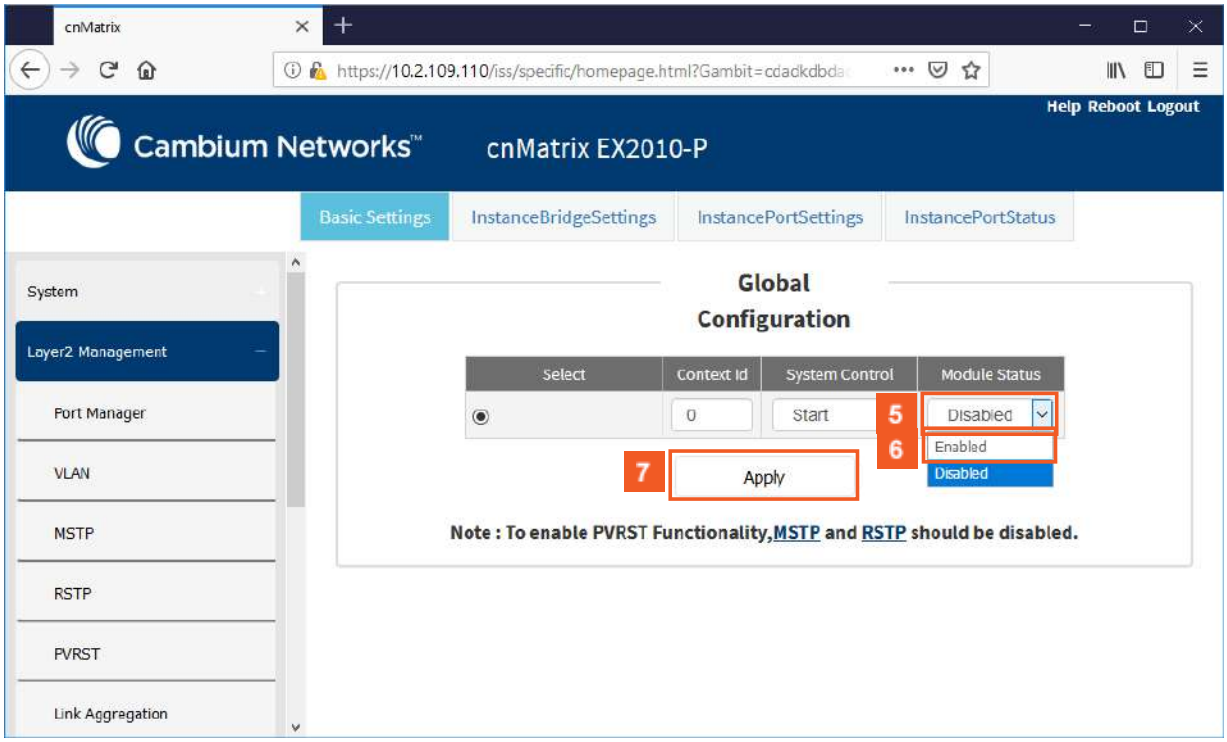


2 Click the **PVRST** menu item.



3 In the **System Control** column, select the administrative system control status for the PVRST feature.

4 Select the **Start** list item.



5 In the **Module Status** column, select from the drop-down the administrative module status for the PVRST feature.

6 Select the **Enabled** list item.

7 Click the **Apply** button.

Section complete. Click X to close.

2.3 LLDP

2.3.1 LLDP in WEB interface

2.3.1.1 Managing LLDP

Feature Overview

The LLDP feature enables you to discover the neighbor devices.

LLDP (Link Layer Discovery Protocol) is a link-layer protocol used by devices to advertise their identity and capabilities to their neighbors on a LAN.

Standards

- The protocol is standardized as IEEE 802.1ab and IEEE 802.3-2012 section 6 clause 79.

Scaling Numbers

- A maximum number of 256 neighbors are supported in this release.

Limitations

- LLDP-MED is not supported in this release.

Default Values

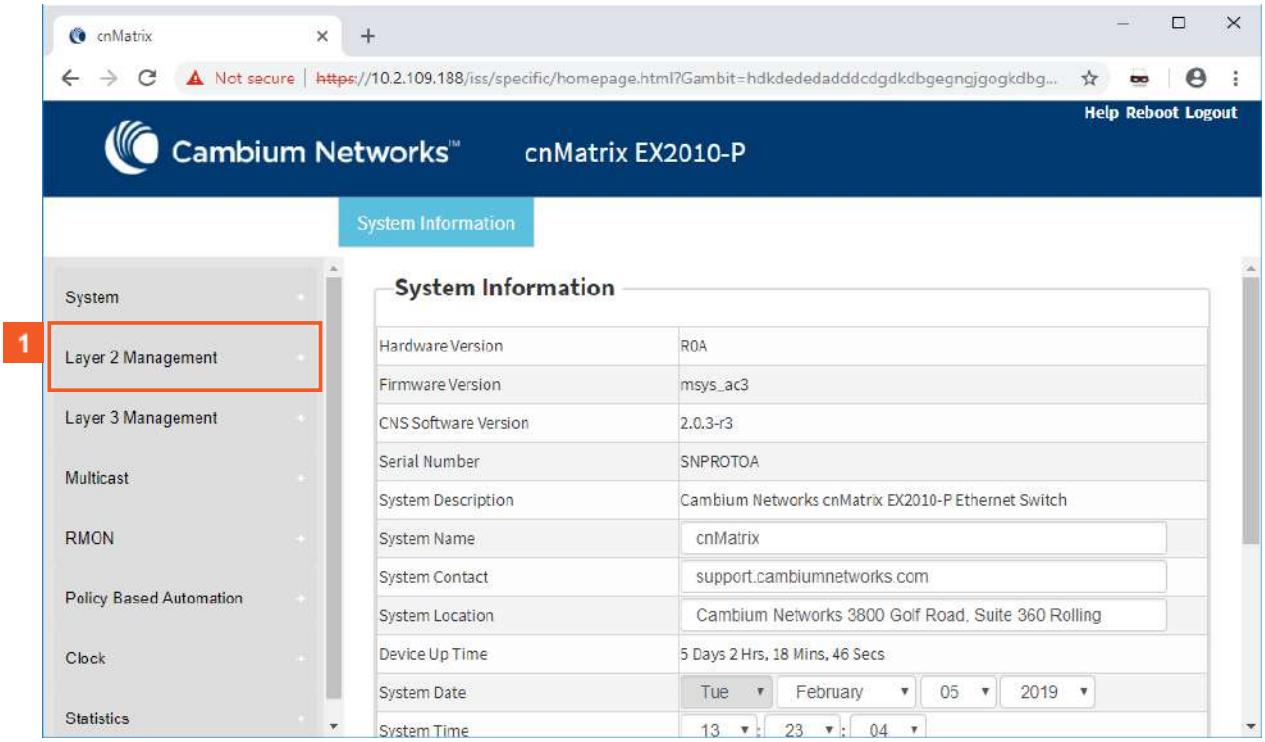
- The default transmission interval: 30 seconds.
- The default value for holdtime-multiplier: 4.
- The default value for reinitialization delay time: 2.

- Transmission / reception of LLDPU are enabled by default.
- The default LLDP version is v2.
- Port description, system name, system description and system capabilities TLVs are enabled on all ports.

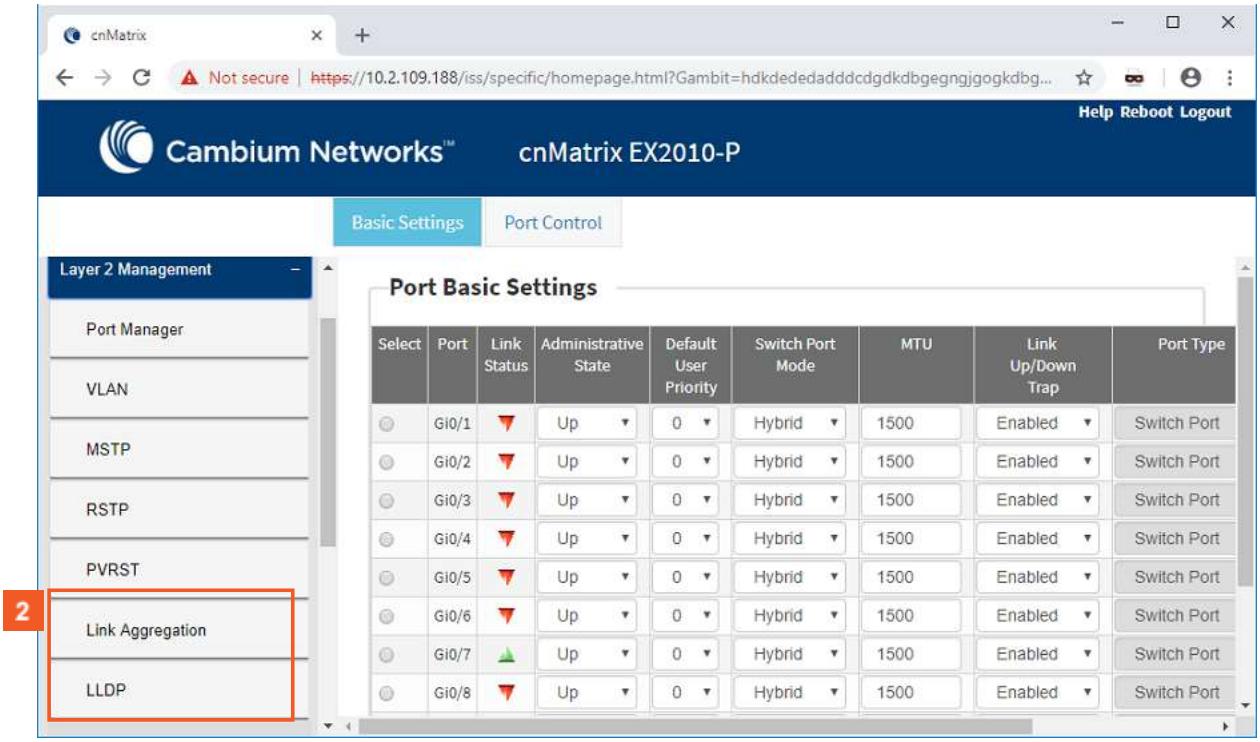
Prerequisites

- For the basic functionality, no user configuration is necessary. The reception and transmission of LLDPDUs are enabled by default on all ports.

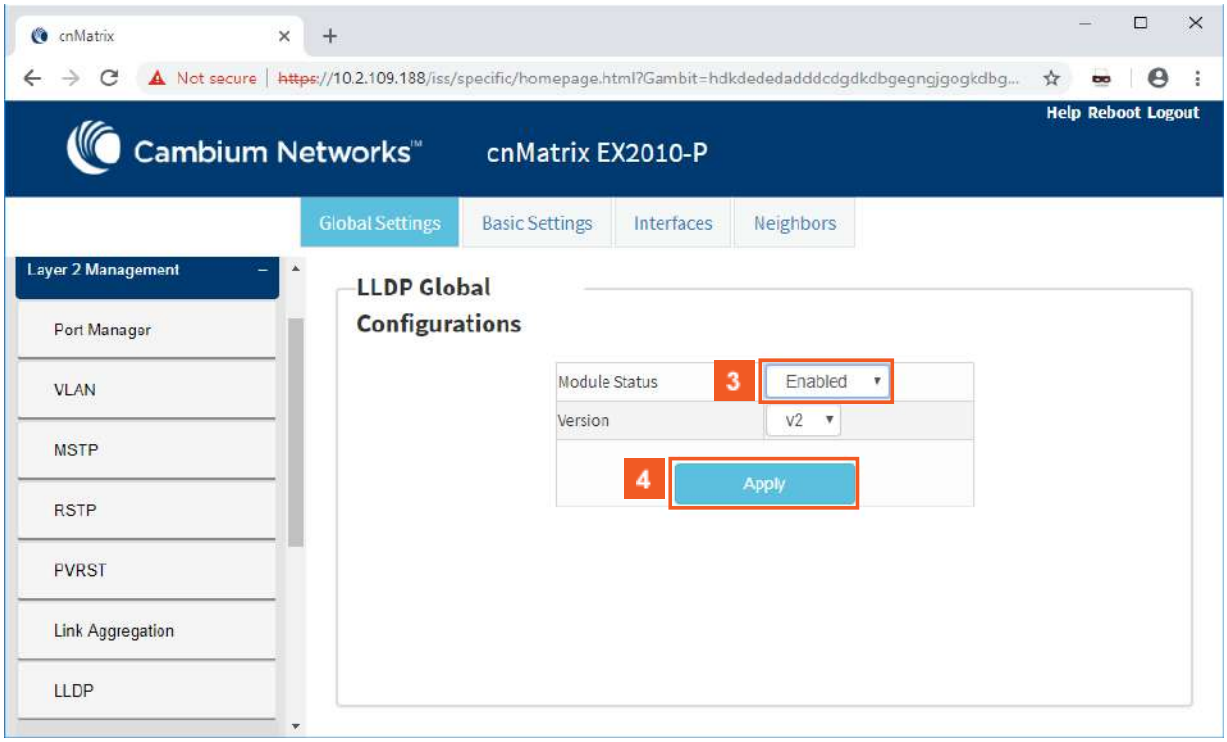
2.3.1.2 Configuring LLDP in WEB



1 Click the **Layer2 Management** menu item. The **L2 Features** are displayed.



2 Click the **LLDP** menu item.



3 Click the **Module Status** drop-down button to select the administrative module status of LLDP module. Select the **Enabled** list item.

4 Click the **Apply** button.

2.4 RMON

2.4.1 RMON in WEB interface

2.4.1.1 Managing RMON

The RMON feature defines a set of statistics and functions that can be exchanged between RMON-compliant console managers and network probes and enables various network monitors and console systems to exchange network-monitoring data.

Feature Overview

Standards

- The RMON feature is documented in RFC 2819.

Scaling Numbers

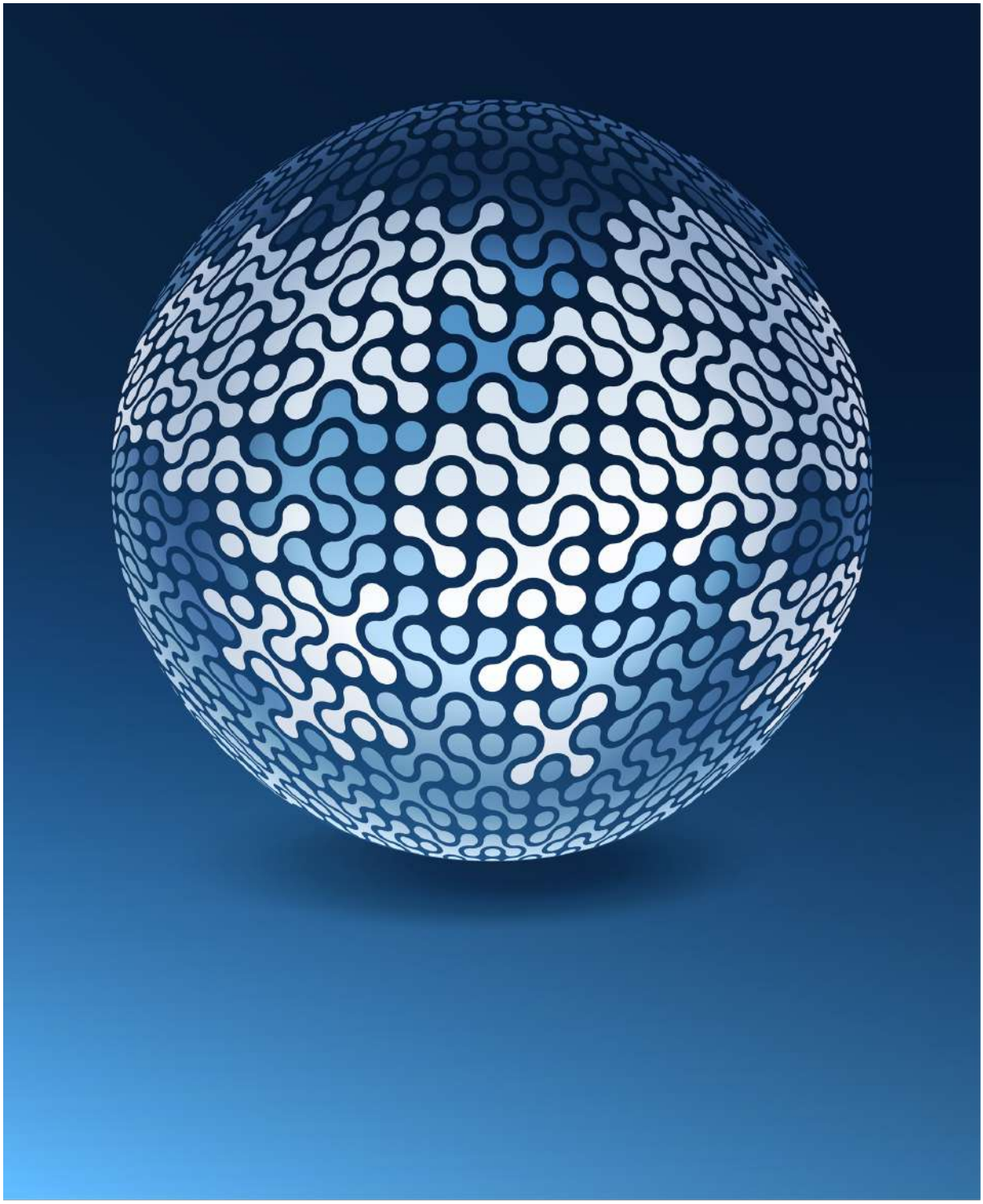
- A maximum number of 50 RMON events can be created.
- A maximum number of 50 RMON alarms can be created.
- A maximum number of 74 history collection entries can be created.

Limitations

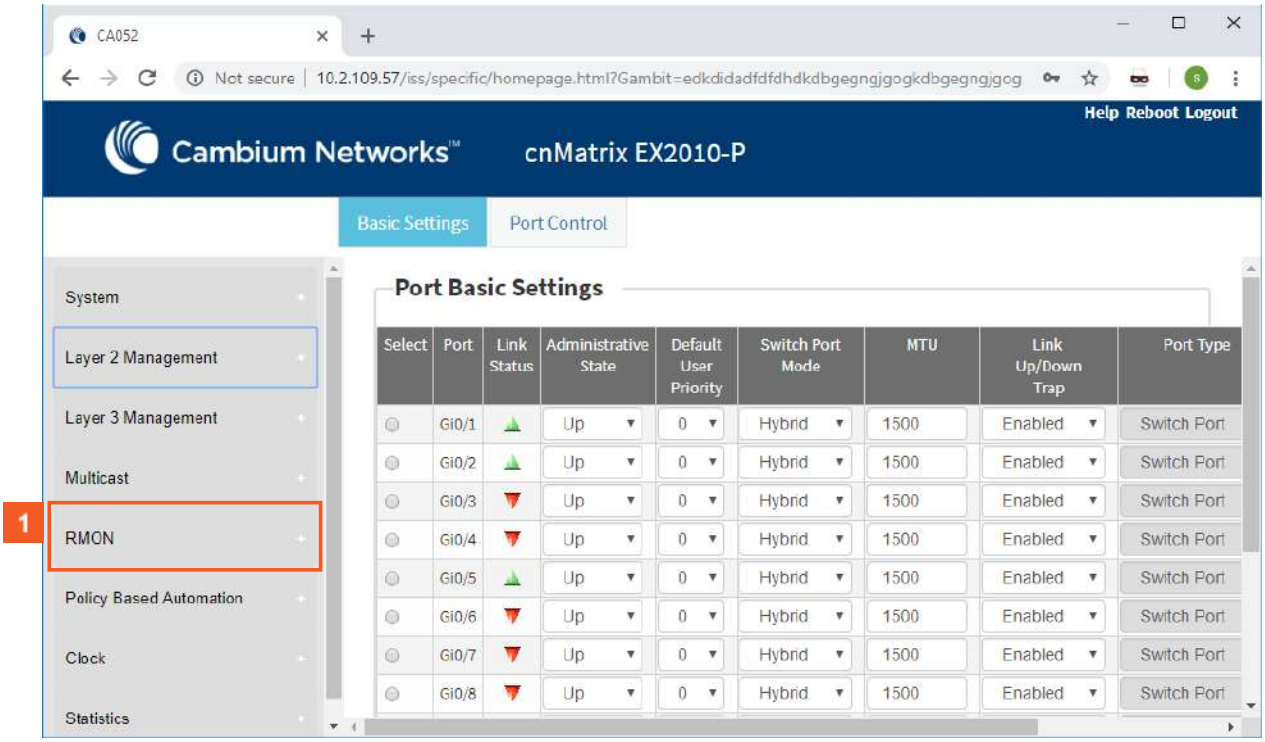
- User must configure an SNMP user and a notification receiver to use the SNMP notification events.
- The RMON alarm mib must be configured in its complete format, including final index For example 1.3.6.1.2.1.2.2.1.10.1 refers to ifInOctets for interface 1.
- RMON alarms can be configured only for MIB objects that resolve to an integer.

Default Values

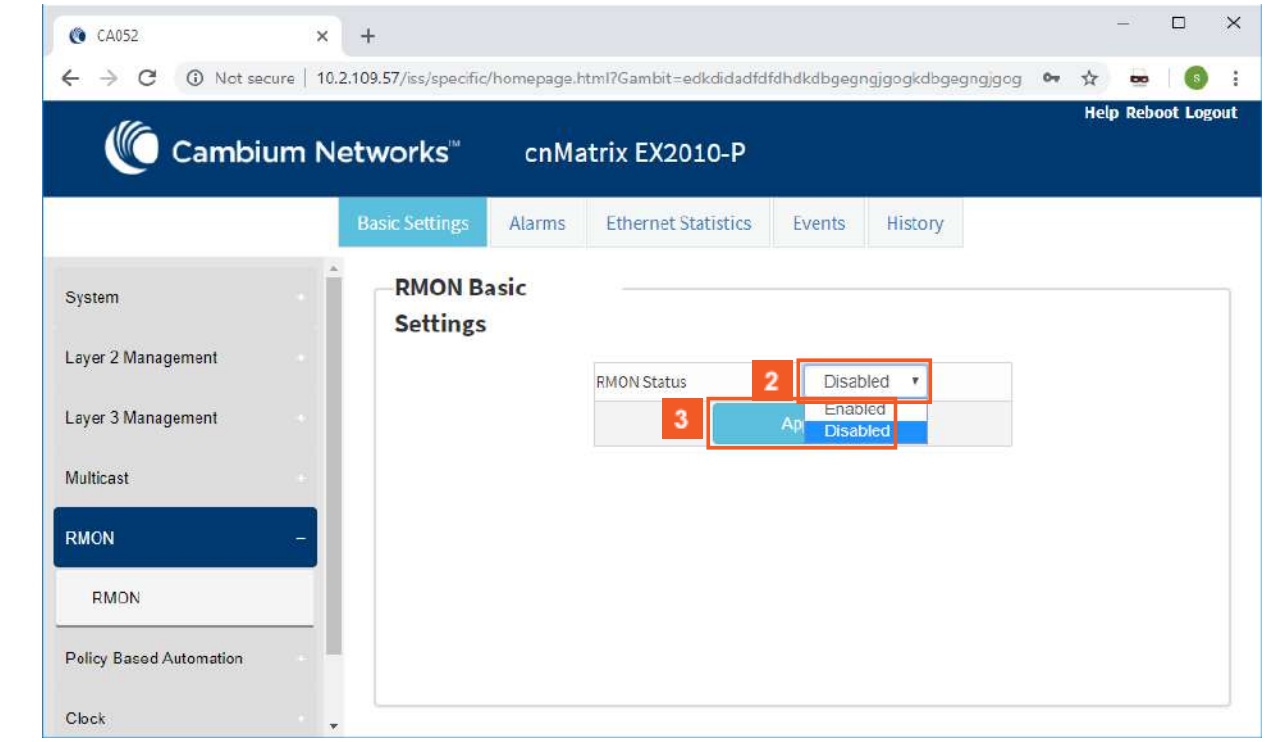
- The RMON feature is disabled by default.
- By default, the least event number in the event table is assigned for the rising and falling threshold as its event number.



2.4.1.2 Configuring RMON in WEB

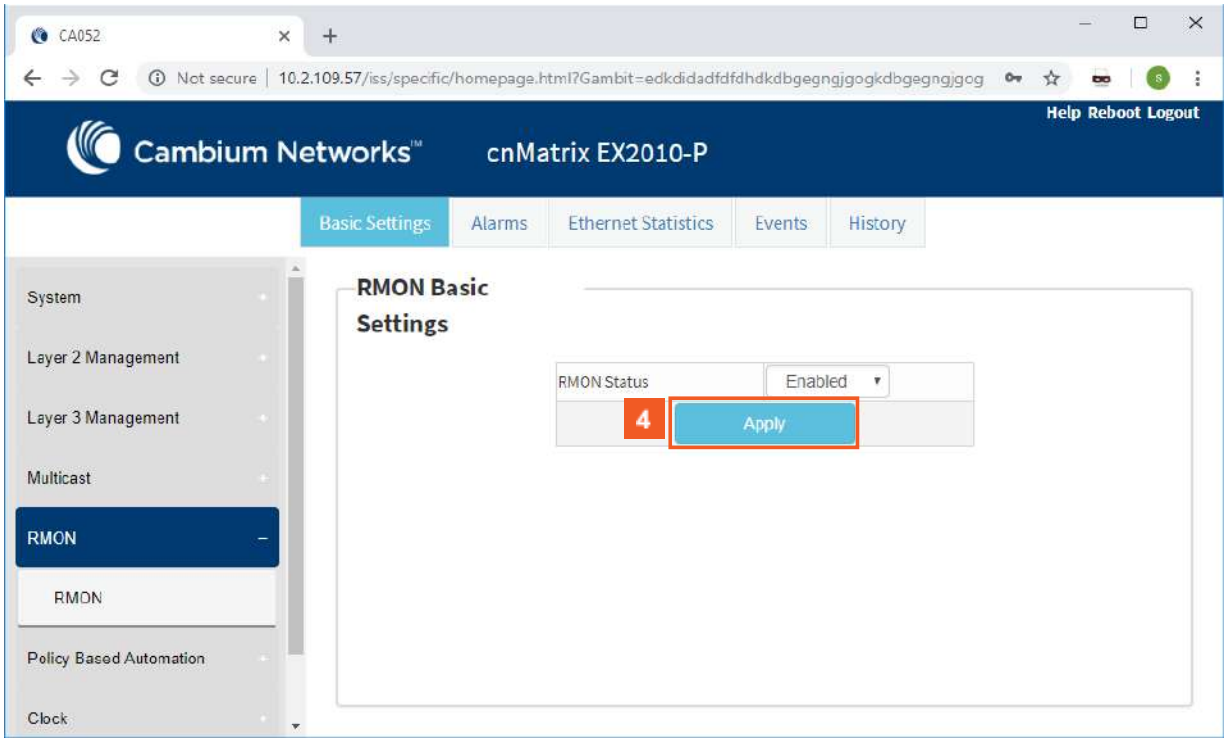


1 Click the **RMON** menu item.



2 Click the **RMON Status** drop-down button and select the status of the RMON feature on the switch.

3 Select the **Enabled** list item.



4 Click the **Apply** button.

2.5 SNTP

2.5.1 SNTP in WEB interface

2.5.1.1 Managing SNTP

1.1.1.1.7 Feature Description

The SNTP client feature enables you to synchronize the time and date in cnMatrix with a SNTP Server and to determine the time, roundtrip delay and local clock offset in reference to a SNTP server.

Standards

- cnMatrix SNTP client is RFC 4330 compliant.

Scaling Numbers

- cnMatrix SNTP is a client feature and depends only on scaling capabilities of the server.

Limitations

- SNTP client accesses a single server to synchronize with. For unicast mode, there is a backup server in case the primary server fails.
- The software does not support SNTP symmetric mode.
- When configured to function in Unicast Addressing mode, the software delivers the functionality listed below:
  - Discovers dynamically the Version Number of the SNTP server.
  - Sets the transmit time field in the request packet to determine roundtrip delay and system clock offset relative to the server.
  - Avoids sending client request message with less than 1-minute periodic interval.

  - Stops sending request packets to a particular server while receiving a reply with stratum field set to zero.
  - Retransmits request packet using an exponential-back off algorithm, after receiving reply packet with stratum field set as zero.
  - Allows administrative configuration for two designated SNTP servers.
- When configured to function in Broadcast or Multicast Addressing Mode, the software delivers the functionality listed below:
  - Listens for a Broadcast or Multicast Address from one or more broadcast servers.
  - Allows configuration of the designated Broadcast or Multicast servers.
  - Sends request packet to measure the propagation delay and continues operation in listen-only mode.
  - Abandons the measurement and assumes a default value for the delay, if it does not receive a reply from the broadcast server.
- The software does not support any authentication schemes.
- When configured to function in Manycast Addressing Mode, the software delivers the functionality listed below:
  - Sends a client request packet to designated Manycast servers.
  - Adjusts the TTL field in the IP header for appropriate scope in the client request message.
  - Sets the message header to zero, except the Mode, Version Number and optional transmit Timestamp fields in the client request message.
  - Sets the Mode field to three (client) in the client request packet header.
  - Avoids sending any request packet with version number set as zero.
  - Allows the administrator to configure the version number field.
  - Discovers the version number of the server dynamically.
  - Sets the transmit time field in the request packet which allows to determine roundtrip delay and system clock offset relative to the server.
  - Sends client request messages periodically.
  - Avoids sending client request messages with less than 1-minute periodic interval.
  - Stops sending request packets to a particular server when receives a reply with stratum field set to zero.
  - Retransmits a request packet using an exponential-backoff algorithm, after receiving reply packet with stratum field set as zero.

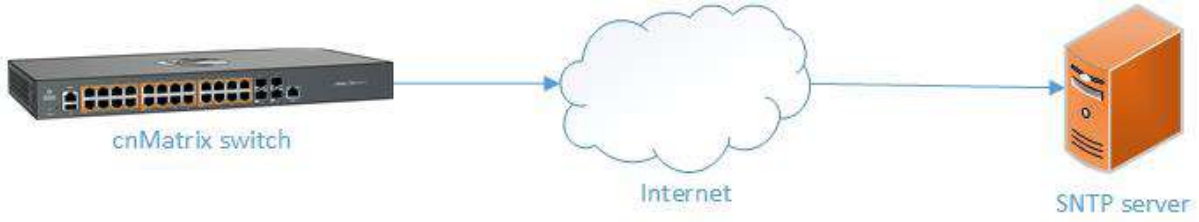
Default Values

- The default SNTP client version is v4
- The default SNTP addressing mode is unicast
- The SNTP to send status request is disabled by default.
- The default SNTP unicast server: IPv4.
- The default value for the maximum poll retries is 3.
- The default value for the maximum poll interval timeout: 5 seconds.
- The default unicast poll interval is: 64 seconds.
- The auto discovery option is disabled by default.
- The default time zone is: +00:00.
- The default clock format: hours.
- The default client port number is: 123.
- The default SNTP addressing mode is unicast.

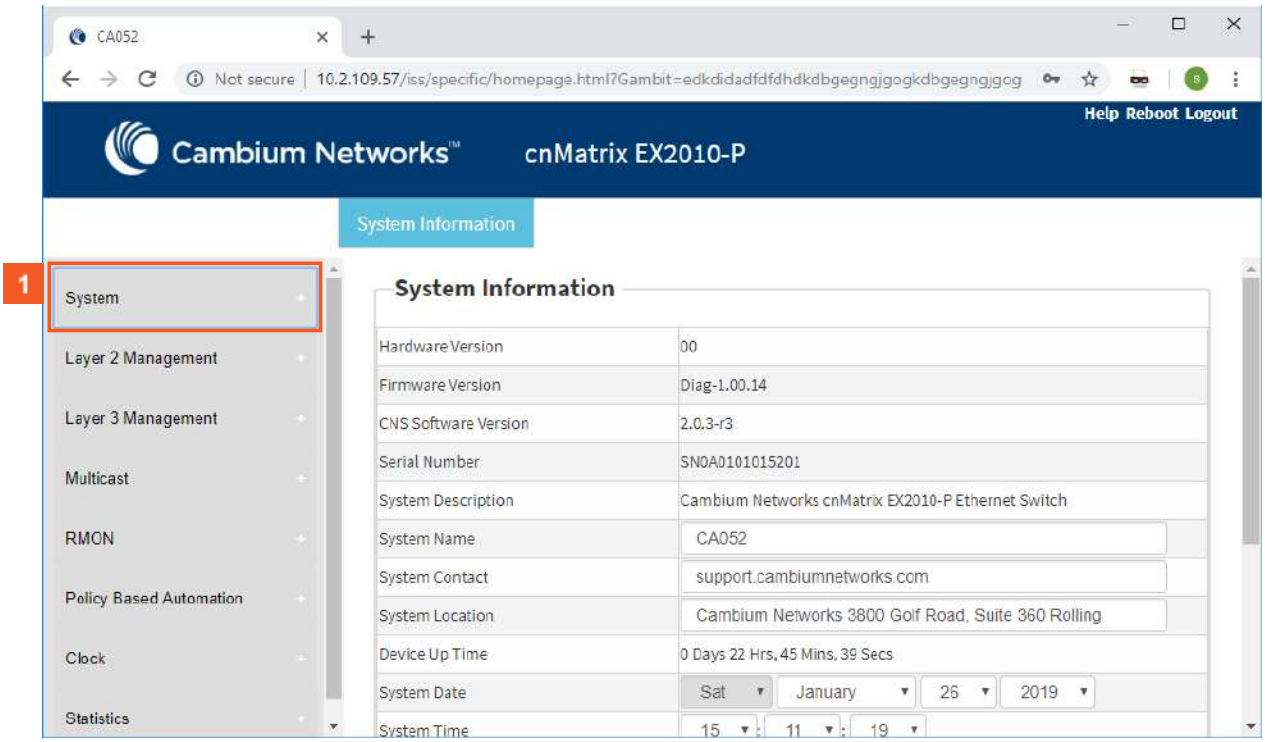
Prerequisites

- Network connectivity to a SNTP server.

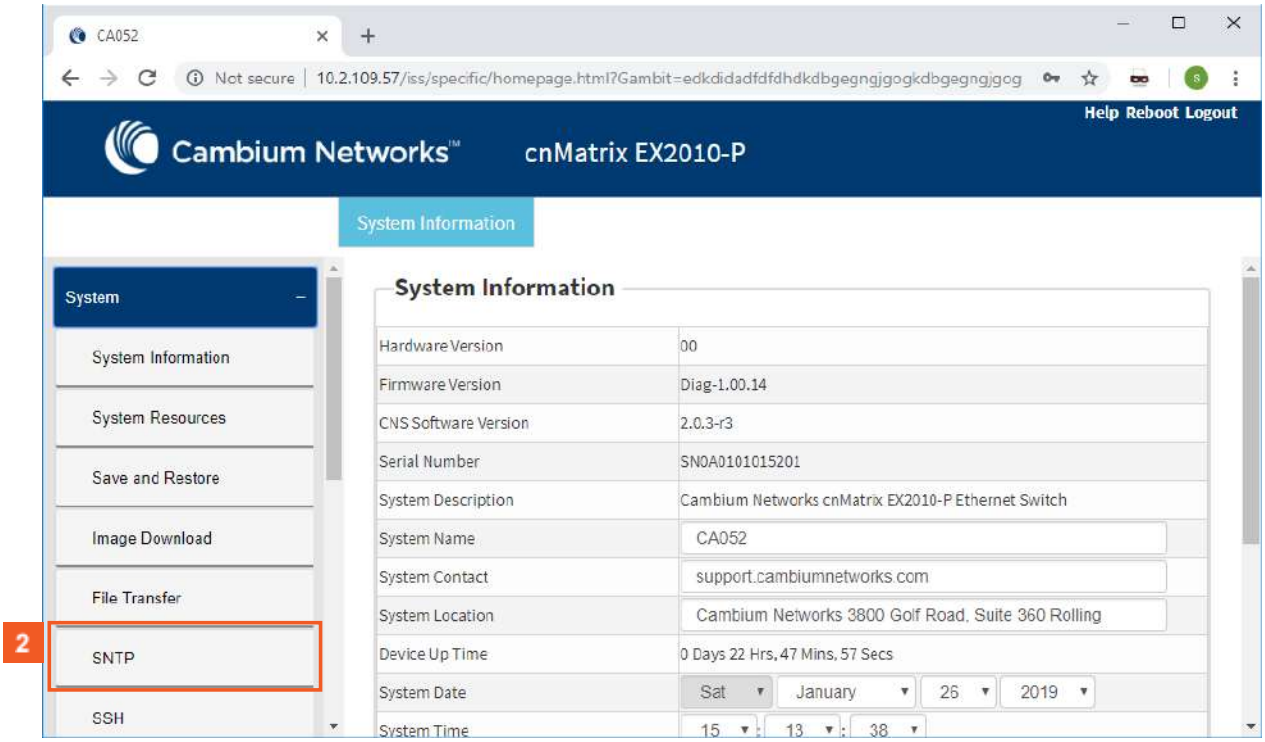
1.1.1.1.8 Network Diagram



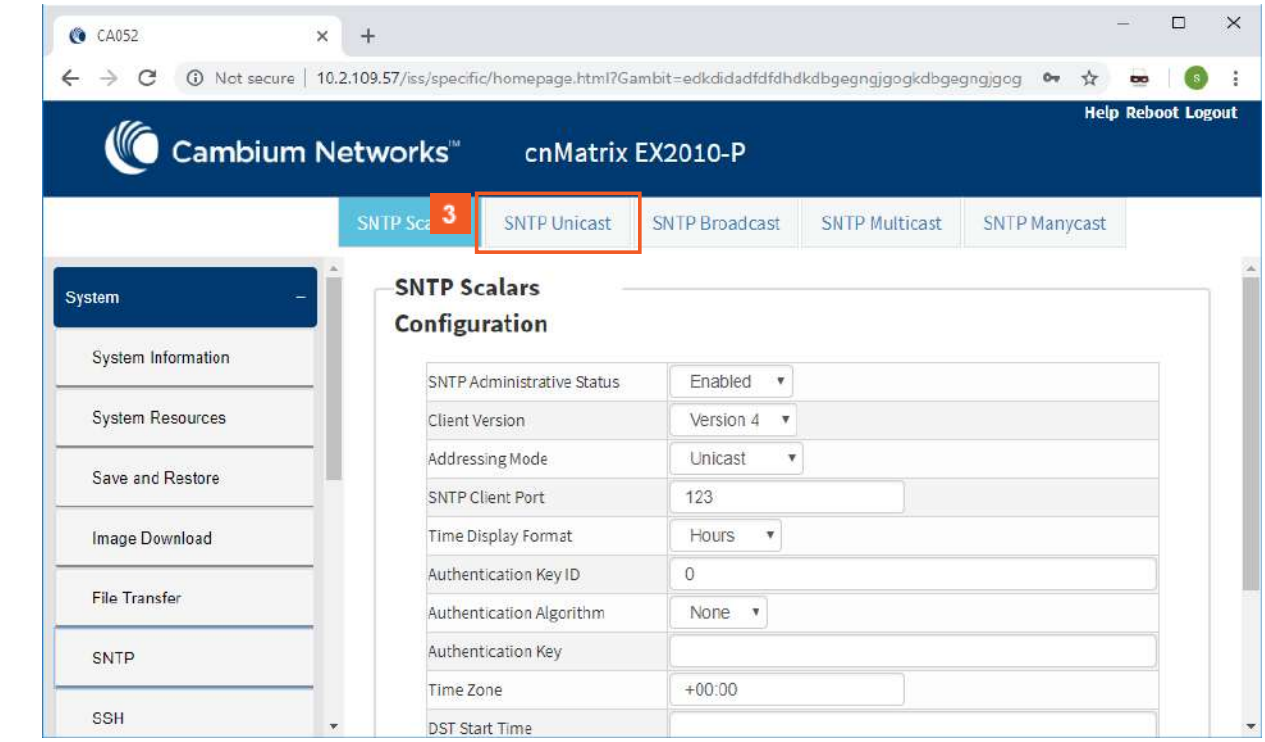
2.5.1.2 Configuring SNTP in WEB



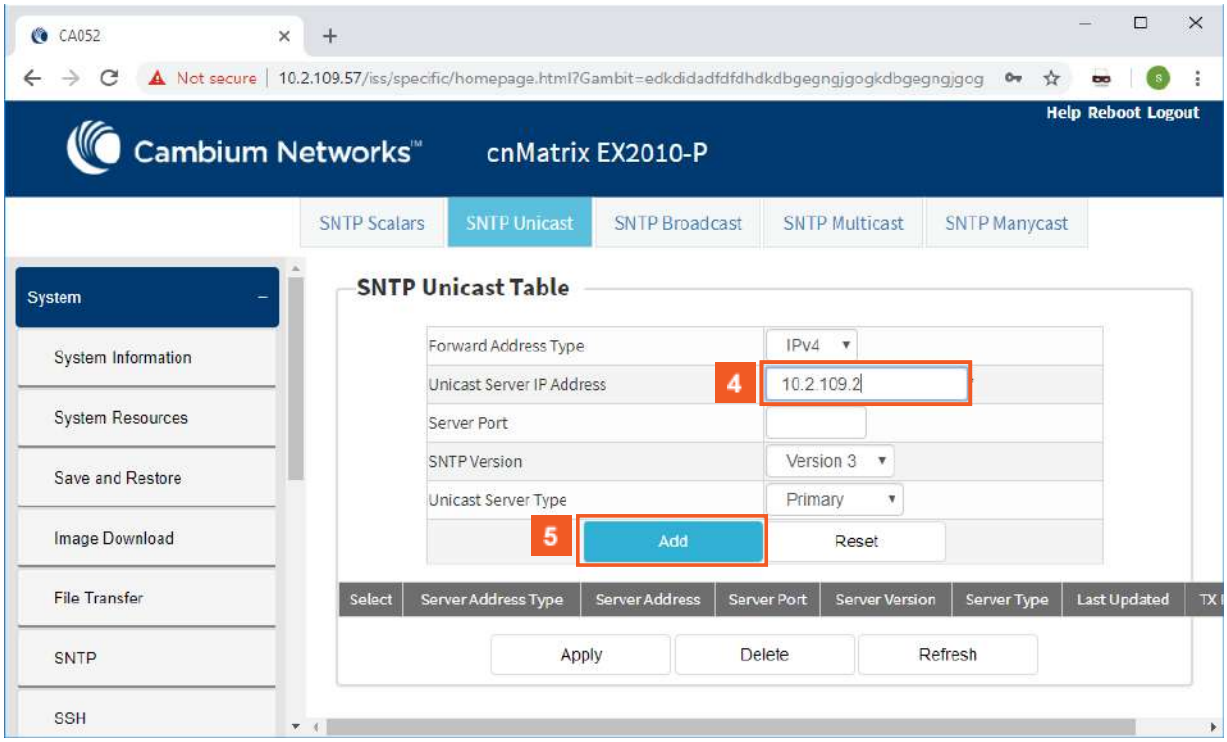
1 Click the **System** menu item.



2 Click the **SNTP** menu item.



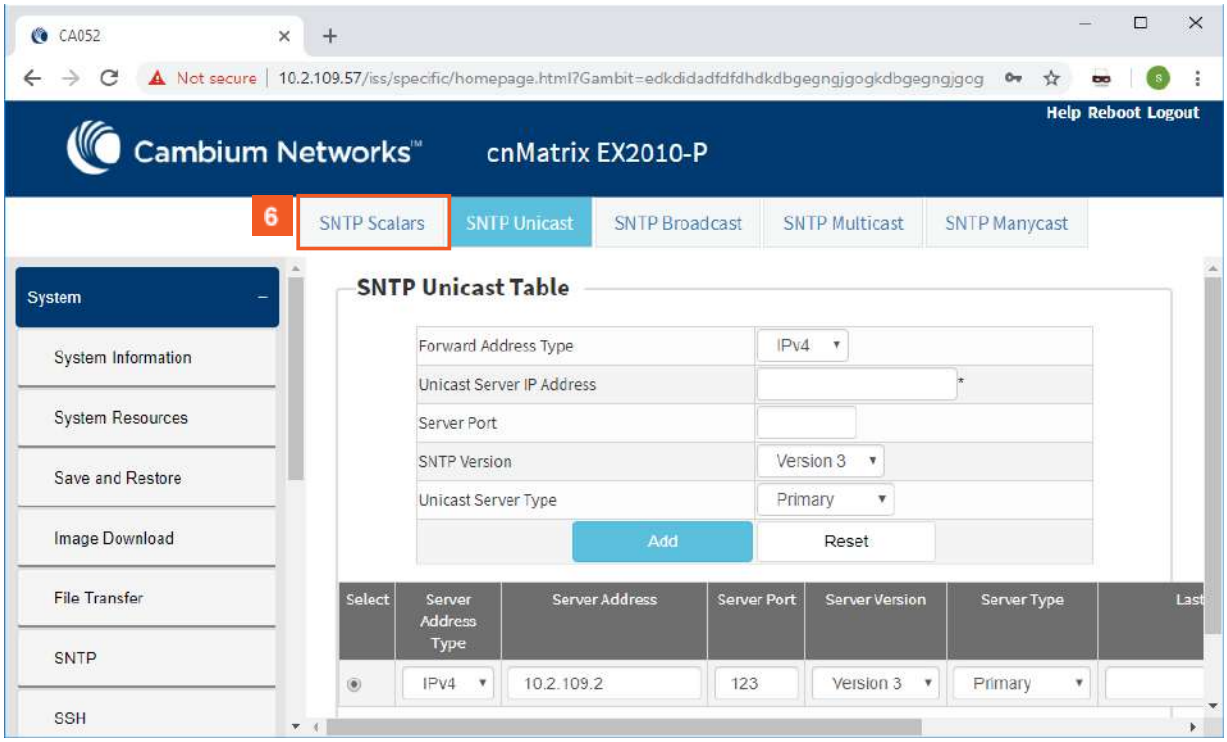
3 Click the **SNTP Unicast** tab. The **SNTP Unicast Table** window is displayed.



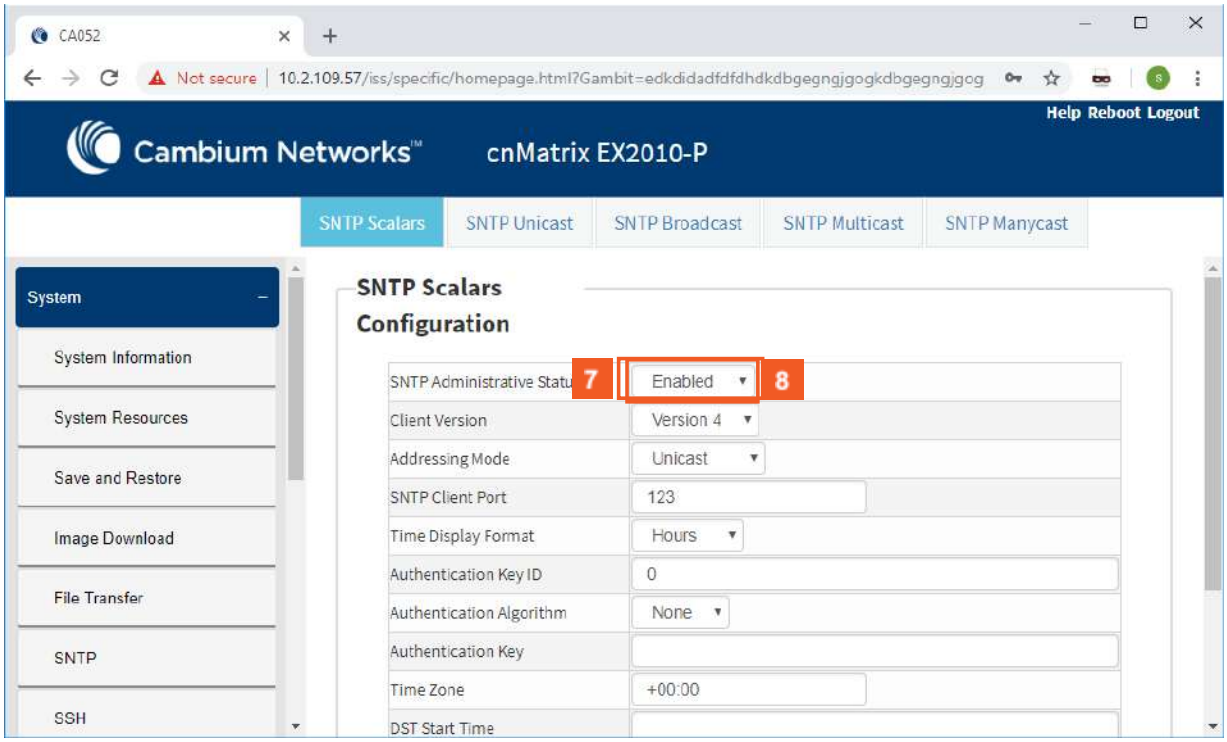
4 Enter **10.2.109.2** into the **Unicast Server IP Address** field.

10.2.109.2 represents the unicast IPv4 server address.

5 Click the **Add** button.

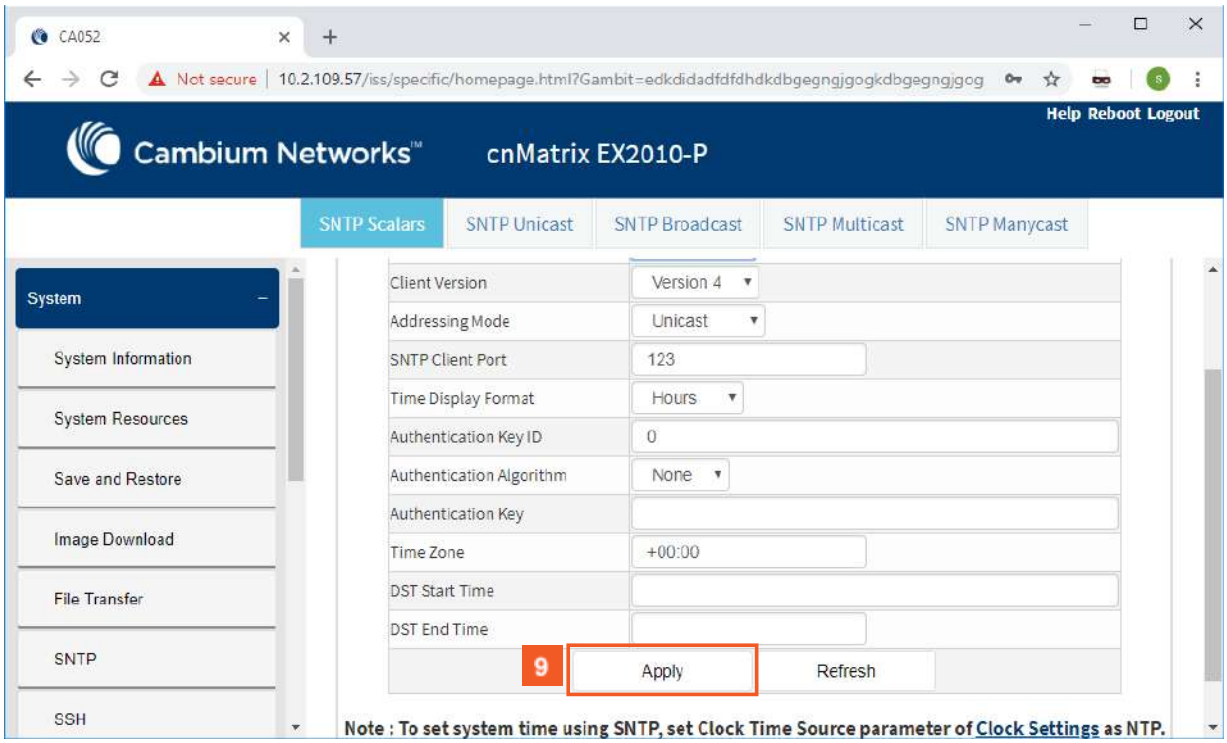


6 Click the **SNTP Scalars** tab. The **SNTP Scalars Configuration** window is displayed.

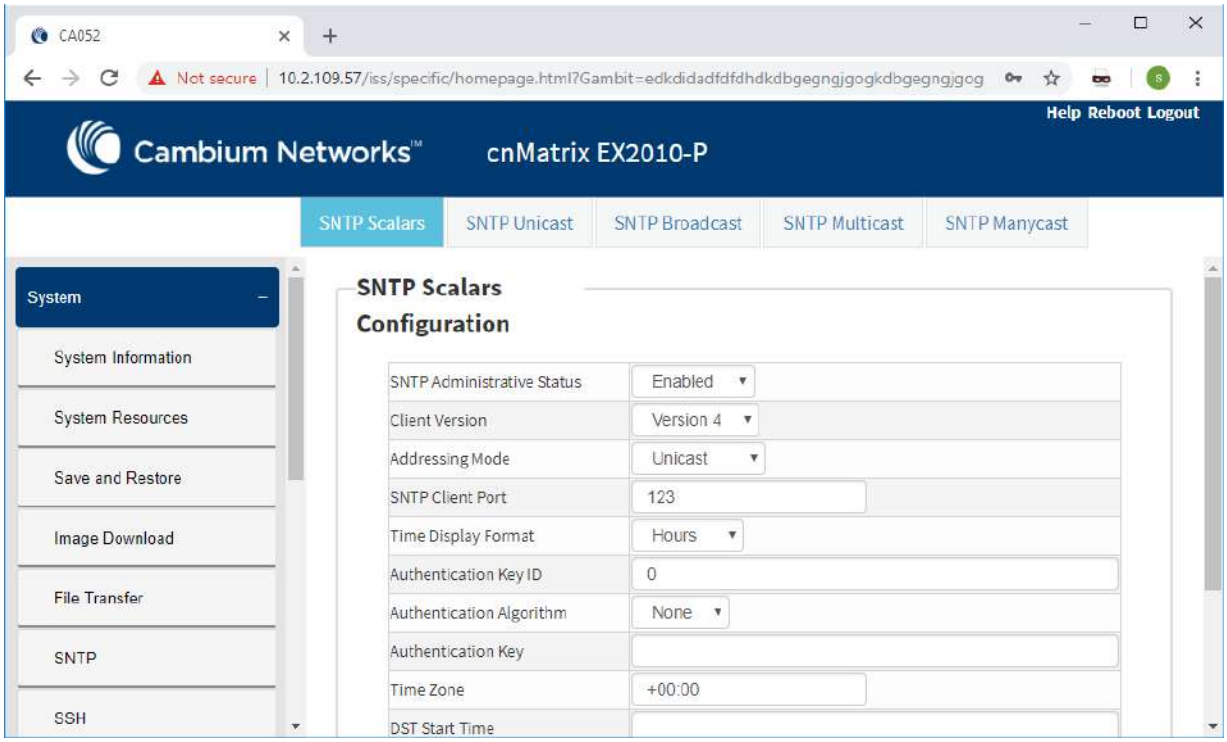


7 Click the **SNTP Administrative Status** drop-down button and select the SNTP client module status.

8 Select the **Enabled** list item.



9 Click the **Apply** button.



2.6 Port Settings Feature

2.6.1 Managing Negotiation

Feature Overview

The **negotiation** setting enables the auto-negotiation on the interface so that the port can negotiate with the other end of port properties.

Standards

N/A

Scaling Numbers

N/A

Limitations

- Fiber ports do not support auto-negotiation.

Default Values

- The negotiation setting is enabled by default.

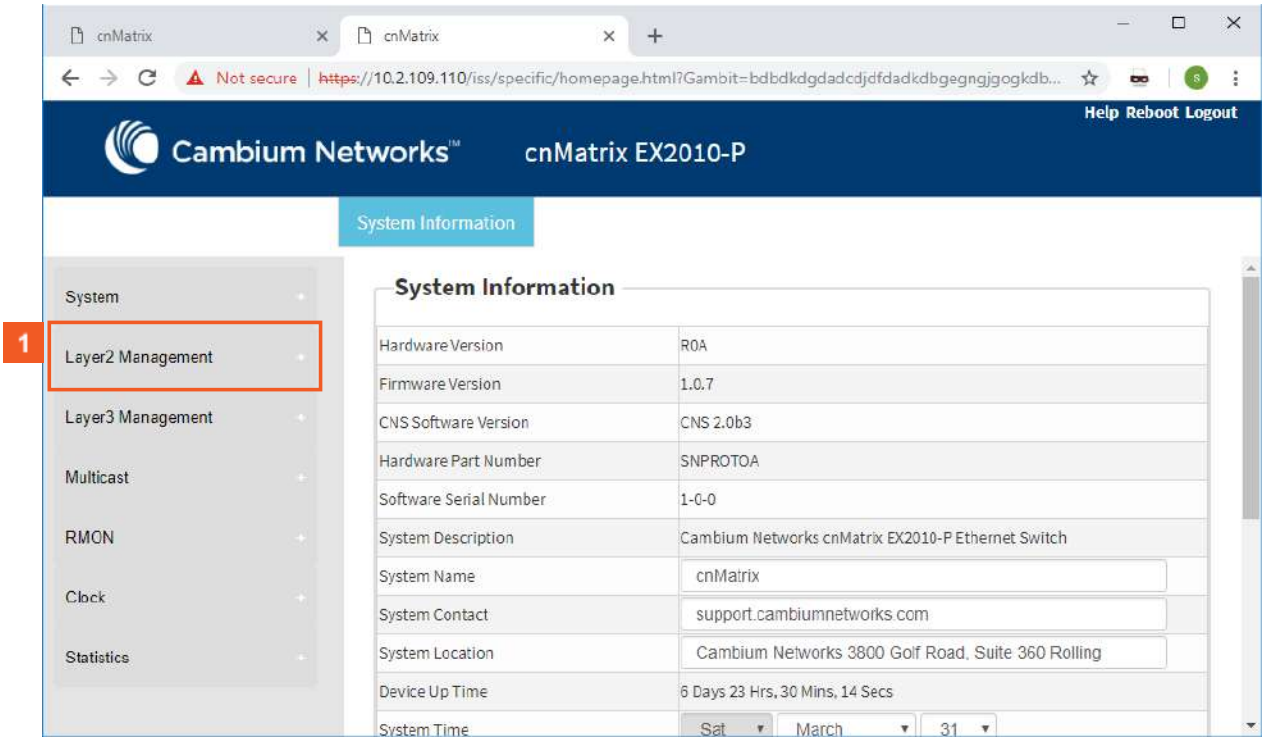
Prerequisites

```
cnMatrix# conf terminal

cnMatrix(config)# int gi 0/1

cnMatrix(config-if)#
```

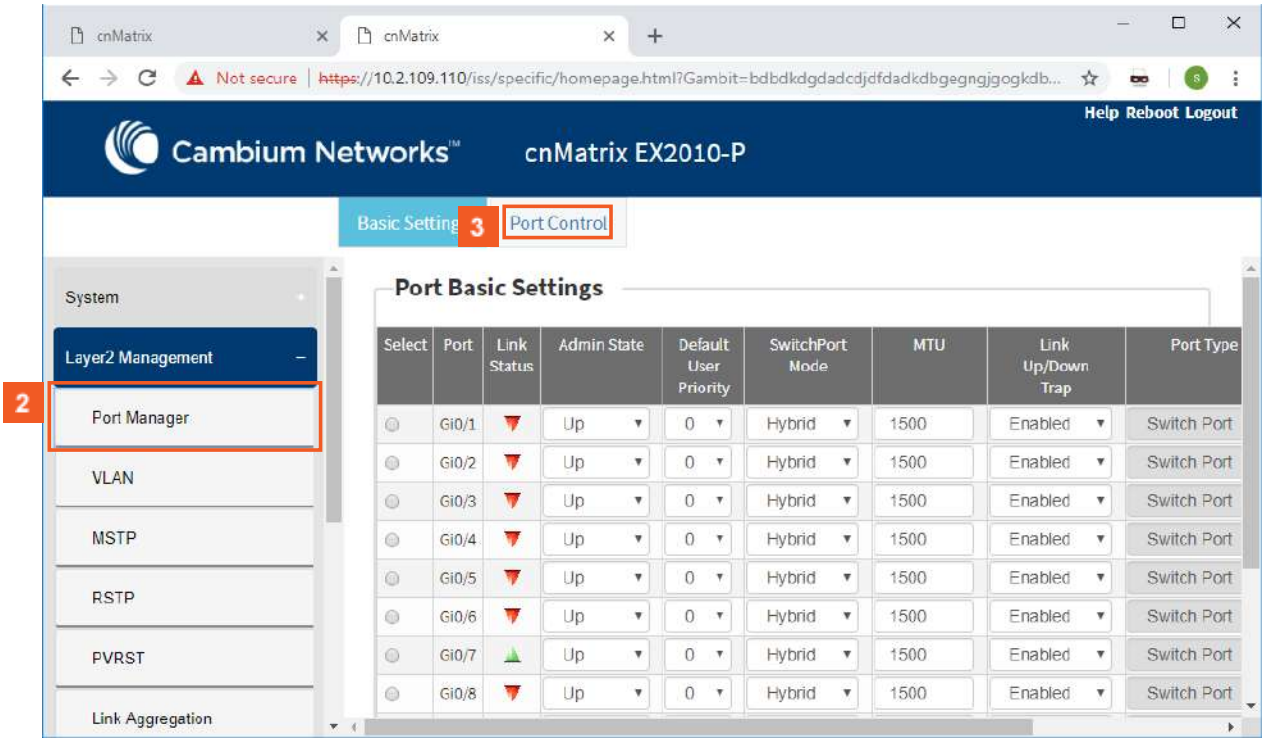
SNMP

- The object is called issPortCtrlMode and it is accompanied by an index which represents the port number. It is part of the issPortCtrlTable table.

2.6.2 Configuring Negotiation WEB

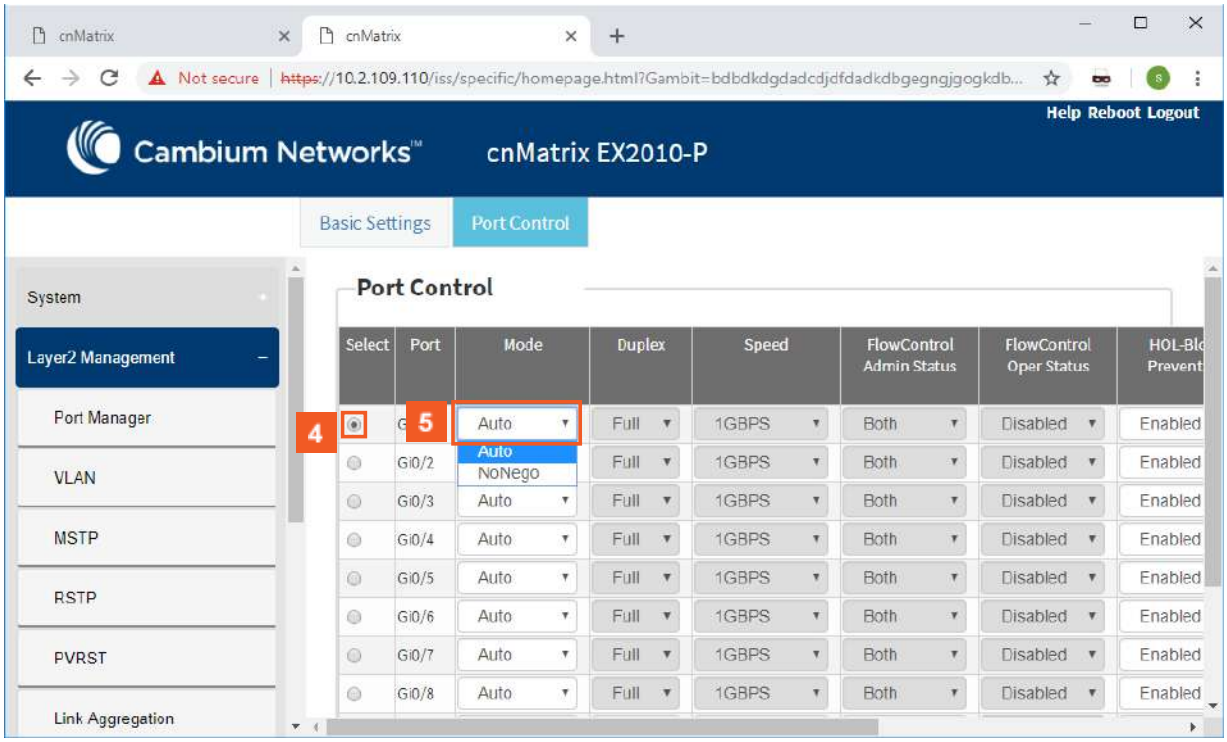


1 Click the **Layer2 Management** button.



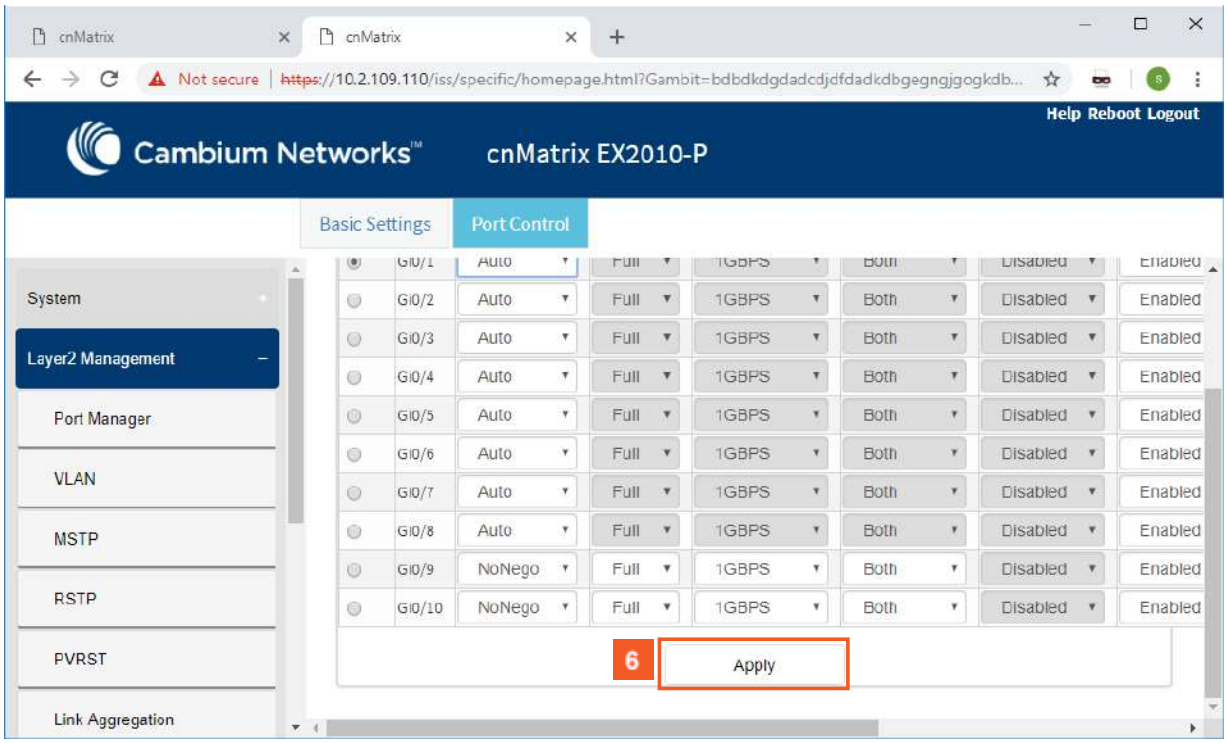
2 Click the **Port Manager** menu item.

3 Click the **Port Control** tab. The **Port Control** window is displayed.



4 Click the **Select** radiobutton and select the port for which the configuration needs to be done.

5 In the **Mode** column, select the **Auto** list item (the mode for negotiation of the port).



6 Click the **Apply** button.

Section complete. Click X to close.

2.6.3 Managing Speed

Feature Overview

The **speed** setting enables you to set the speed of the interface.

Standards

N/A

Scaling Numbers

N/A

Limitations

- Manual speed cannot be set if auto-negotiation is enabled.
- Manual speed can be set on fiber ports only if module is inserted.

Default Values

- The default speed: 1 Gbps (copper ports), 1Gbps/10Gbps(fiber ports).

Prerequisites

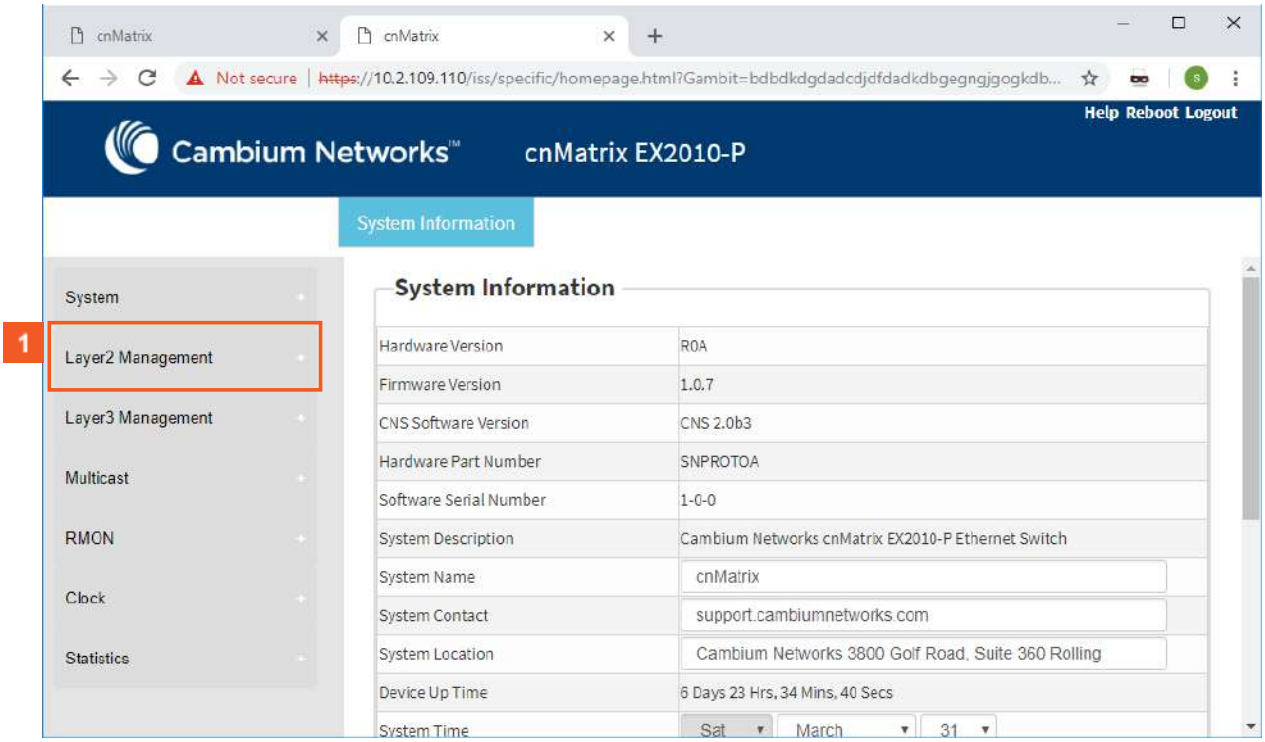
```
cnMatrix# conf terminal

cnMatrix(config)# int gi 0/1

cnMatrix(config-if)#
```

SNMP

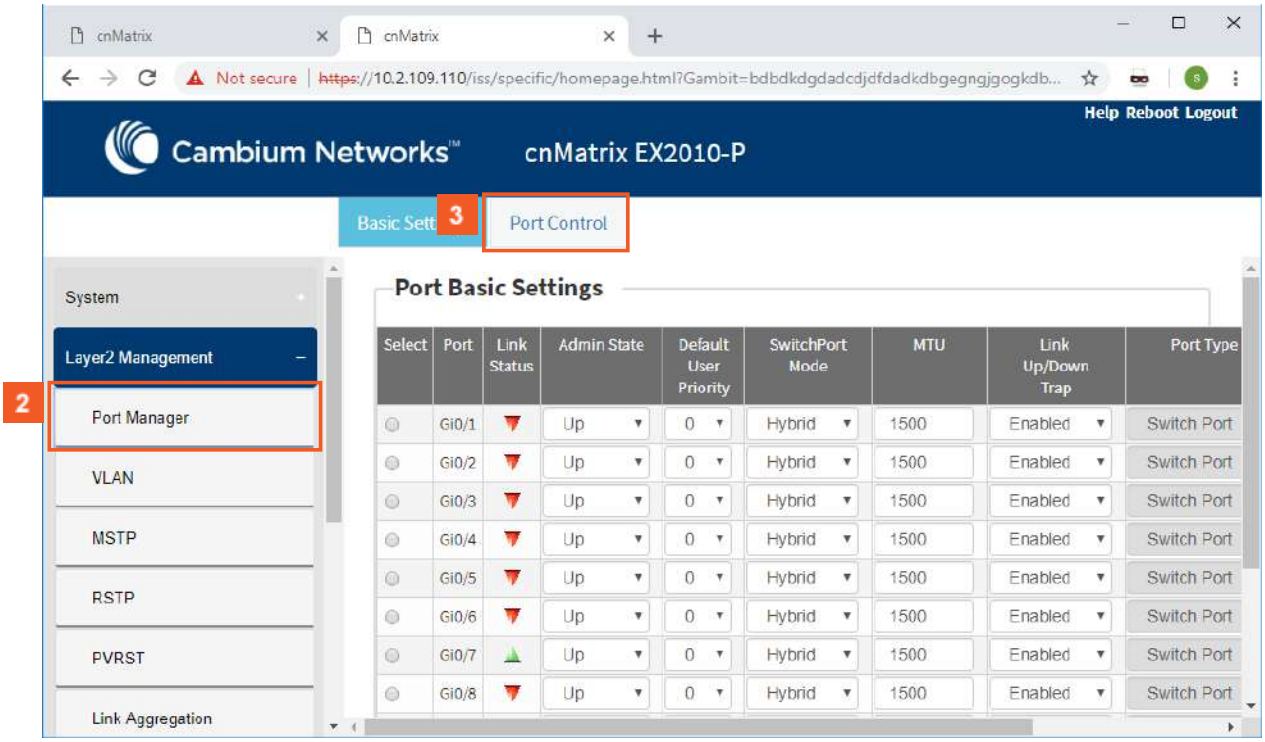
The object is called issPortCtrlSpeed and it is accompanied by an index which represents the port number. It is part of the issPortCtrlTable table.

The speed feature can be configured, only if the nogotiation **Mode** is set to **No Nego**.

2.6.4 Configuring Speed WEB

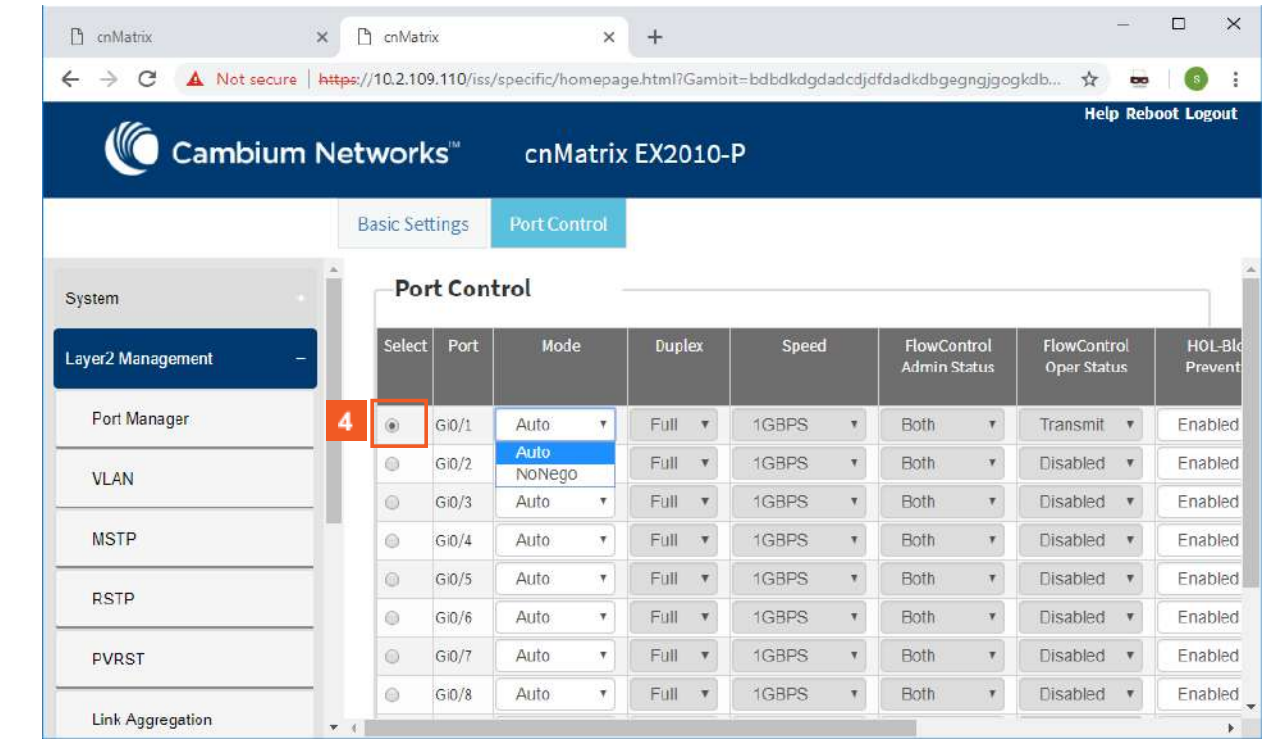


1 Click the **Layer2 Management** menu item. The **L2 Features** are displayed.

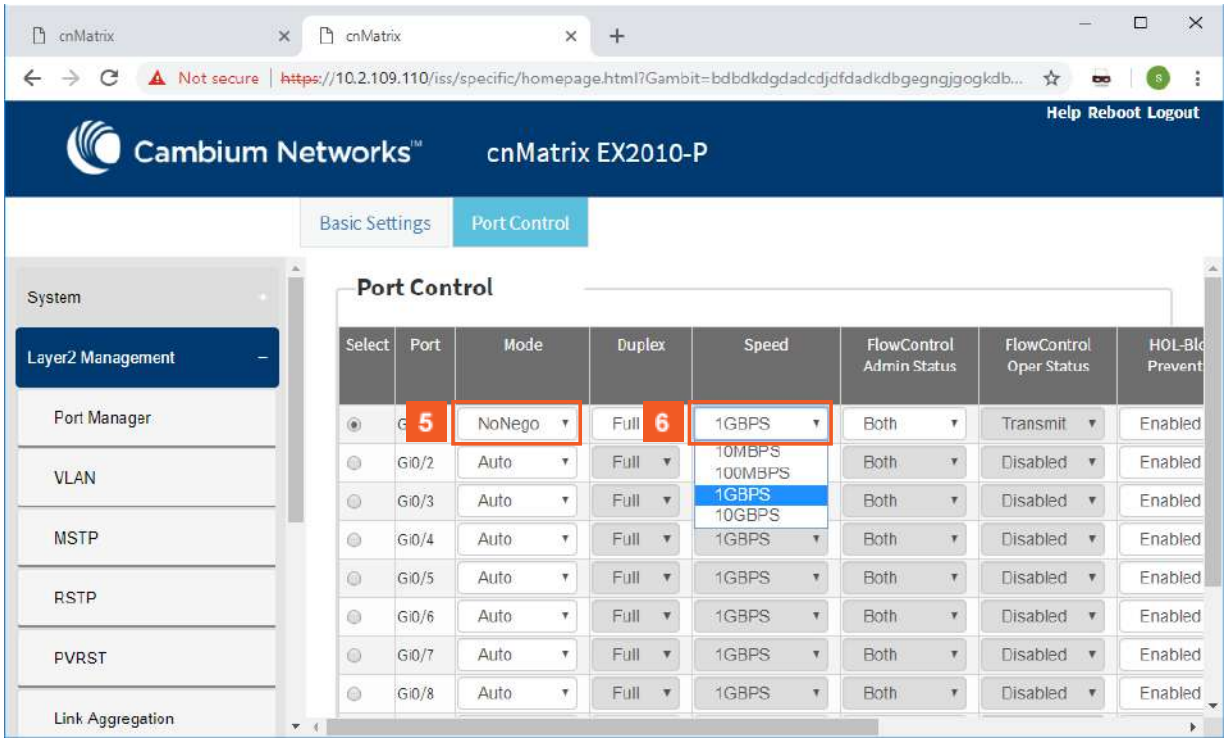


2 Click the **Port Manager** menu item.

3 Click the **Port Control** tab. The **Port Control** window is displayed.

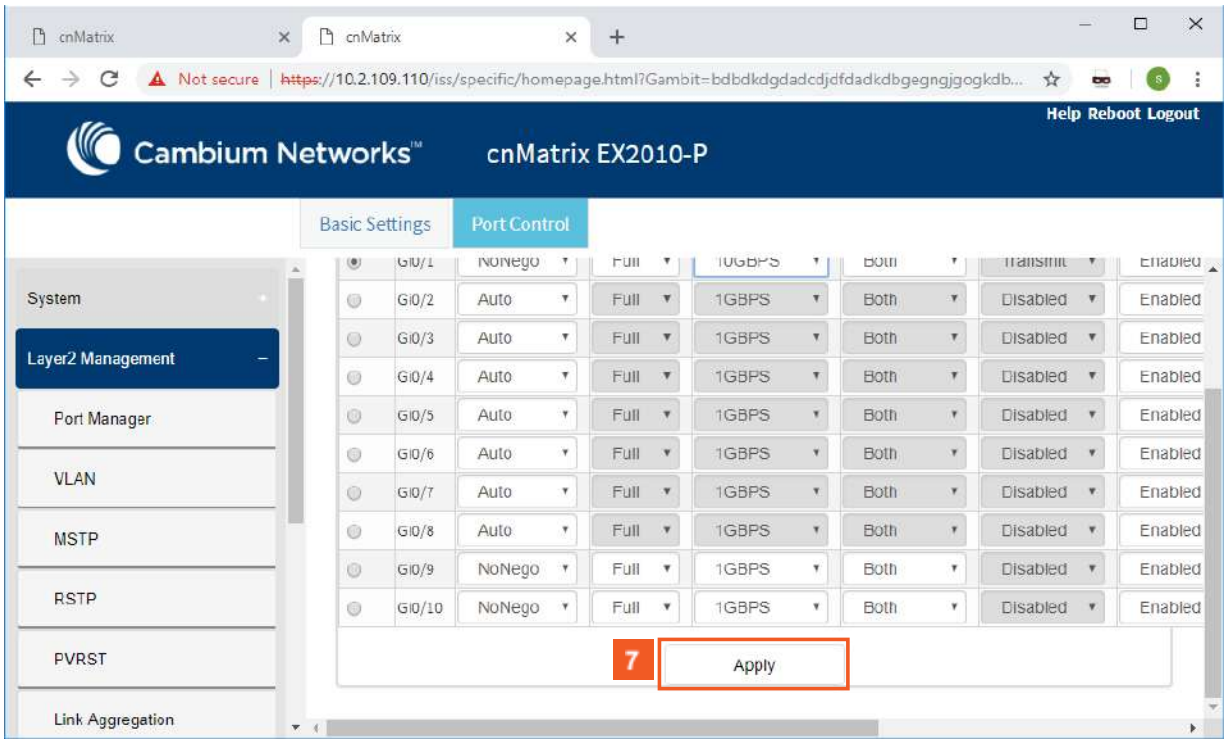


4 Click the **Select** radiobutton and select the port for which the configuration needs to be done. For example,**Gi0/1** radiobutton.



5 In the **Mode** column, select the **NoNego** list item (the mode for negotiation of the selected port).

6 In the **Speed** column, select the **1GBPS** list item (the speed of the interface).



7 Click the **Apply** button.

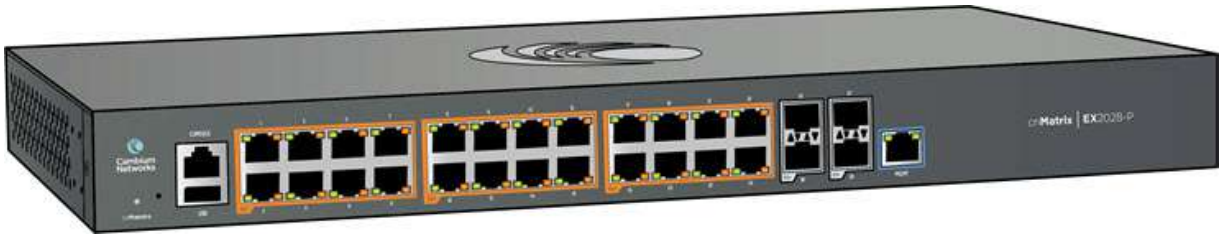
2.6.5 Managing Duplex

Feature Overview

The **duplex** setting enables you to set the port duplex mode.

Full-duplex communication improves the performance of a switched LAN. Full-duplex communication increases effective bandwidth by allowing both ends of a connection to transmit and receive data simultaneously.

The duplex mode can be configured, only if the negotiation **Mode** is set to **NoNego**.



Limitations

- Full/Half duplex cannot be set when auto-negotiation is enabled.

Default Values

- The default value: full.

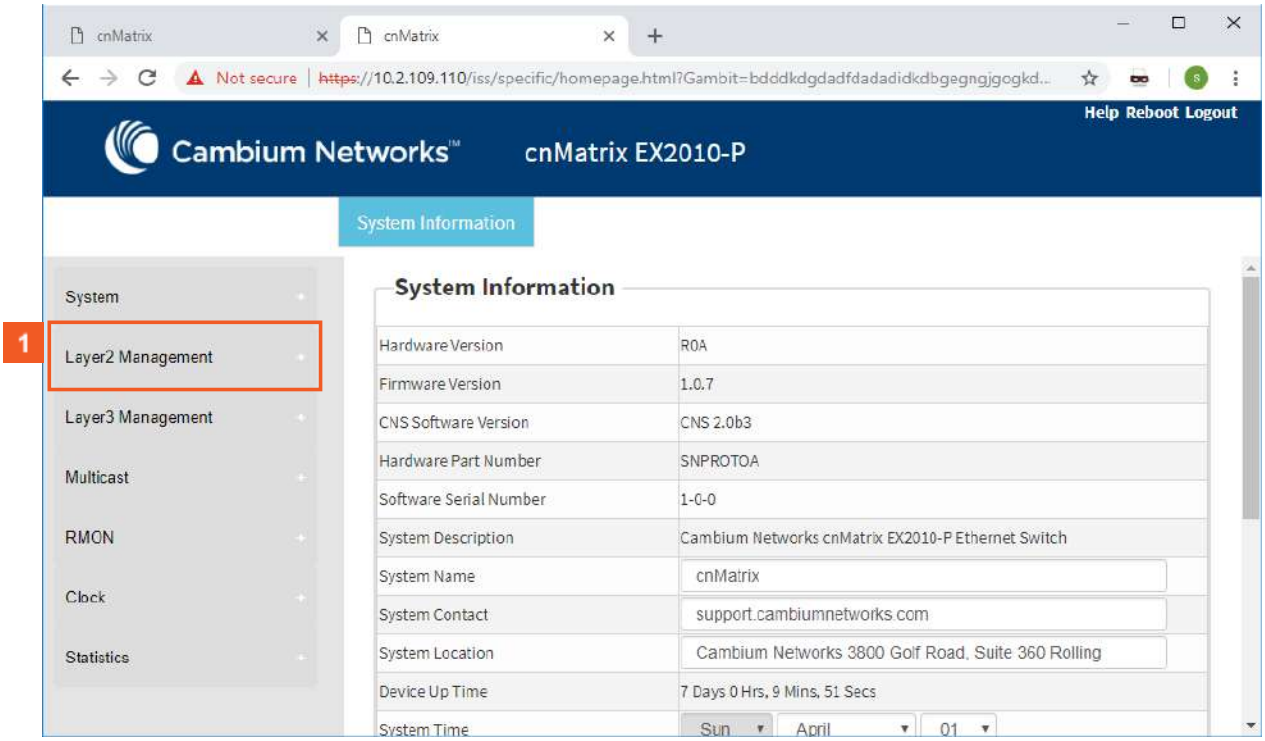
Prerequisites

- cnMatrix# conf terminal
- cnMatrix(config)# int gi 0/1
- cnMatrix(config-if)#

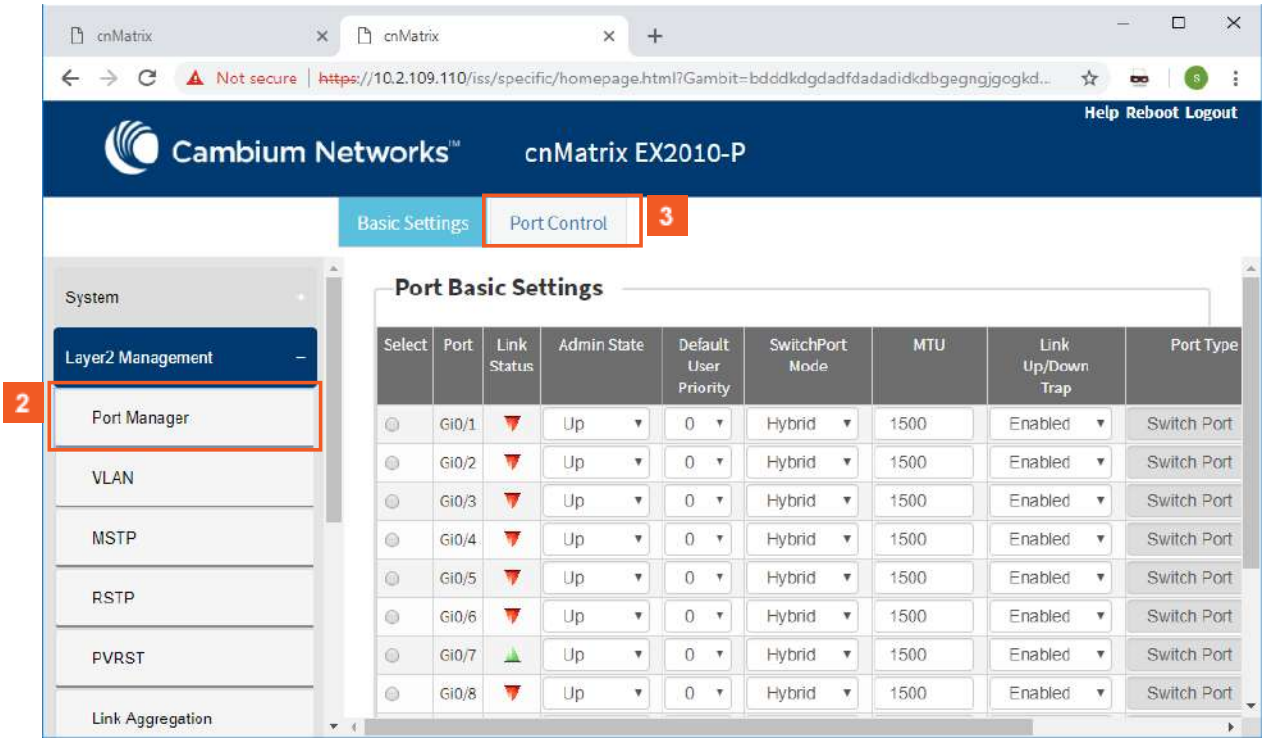
SNMP

- The object is called **issPortCtrlDuplex** and it is accompanied by an index which represents the port number. It is part of the **issPortCtrlTable** table.

2.6.6 Configuring Duplex WEB

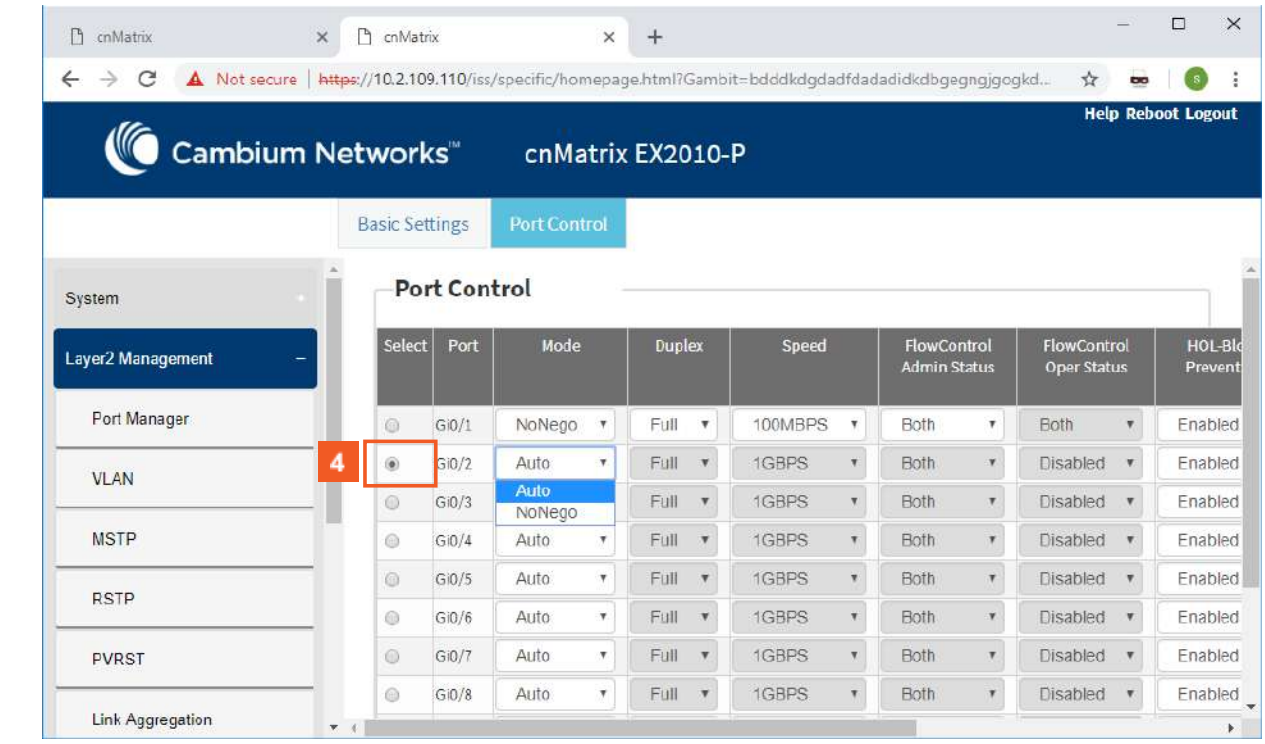


1 Click the **Layer2 Management** button. The **L2 Features** are displayed.

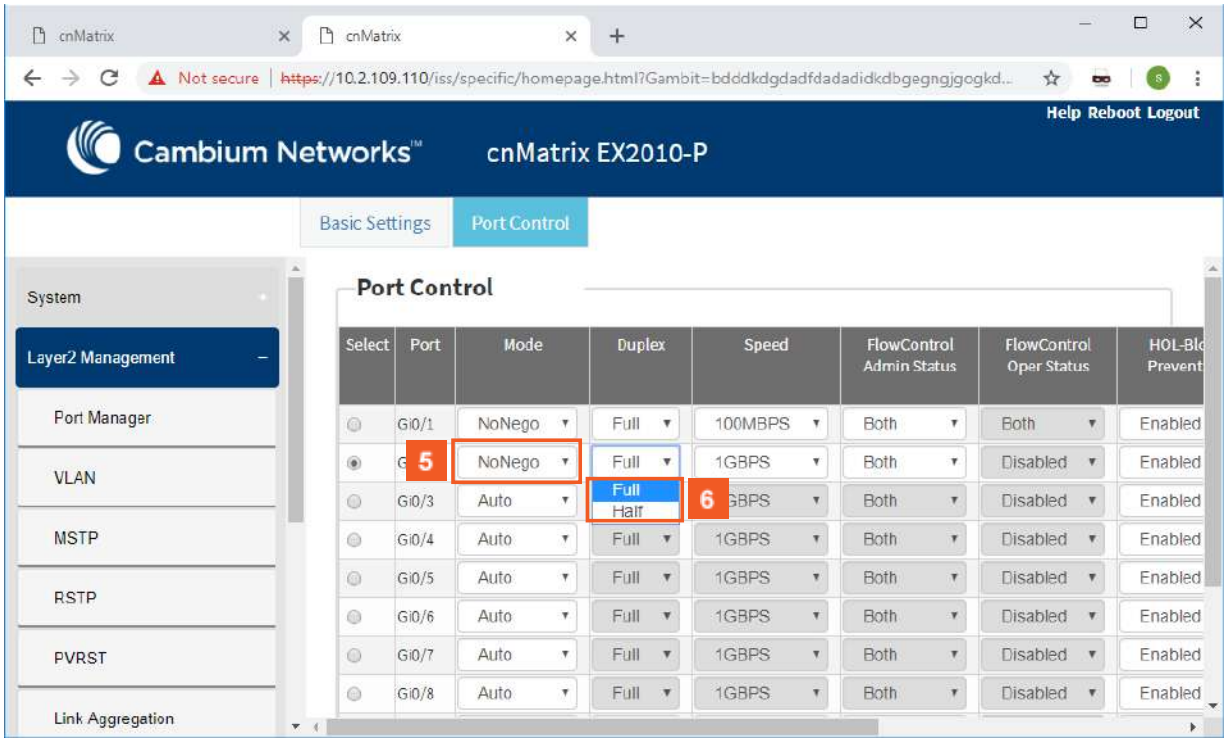


2 Click the **Port Manager** menu item.

3 Click the **Port Control** tab. The **Port Control** window is displayed.

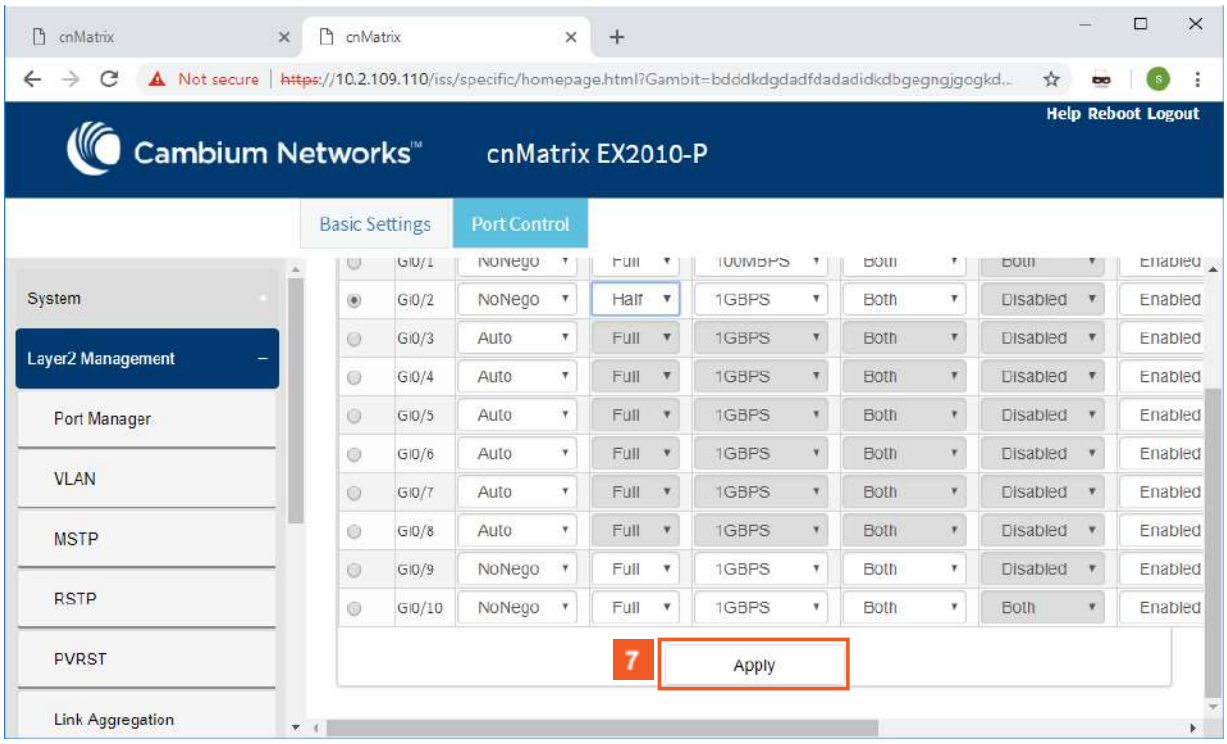


4 Click the **Select** radiobutton and select the port for which the configuration needs to be done.



5 In the **Mode** column, select the **NoNego** list item (the mode for negotiation of the port).

6 In the **Duplex** column, select the **Full** list item (the flow of data through the port).



7 Click the **Apply** button.

2.6.7 Managing MTU

Feature Overview

The MTU setting enables you to configure the maximum transmission unit size for all the frames transmitted and received on all the interfaces in a switch.

Standards

N/A

Scaling numbers

N/A

Limitations

- Port must be administratively down before configuring this setting.

Default Values

- The default MTU value: 1500 bytes.

Prerequisites

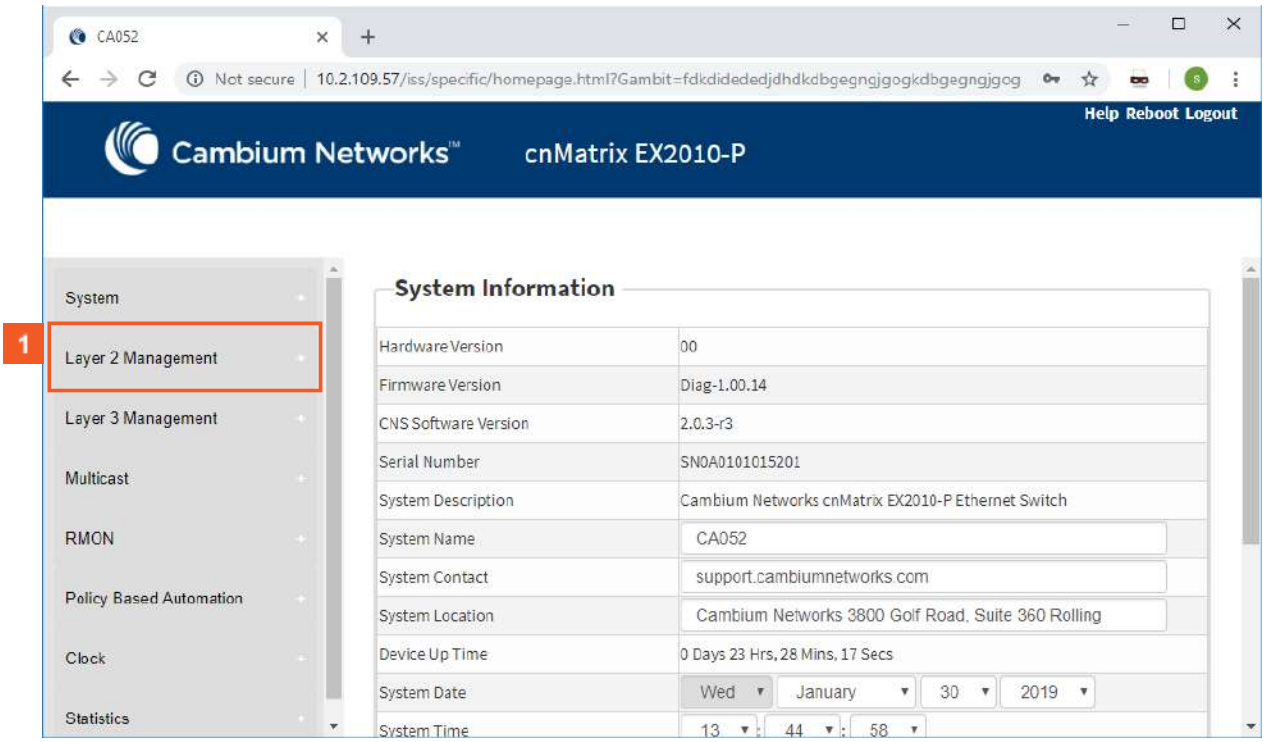
```
cnMatrix# conf terminal

cnMatrix(config)# int gi 0/1

cnMatrix(config-if)#
```

SNMP

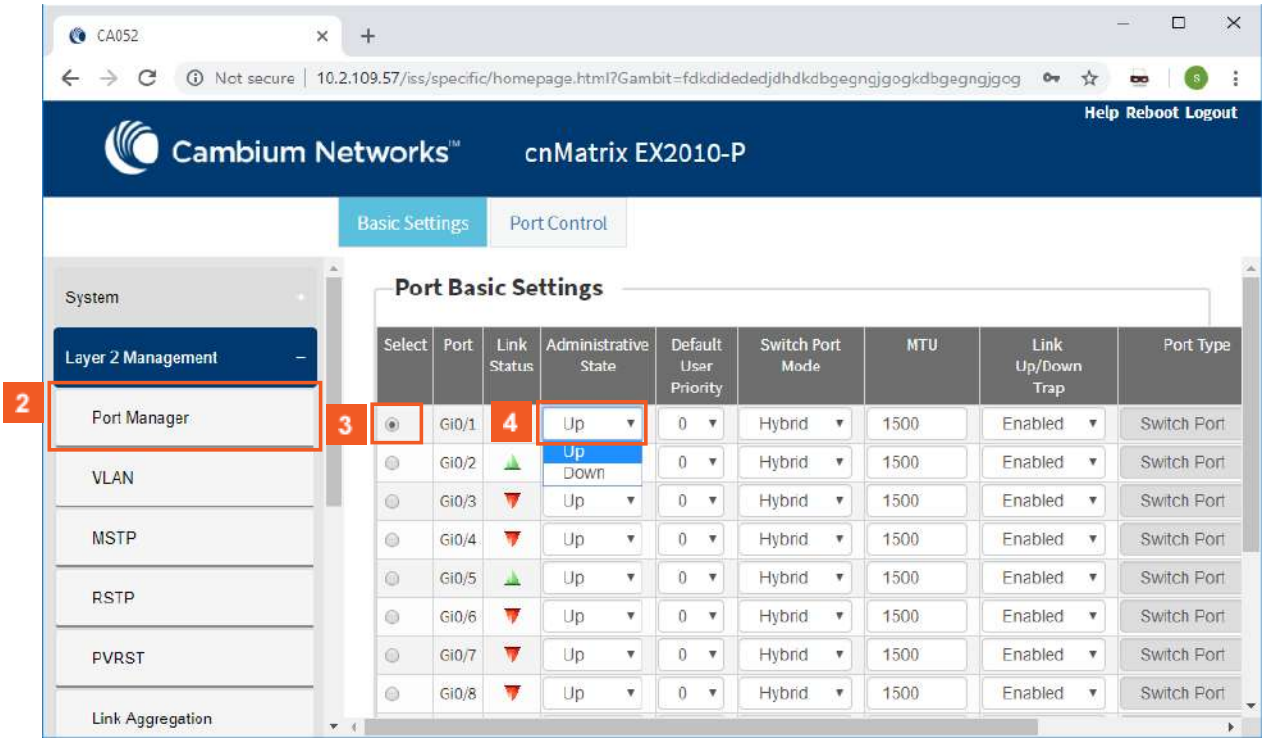
The object is called ifMainMtu and it is accompanied by an index which represents the port number. It is part of the ifMainTable table.

The MTU value can be changed, only if the **Admin State** is set as **Down**.

2.6.8 Configuring MTU (Maximum Transmission Unit) WEB



1 Click the **Layer2 Management** button. The **L2 Features** are displayed

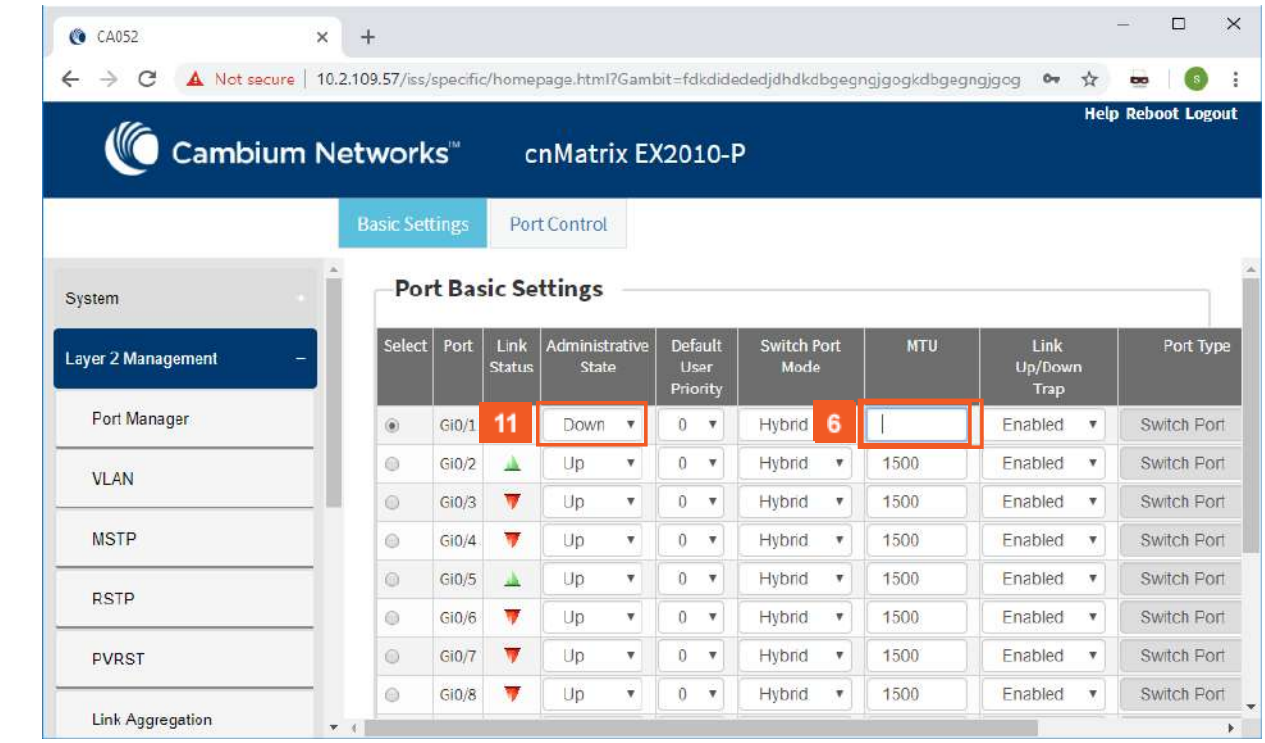


2 Click the **Port Manager** menu item.

3 Click the **Select** radio button and select the port for which the configuration needs to be done.

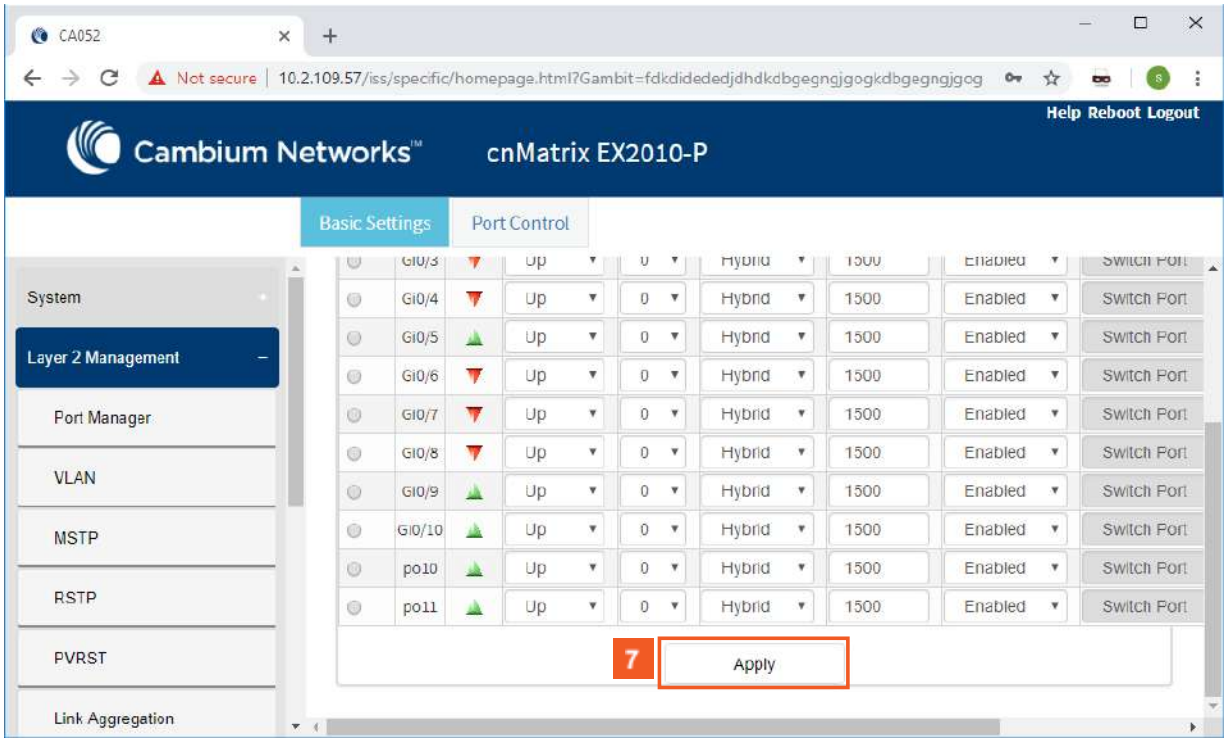
Make sure that the selected port is not part of the port channel group.

4 In the **Administrative State** column, select the **Down** list item (the desired state of the port).



5 In the **MTU** column, type the maximum transmission unit frame size MTU for the interface.

6 Enter **1000** into the **MTU** field.



7 Click the **Apply** button.

2.6.9 Managing Flow Control

Feature Overview

Flow Control is a per-port feature that detects packet congestion at its end and notifies the link partner by sending a pause frame. By enabling Flow Control, both the Tx (sending of pause frames) and Rx (receiving and obeying pause frames originating from a partner) are enabled.Flow control can be enabled manually on a per-port basis, or by auto-negotiation with a compatible link partner.

Standards

- IEEE 802.3x

Scaling Numbers

N/A

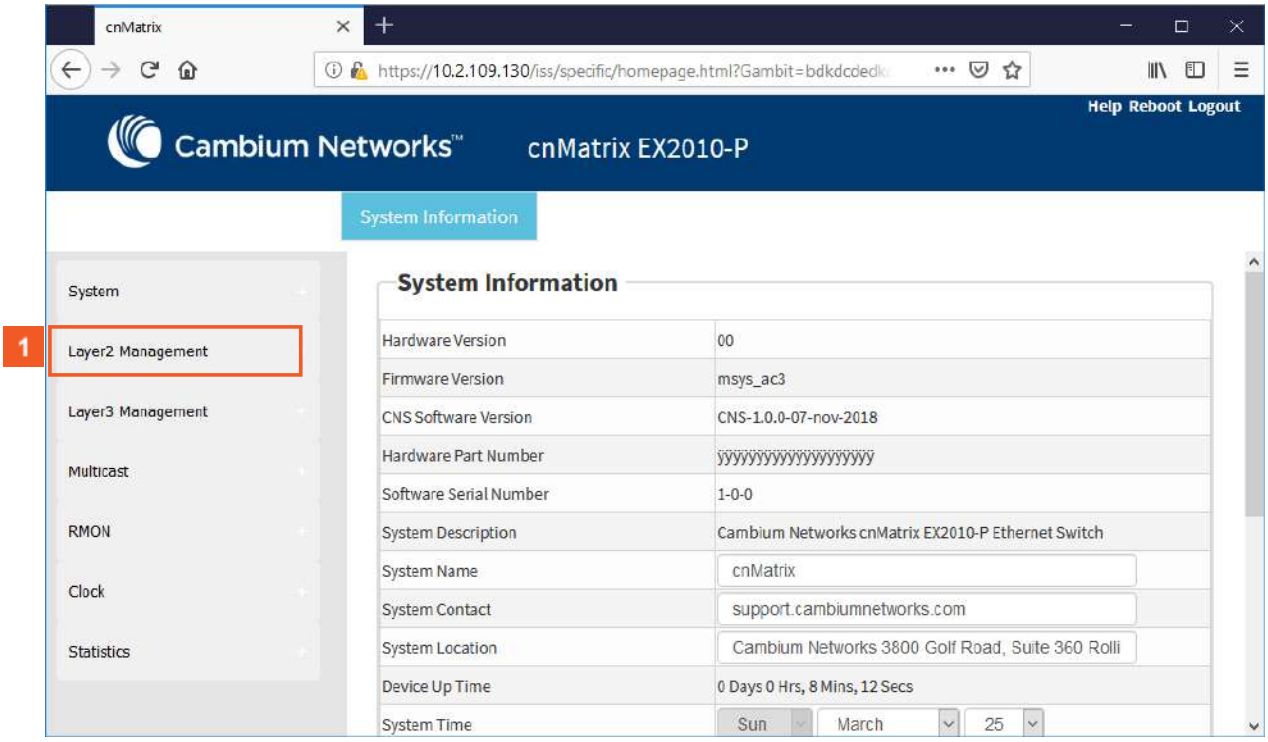
Limitations

- This feature requires the port to be down while the setting is changed.
- This feature only works in full-duplex mode.
- Flow control can be either disabled or enabled on both RX and TX, not separately on RX or TX.

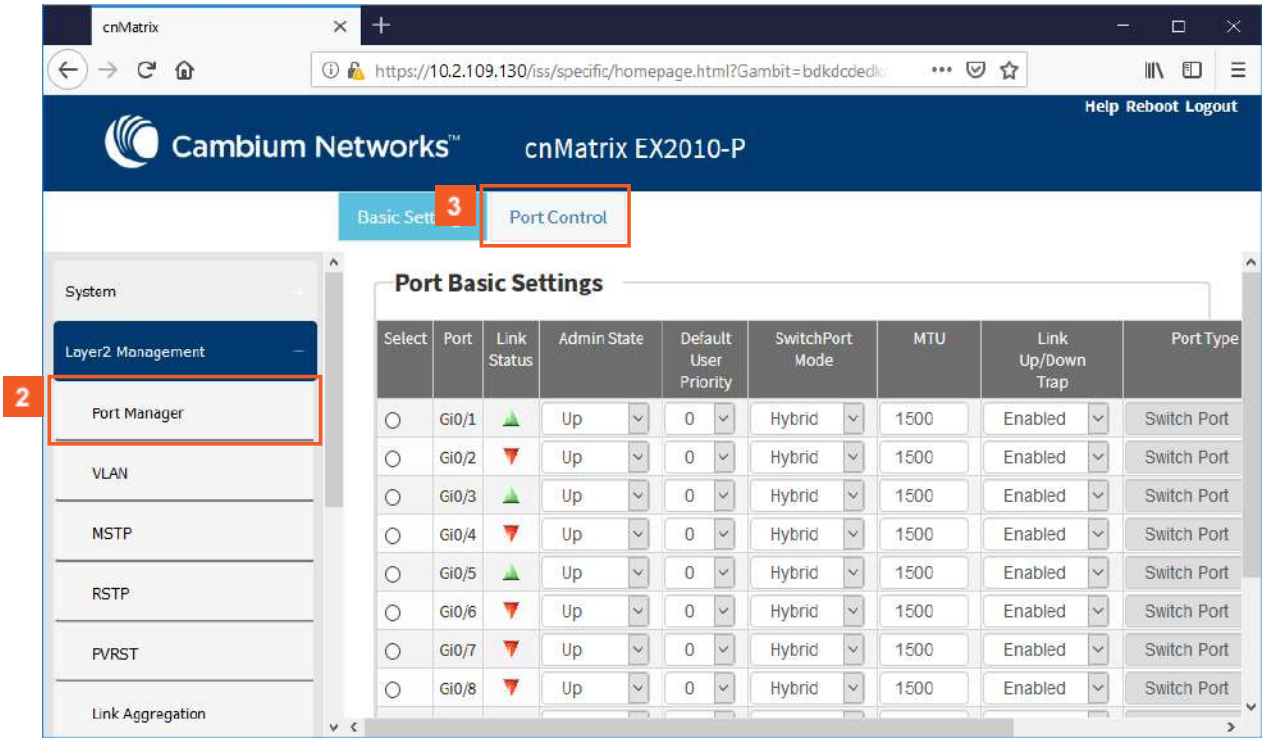
Default Values

- By default, auto-negotiation is enabled on all ports. If the compatible link partner advertises flow control capability, flow control will be operationally enabled.

2.6.10 Configuring Flow Control WEB

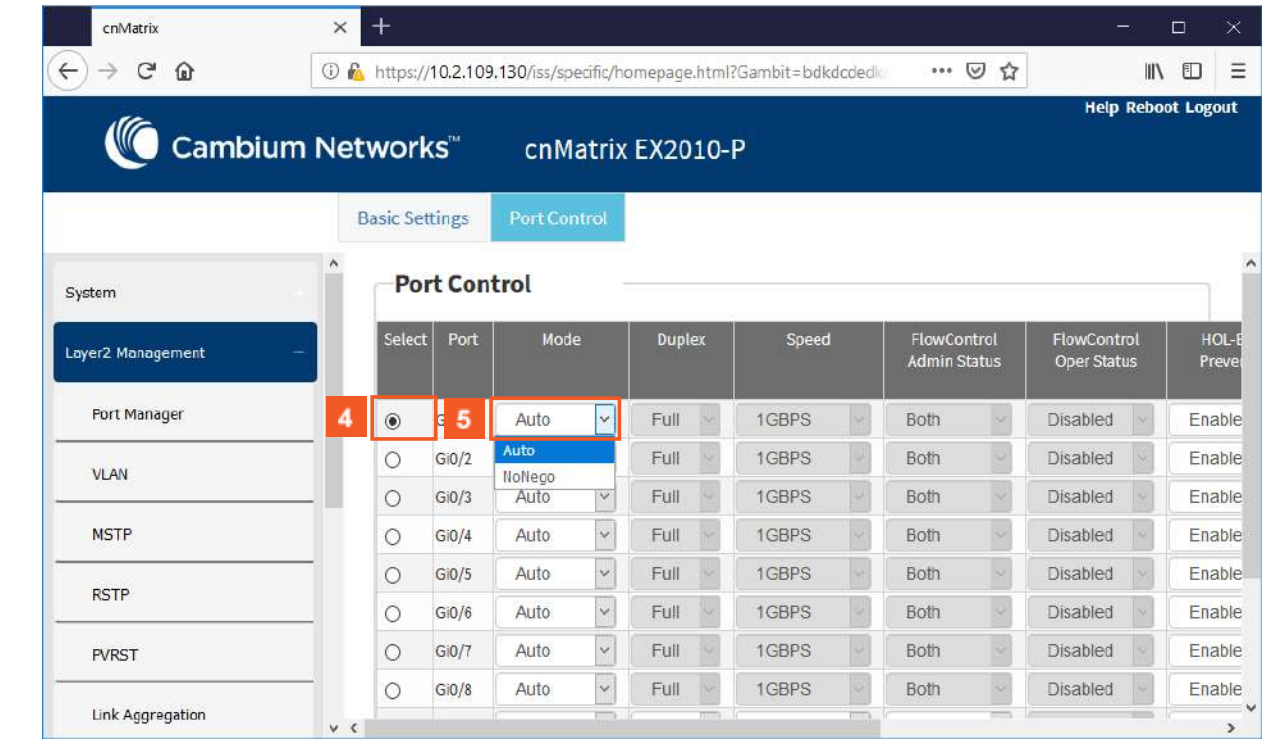


1 Click the **Layer2 Management** button. The **L2 Features** are displayed.



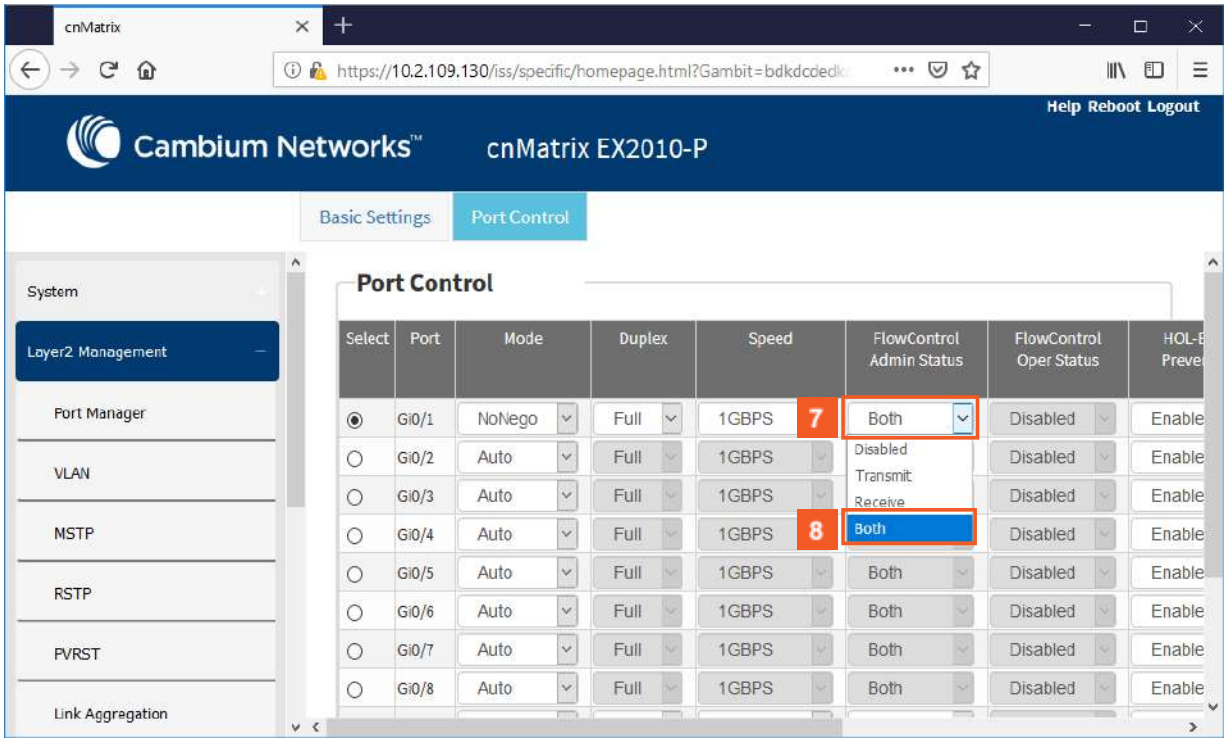
2 Click the **Port Manager** menu item.

3 Click the **Port Control** tab. The **Port Control** window is displayed.



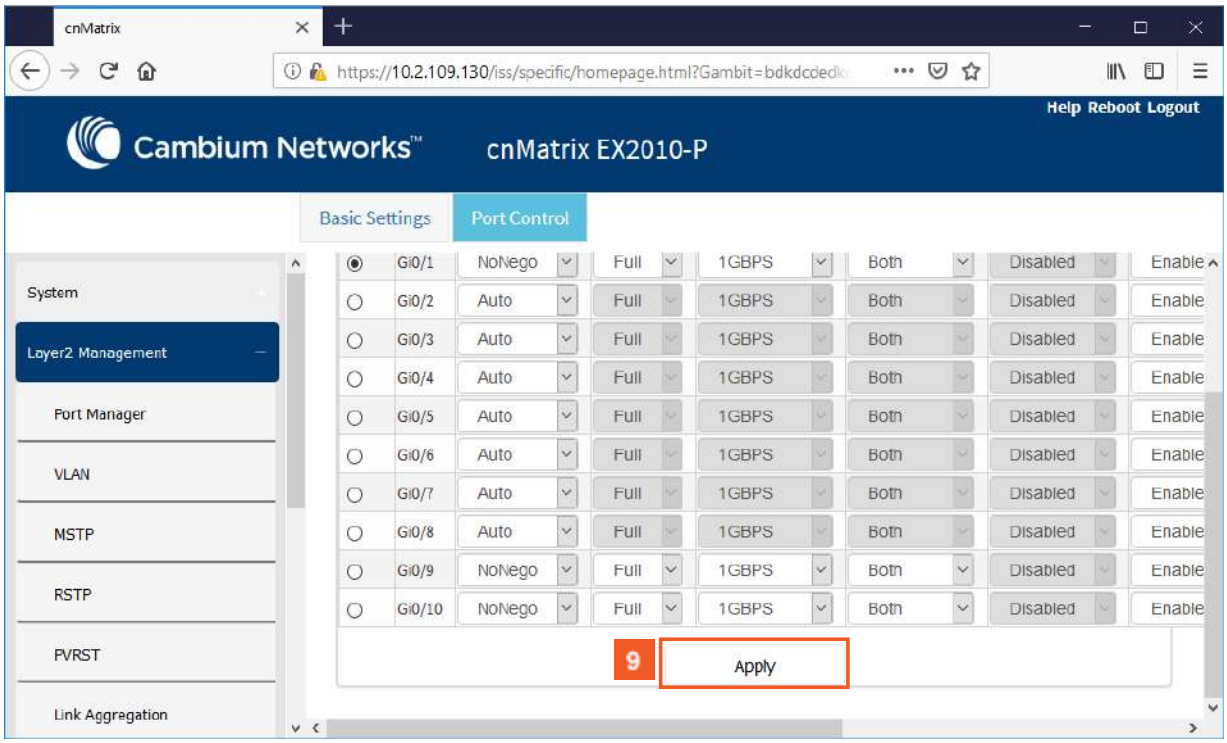
4 Click the Select radiobutton and select the port for which the configuration needs to be done. For example, Click the **Gi0/1** radiobutton.

5 In the **Mode** column, select the **Auto** list item (the mode for negotiation of the port).



7 In the **FlowControl Admin Status** column, select from the drop-down the default administrative pause mode for the interface.

8 Select the **Both** list item.



9 Click the **Apply** button.

Section complete. Click X to close

2.7 Link Aggregation

2.7.1 Managing Link Aggregation

2.7.1.1 Feature Description

Feature Overview

The **Link Aggregation** feature enables you to combine physical network links into a single logical link so that you can have increased bandwidth, higher link availability and increased link capacity.

Standards

- IEEE 802.3ad

Scaling Numbers

- Maximum 8 Ports per Port Channel.
- Maximum 8 Port Channels on Switch.

Limitations

- Maximum 8 Ports per Port Channel.
- Maximum 8 Port Channels on Switch.

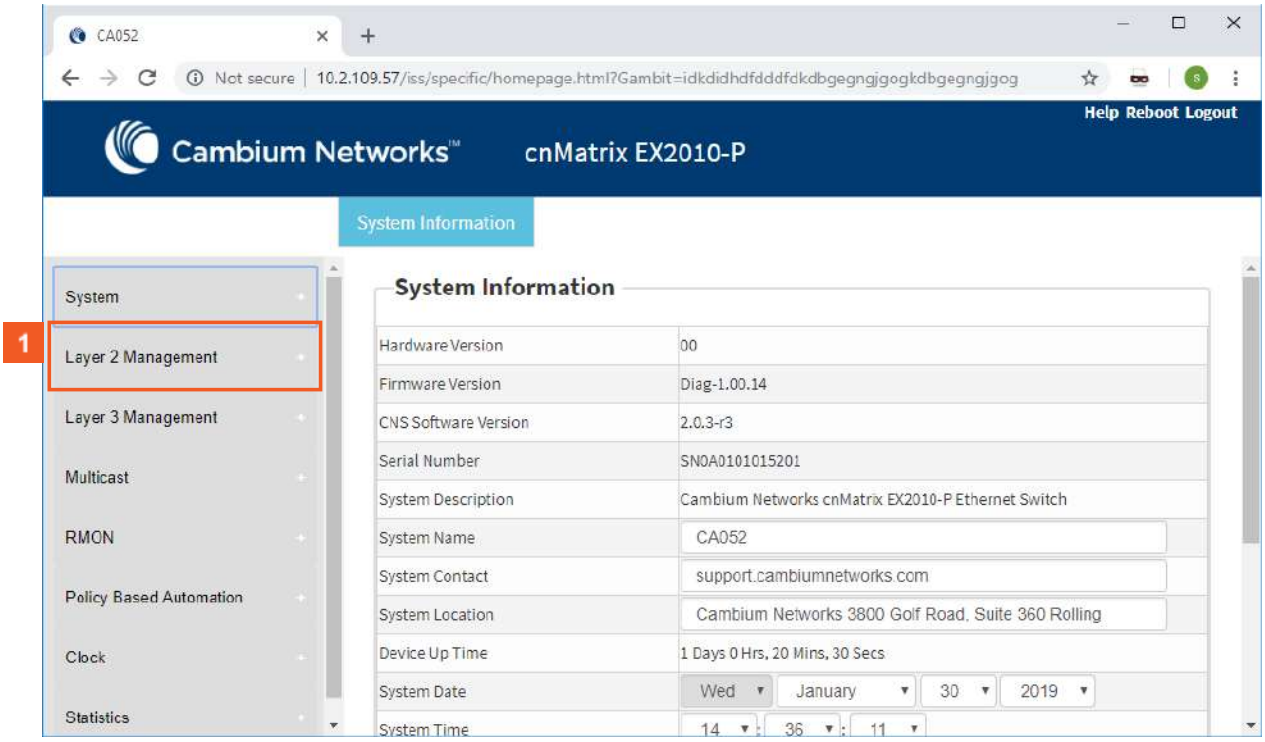
Default Values

- The Link Aggregation feature is enabled by default.
- The admin status of the Link Aggregation Status in the switch is disabled by default.
- The default LACP wait-time: 2.
- The default LACP timeout period: long.
- The default LACP rate: normal.

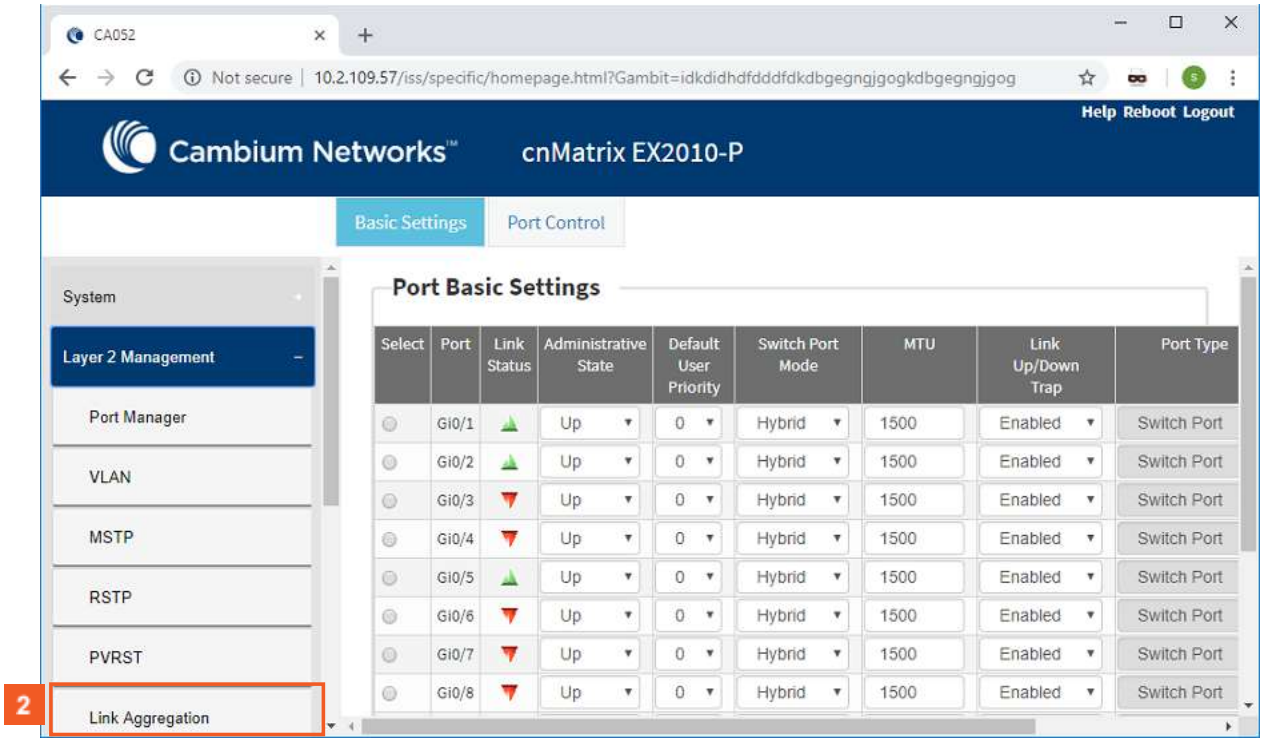
Prerequisites

N/A

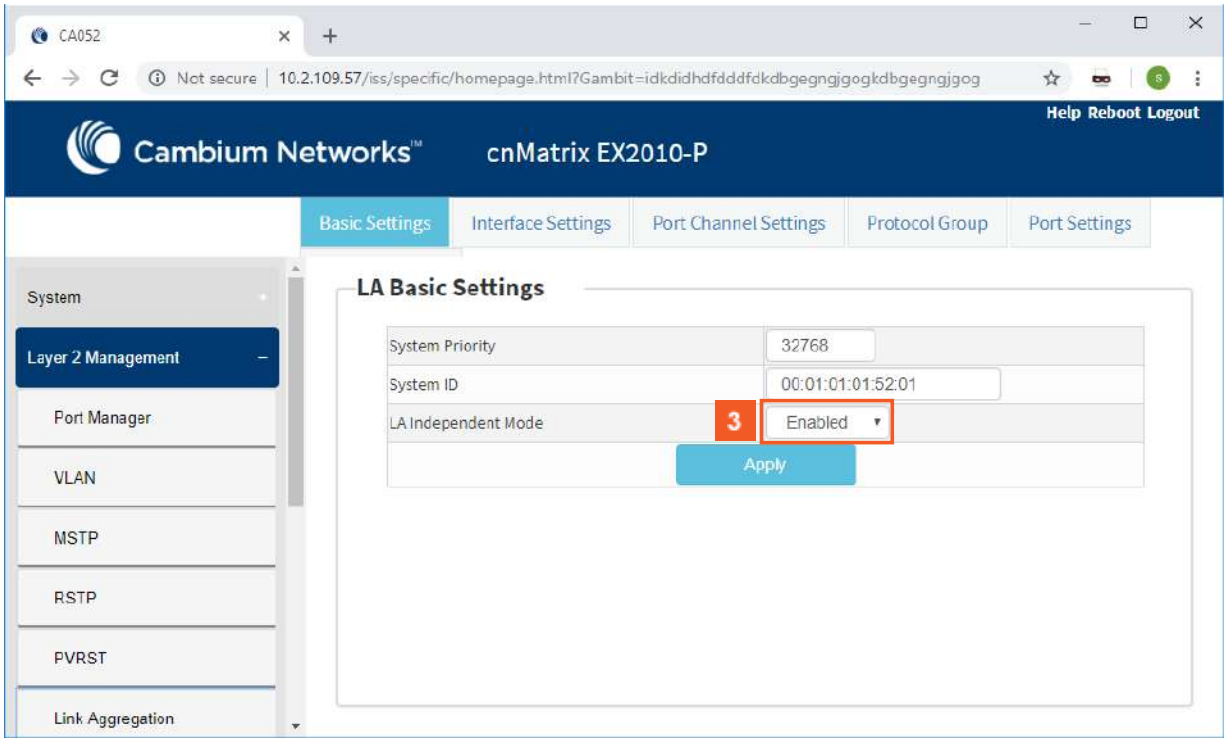
2.7.2 Configuring Link Aggregation in WEB



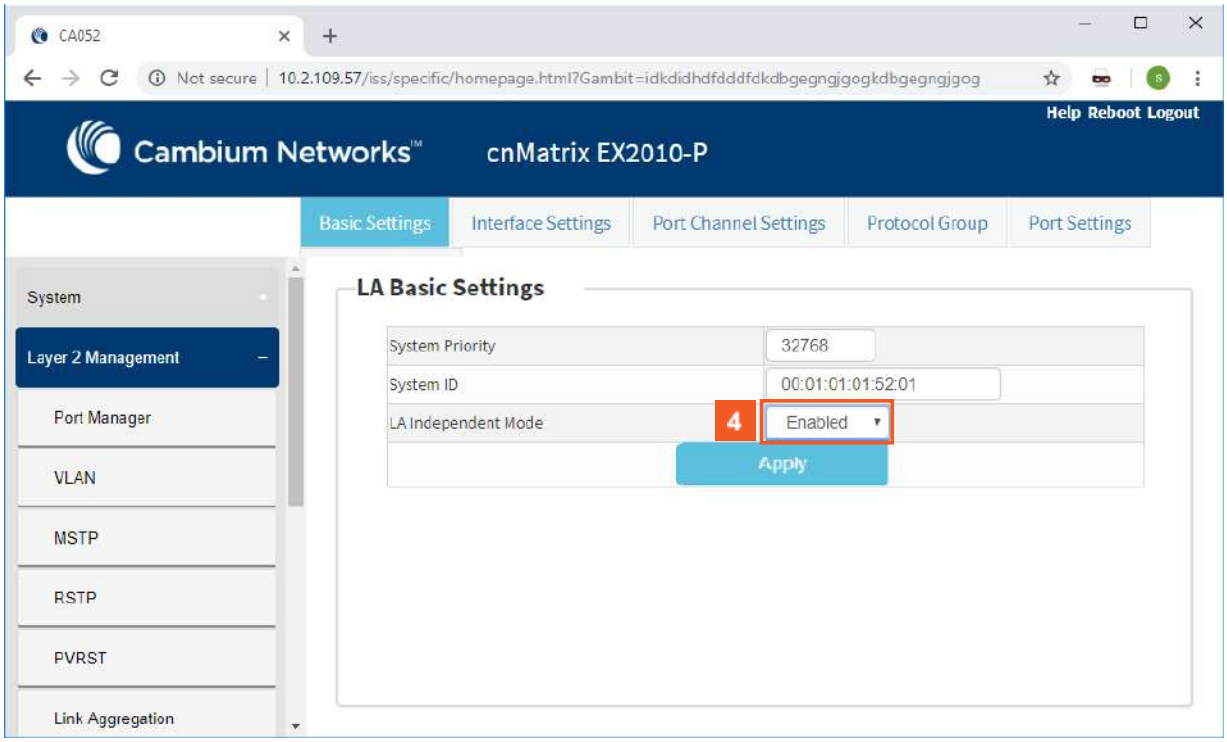
1 Click the **Layer2 Management** button. The **L2 Features** are displayed.



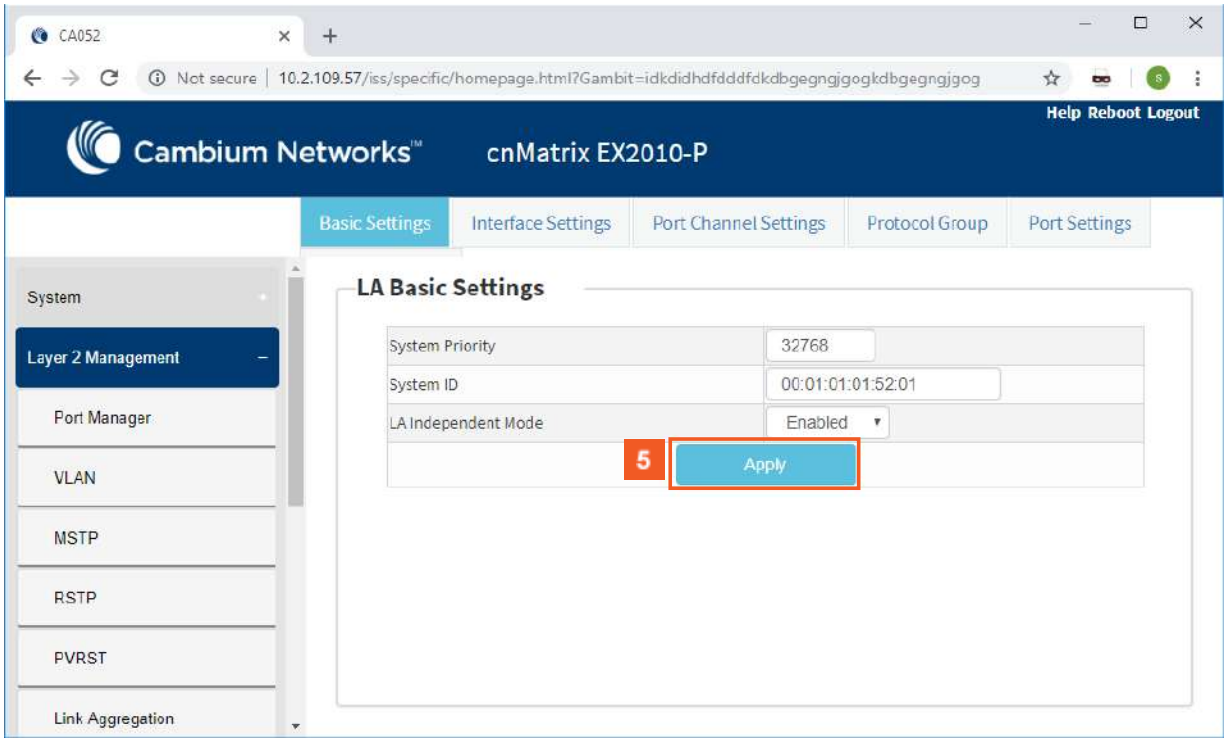
2 Click the **Link Aggregation** menu item.



3 Click the **LA Independent Mode** drop-down button and select the independent mode of the Link Aggregation module.



4 Select the **Enabled** list item.



5 Click the **Apply** button.

2.8 Private VLAN Edge

2.8.1 Managing Private VLAN Edge

2.8.1.1 Feature Description

When a port has protected status, it no longer forwards any L2 traffic (unicast, multicast, broadcast) to any other port that is also protected and on the same switch. What enables you to control the flow of the Layer 2 Traffic on the switch is the PVLAN Edge feature.

Standards

N/A

Scaling Numbers

- All front panel ports can be set to have protected status.

Limitations

N/A

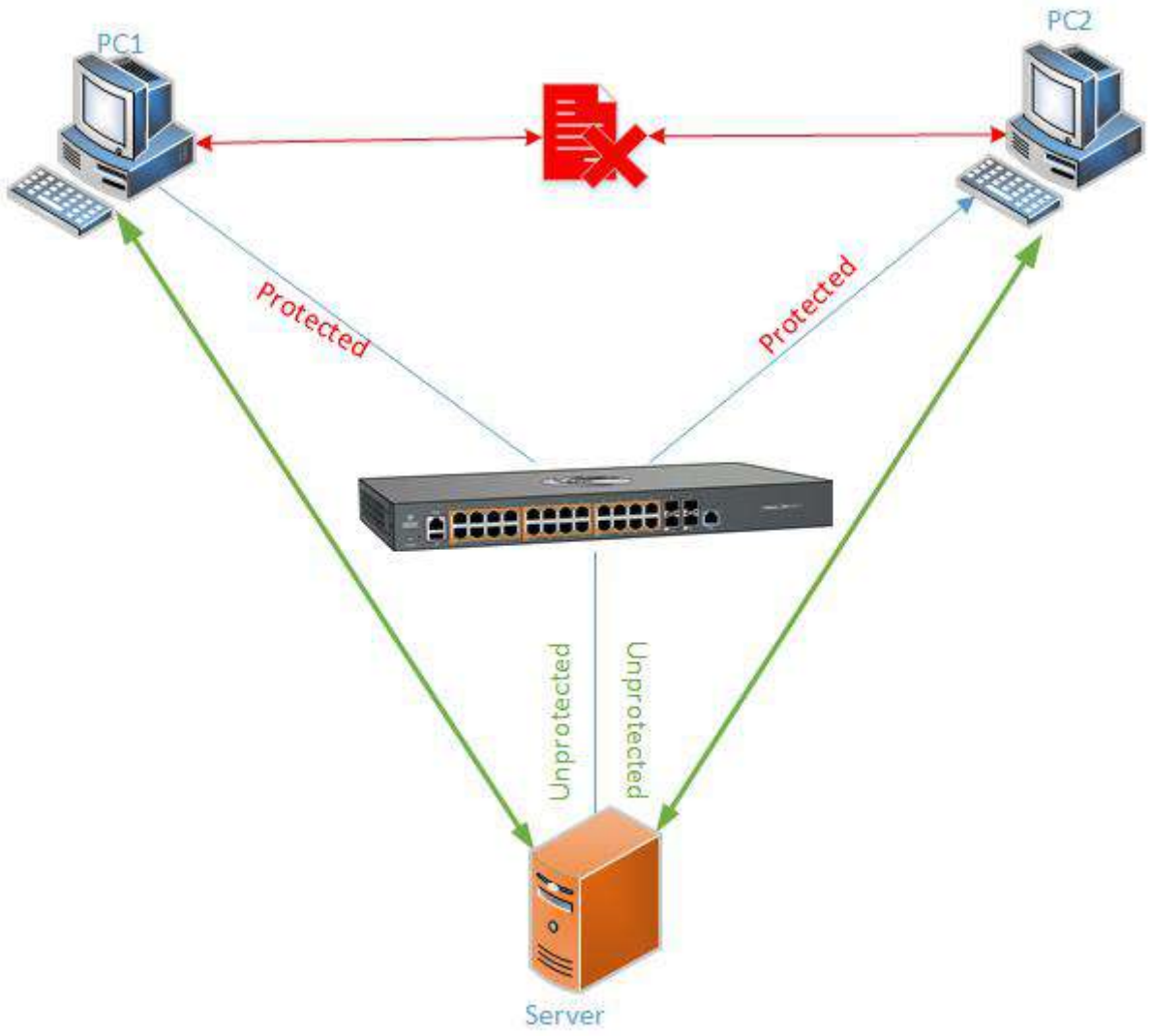
Default Values

- By default the switch boots with protected status disabled for all ports.

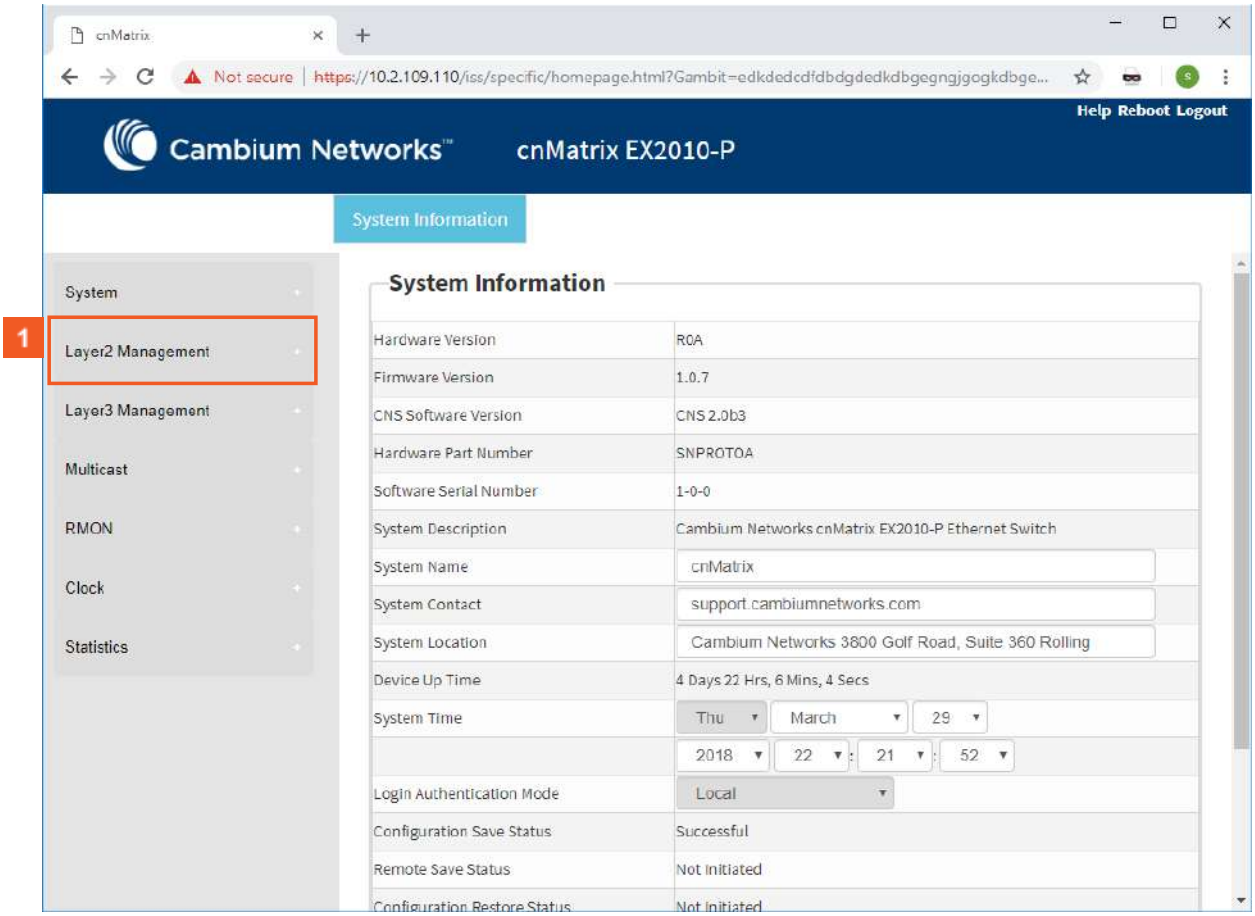
Prerequisites

```
cnMatrix# config terminal
```

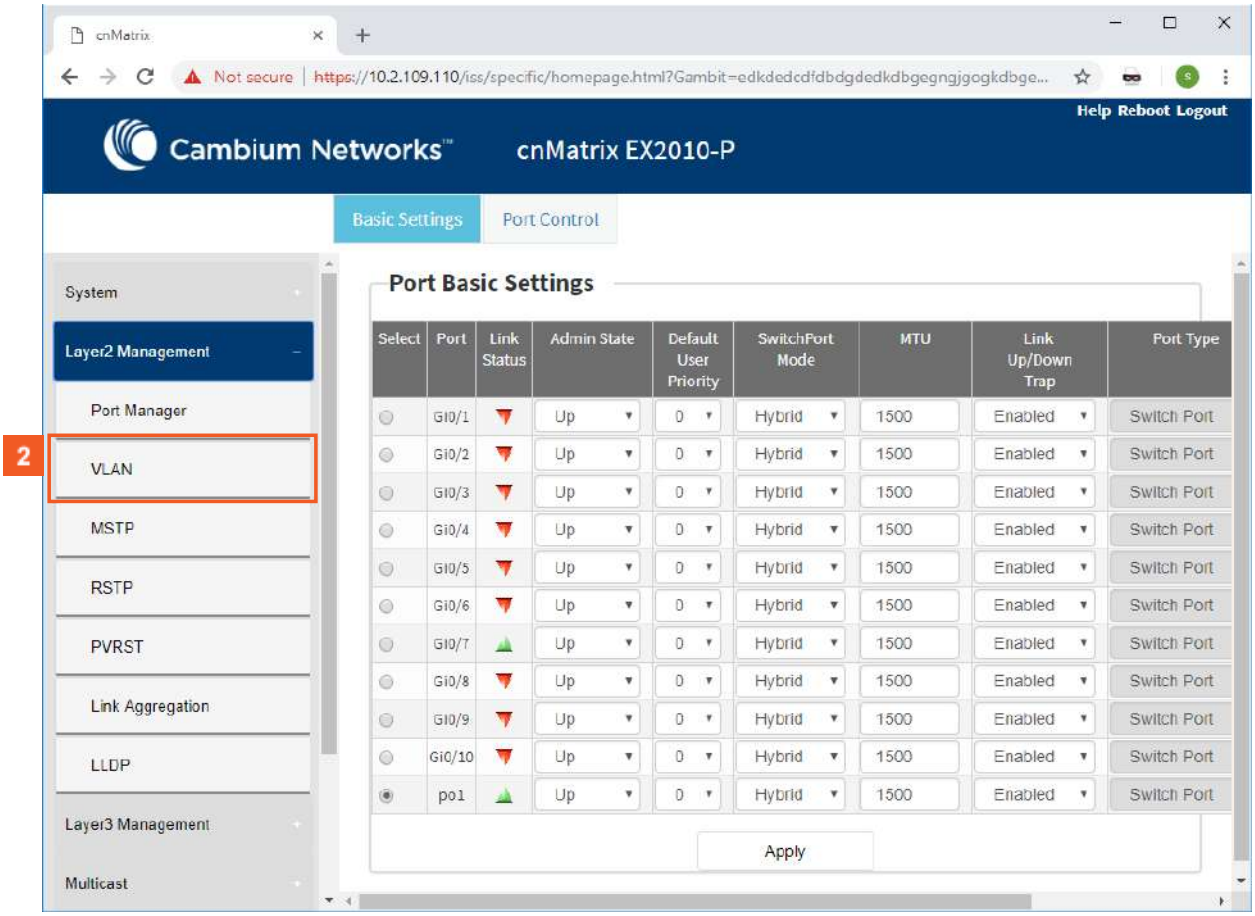
2.8.1.2 Feature Description



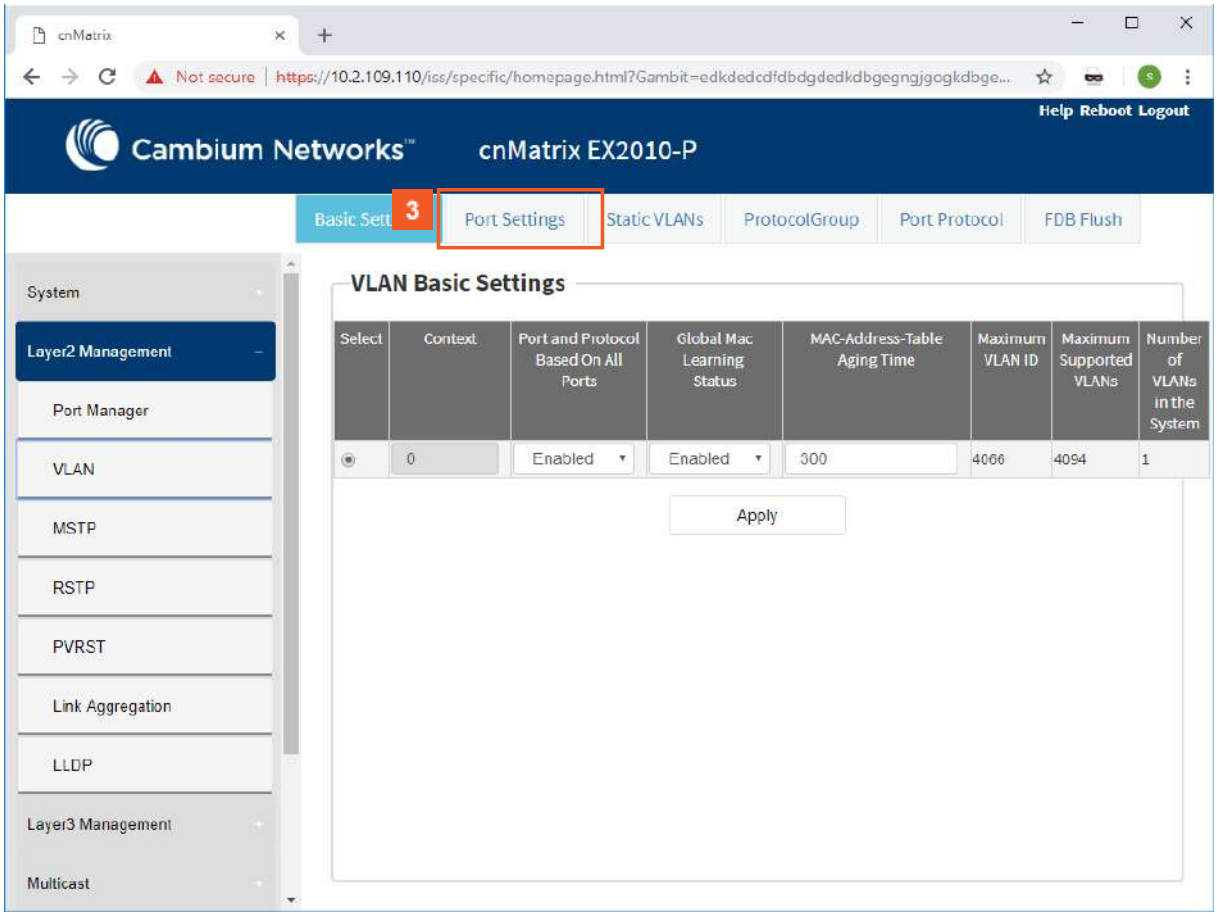
2.8.2 Configuring Private VLAN Edge WEB



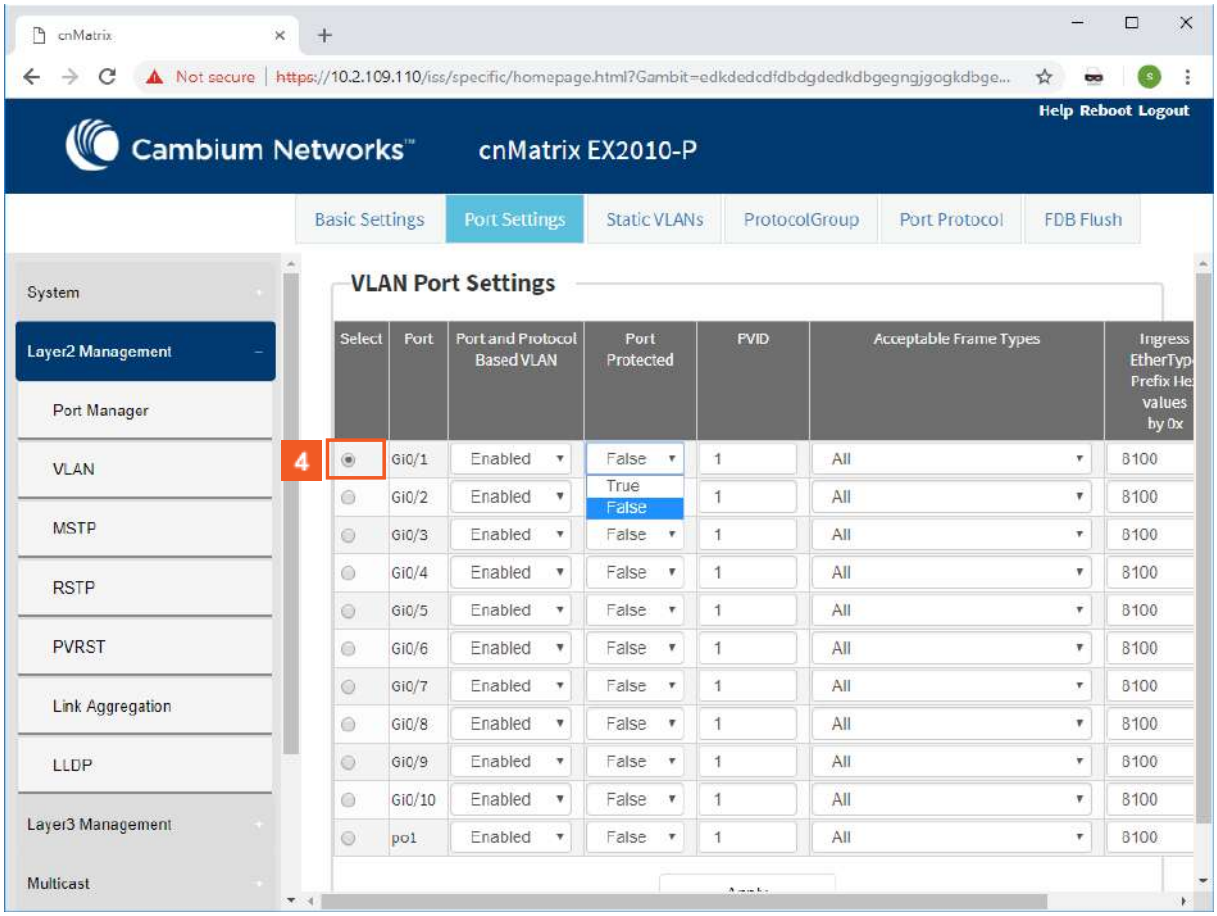
1 Click the **Layer2 Management** button. The **L2 Features** are displayed



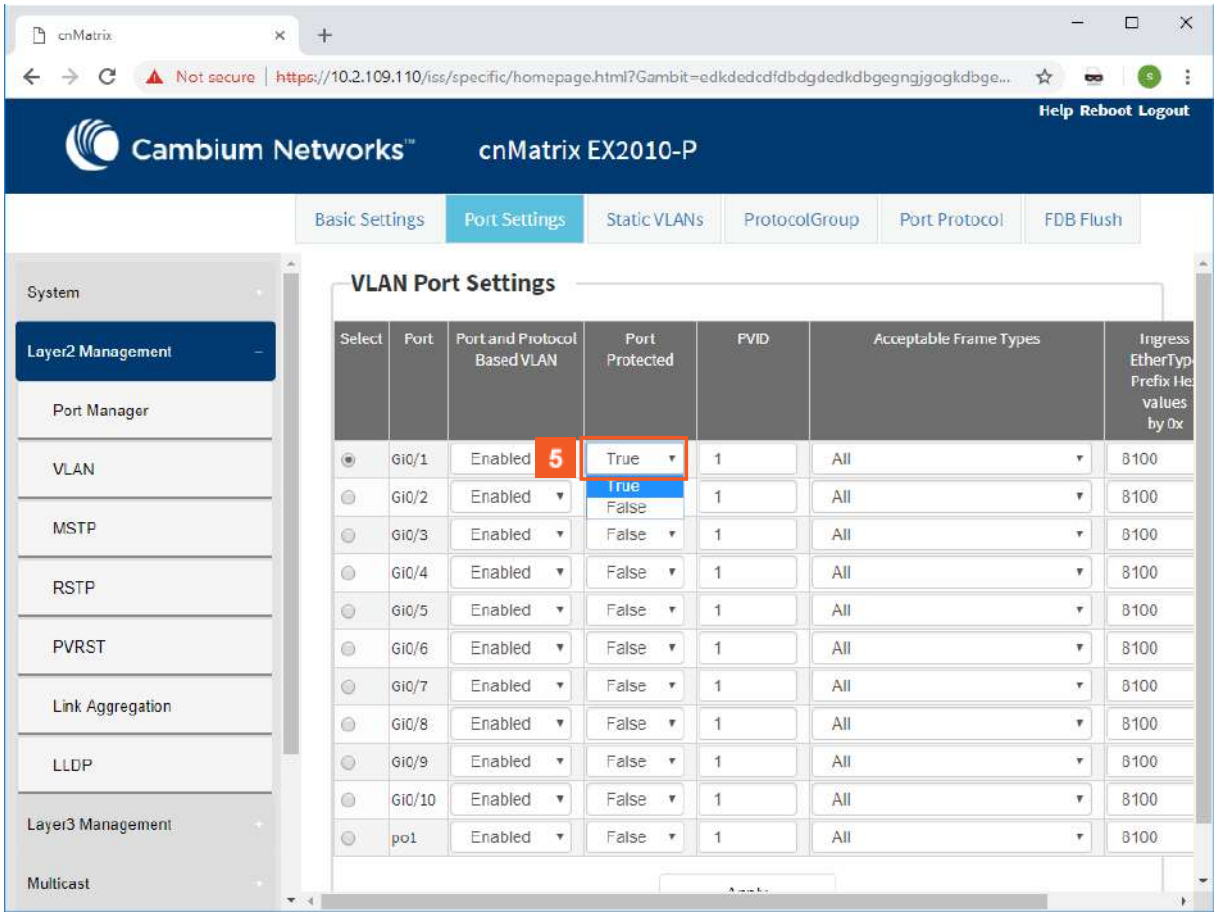
2 Click the **VLAN** menu item.



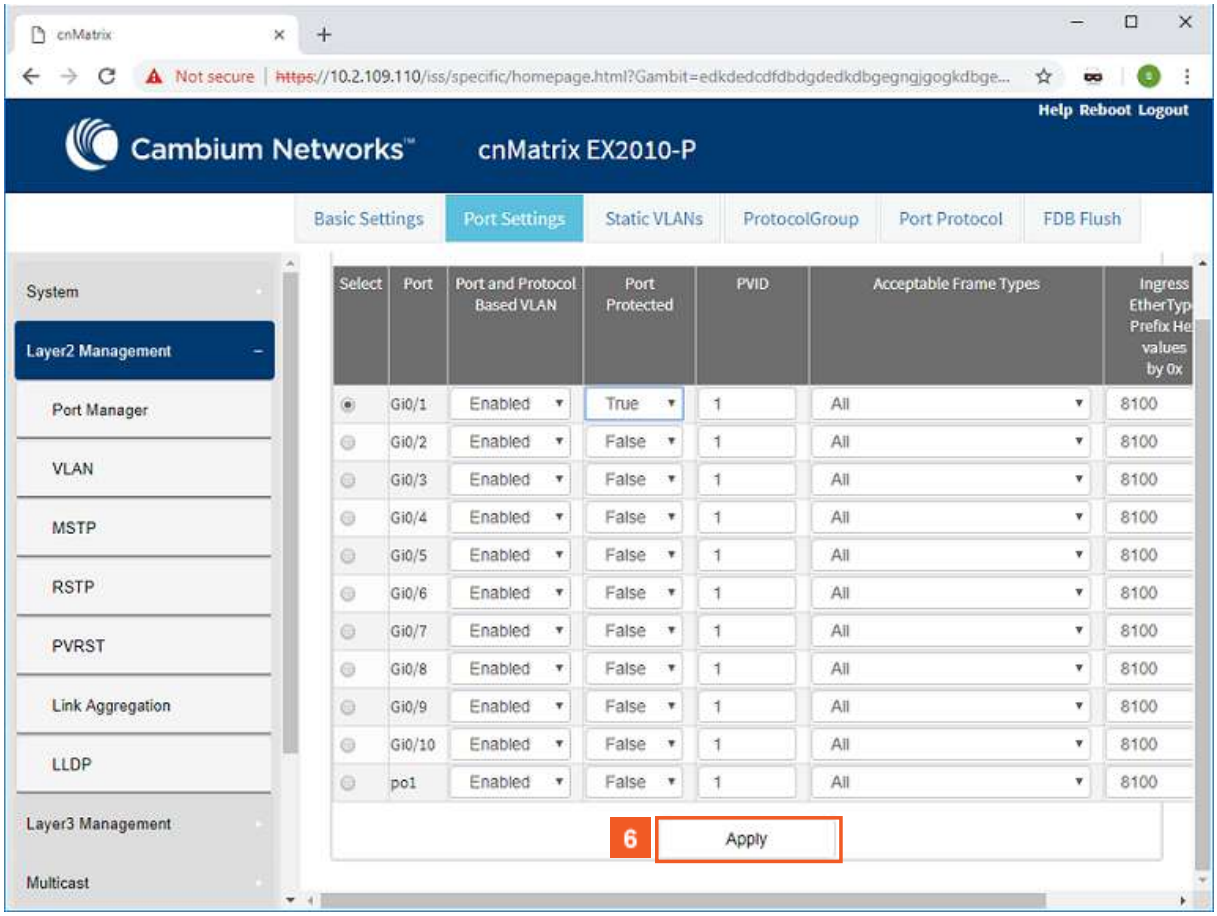
3 Click the **Port Settings** tab.



4 Click the **Select** radiobutton and select the port for which the configuration needs to be done. For example, click the **Gi0/1** radiobutton.



5 In the **Port Protected** column, select whether the port should be configured as protected or not. Select the **True** list item.



6 Click the **Apply** button.

2.9 Power over Ethernet

2.9.1 Managing PoE (Power over Ethernet)

Feature Overview

The **PoE** feature enables data connection and electric power to be transmitted to devices such as wireless access points, IP cameras and VOIP phones. Power over Ethernet technology is a system that transmits electrical power, along with data, to remote devices over standard twisted-pair cable in an Ethernet network.

Standards

- IEEE 802.3af
- IEEE802.3at

Scaling Numbers

N/A

Limitations

N/A

Default Values

- The PoE feature is enabled by default, both globally and per-port.
- The power inline priority is set to low by default.

2.10 Port Mirroring

2.10.1 Managing Port Mirroring

2.10.1.1 Feature Description

The **Port Mirroring** feature is used on the switch to send a copy of network packets available on one switch port (or an entire VLAN) to a network monitoring connection on another switch port or local sniffer device.

The following port mirroring modes are supported:

- Port based – mirror ingress/egress/ingress and egress packets from one source interface or multiple source interfaces to a destination interface.
- VLAN based – mirror packets tagged with a specific VLAN ID to a destination interface.
- IP/MAC ACL based – any packets that match an ACL rule are also forwarded to a mirroring interface.

Standards

N/A

Scaling Numbers

- A maximum of 7 monitoring sessions can exist at once.

Limitations

- Only one ACL based mirroring session is supported.

- Port-channel can NOT be source or destination in monitor session.

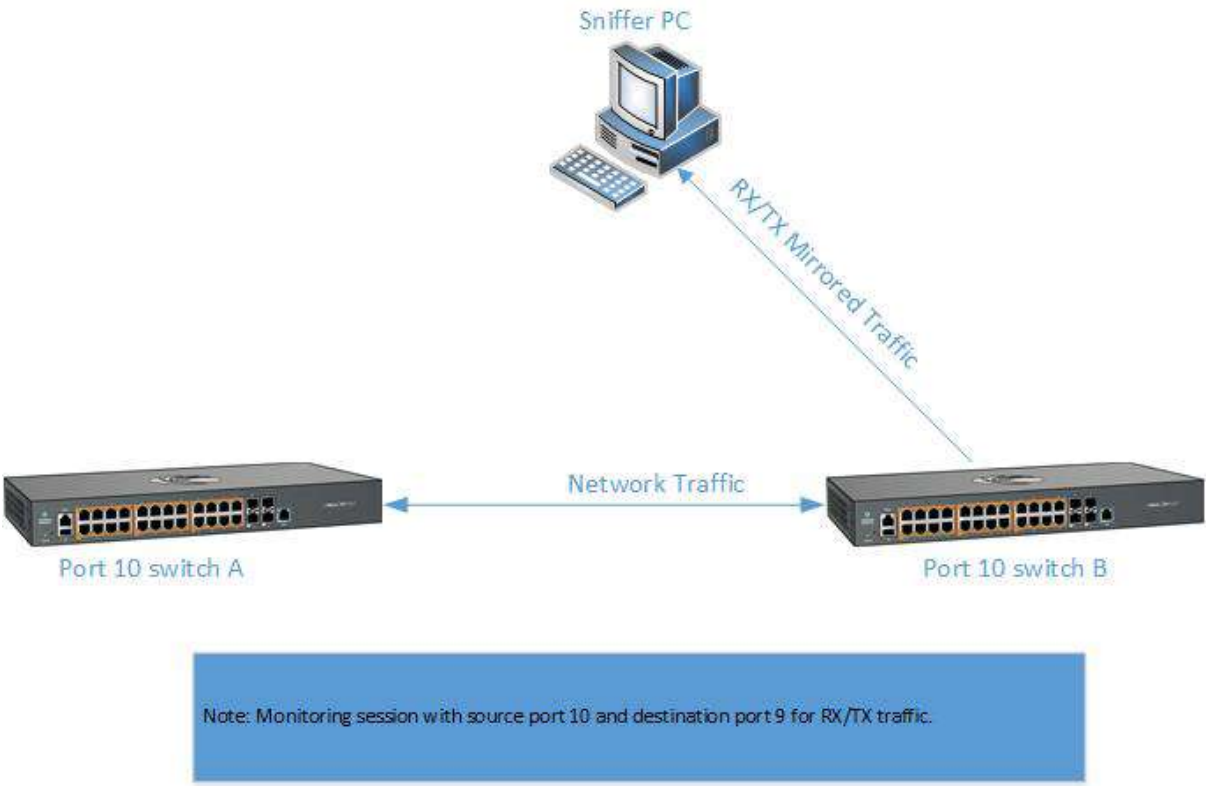
Default Values

- The port mirroring feature is enabled by default.

Prerequisites

```
cnMatrix# config terminal

cnMatrix(config)#
```

2.10.1.2 Network Diagram



2.10.2 Configuring Port Mirroring WEB

The **Port Mirroring** feature is not available in WEB interface.

2.11 Storm Control

2.11.1 Managing Storm Control

Feature Overview

A traffic storm occurs when packets flood the LAN, creating excessive traffic and degrading network performance. The traffic storm control feature prevents LAN ports from being disrupted by a broadcast, multicast, or unicast traffic storm on physical interfaces.

Traffic **storm control** (also called traffic suppression) monitors incoming traffic levels over a fixed interval, and during the interval it compares the traffic level with the traffic storm control level that you configure. Each port has a single traffic storm control level that is used for all types of traffic (broadcast, multicast, and unicast).

Standards

N/A

Scaling Numbers

N/A

Limitations

- Regardless of the value configured by the user, in HW the actual configured value is rounded-down to the closest multiple of 640pkts/sec (for 100M speed), of 6400pkts/sec (for 1G speed) and for 64000pkts/sec (for 10G speed).

Default Values

- DLF Storm Control – Disabled by default.
- Broadcast Storm Control – Disabled by default.
- Multicast Storm Control – Disabled by default.

2.12 Rate Limit Output

2.12.1 Managing Rate-Limit-Output

The R**ate-Limit-Output** feature enables the rate limiting and burst size rate. B**urst size** is the actual amount of "burstable" data that is allowed to be transmitted at the peak bandwidth rate in kilobytes. You can set the limit by configuring the egress packet rate of an interface.

Standards

N/A

Scaling Numbers

N/A

Limitations

N/A

Default Values

- The default value for rate and burst value: 0.

2.12.2 Configuring Rate-Limit-Output WEB

The **Rate-Limit-Output** feature is not available in WEB interface.

2.13 Quality of Service

2.13.1 Managing QoS

QoS works in tight conjunction with the ACL module, which provides a way for the user to classify traffic using custom parameters and feed it to the QoS module.

The QoS module revolves about the concept of "class". Traffic can be assigned to classes, based on the QoS information in the packet (dot1p priority or DSCP bits), based on per-port settings (default user-priority) or via an Access Control List (ACL). A policy can then be applied to that class to enforce a certain traffic profile. In the same manner, a meter can be applied to a class and have the corresponding traffic policed.

QoS provides means of doing the following:

- Traffic policing on ingress and egress

- Priority remarking - via priority maps or via traffic policers
- Class-based queueing and scheduling
- Traffic shaping
  - **Traffic policing** is a process applied to a flow of traffic that enforces configured parameters regarding the maximum throughput for that flow. In this context, a traffic flow is an ACL-based class, to which a policy containing a meter is applied. Traffic policing acts on ingress or egress traffic, according to the way the ACL was configured.

Feature Overview

A **meter** is used to classify packets into three conformance levels: Green, Yellow and Red. Traffic that is below the committed information rate is considered conforming, and marked as Green. Traffic that is over the committed information rate, but still conforming to a committed burst size is considered “exceeding” or yellow. Traffic non-conforming to the meter is called “violating” and it’s marked Red. The configured policy determines then what actions should be applied on the packet, depending on this conformance level: allow, remark its priority, or drop.

- **Priority remarking** allows packets to have their dot1p priority or IP DSCP priority field modified by being remapped to a “regenerated” value. When a packet has its dot1p priority remarked, it will be queued according to the new “regenerated” priority. Priority remarking is accomplished via a “priority map”, which is a system-wide setting, therefore, a configured priority map will be by default applied to all ports.

In order to configure which priority information should be used as an input for the QoS application and the priority remapping mechanism, the **qos trust mode** has to be selected. The user can configure QoS trust mode as “none”, in which case the packet is assigned the port’s default dot1p priority regardless of any priority information in the packet, or he can select “dot1p” and “DSCP”. This is a per-port setting.

The cnMatrix switch supports eight **egress queues**. By default, traffic marked with dot1p priority 0 is mapped to queue 1, priority 1 to queue 2, and so on. Default queue assignment can be changed using the “queue-map” command. A priority map can be used to send a specific class of traffic to a particular egress queue without actually remapping the dot1p priority value. In this case, the ingress priority must be the same as the regenerated priority.

- A **scheduler** is an algorithm that decides the sequence in which frames from different egress queue should be forwarded. Four types of scheduling algorithms are supported: strict-priority, round robin, weighted round robin, and strict-wrr.

- **Traffic shaping** is an algorithm that controls the sending of frames, by inserting delays, in such a way that the output bandwidth conforms to a configured traffic profile. The switch uses a token bucket shaper with CIR and CBS parameters to compare outgoing traffic to.

In order for the packet to be taken out of a transmit queue and to be forwarded, a packet has to be scheduled for transmission by the scheduler and to conform to the shaper attributes. Non-conforming packets remain queued until they will conform, even when the link is available for transmission.

Standards

- RFC 2474 defines the differentiated services field in the IP header.
- IEEE 802.1D incorporates the 802.1p definition of the user priority field.
- RFC 2697 defines srTCM (single rate Three Color Marker).
- RFC 2698 defines trTCM (two rate Three Color Marker).

Scaling Numbers

- Up to 120 classes can be defined.

Limitations

- Although DSCP remarking is supported with the priority-map, mapping of the traffic to the updated queue is not supported, and all remarked priority packets will be transmitted via queue 1 only.
- Traffic policing is not supported for classes that use priority maps.
- Two types of meters are supported: srTCM and trTCM.
- Four types of scheduling algorithms are supported: strict-priority, round robin, weighted round robin, strict-wrr.
- The WRR scheduler will not be effective if we send multiple priority traffic from same port. However, if multiple ports are sending traffic with unique priority traffic then the WRR scheduling works as per the configured weights.
- Remarking of flows under violate actions is not supported.
- Shapers support only CIR and CBS parameters.
- Modifying the Queue weight is applicable to all the ports where the scheduler is mapped.

Default Values

- There are eight egress queues for every port, the default scheduling algorithm is strict-priority. Queue 1 is the top priority queue.

2.13.2 Configuring QoS WEB

The QoS feature is not available in WEB interface.

2.14 Policy-Based Automation with Dynamic Configuration

2.14.1 Managing Policy Based Automation Using Auto Attach

2.14.1.1 Feature Description

Feature Overview

The core goal of the Auto Attach (AA) feature is to support automated device deployment at the network edge for networks with a high number of directly attached devices, such as Access Points (APs), video cameras, IP phones and laptops/PCs.

A typical deployment scenario would consist of the following components:

- Access (access/hybrid-mode edge) switch ports.
- Uplink (trunk-mode) ports/LAGs.
- End-devices (APs, video cameras, IP phones, laptops/PCs).

This type of deployment can be handled by manually configuring the network access switch through management interfaces such as CLI, HTTP (web) or SNMP. This type of configuration is static and requires knowledge of the network topology ahead of time, such as which ports are associated with specific VLANs, the related native VLAN (i.e., PVID) and egress tagging mode for each VLAN. A static configuration requires continuous and error-prone manual configuration updates when devices are moved or new devices are added to the network (i.e., for all device moves, adds and changes).

The Auto Attach feature is intended to overcome the burden of constant manual reconfiguration. With Auto Attach, end-devices are automatically detected based on specific device criteria (e.g., LLDP device identification data) and device-specific settings are automatically installed or updated based on predefined Auto Attach policies.

Settings that may be updated based on device discovery include:

- VLAN presence and membership.

- Switch port mode (Access/Hybrid/Trunk).
- Port Native VLAN (PVID) value.

When an end-device is detected on a port, AA is passed the device data (e.g., LLDP-based device data) and the ingress port. If the end-device data matches device identification criteria in a configured AA policy, the associated AA policy actions are initiated, potentially creating VLANs and dynamically updating settings associated with the ingress port (i.e., conditioning the ingress data path).

The automatically applied settings are dynamic and are cleared (with the previous settings restored) when the end-device disconnects, device identification data expires (e.g., LLDP data timeout) or when the switch reboots.

Auto Attach Release 2.0.1 Capabilities

- Device Identification
  - LLDP Core TLVs (user-specified string matching of TLV data):
    - Chassis ID (TLV Type 1)
    - Port ID (TLV Type 2)
    - Port Description (TLV Type 4)
    - System Name (TLV Type 5)
    - System Description (TLV Type 6)
    - System Capabilities (TLV Type 7)
- Dynamic Actions
  - VLAN creation and port association.
  - Port PVID update.
  - Switch port mode (Hybrid only) update.
- AA Monitoring/Configuration
  - CLI
  - SNMP

Limitations

User Interface Limitations:

- Auto Attach cannot be configured Web GUI.
- No support for cnMaestro GUI and JSON files. Templates will be available in the first release and CLI commands can be pushed down to the switch.

Feature Interaction Limitations:

- Interactions with authentication (EAP) support are not supported.
- Setting the port as QoS Trusted/Untrusted is not supported.
- Setting the port default 802.1 User Priority is not supported.
- Auto Attach agent cannot run while Spanning Tree mode PVRST is enabled.

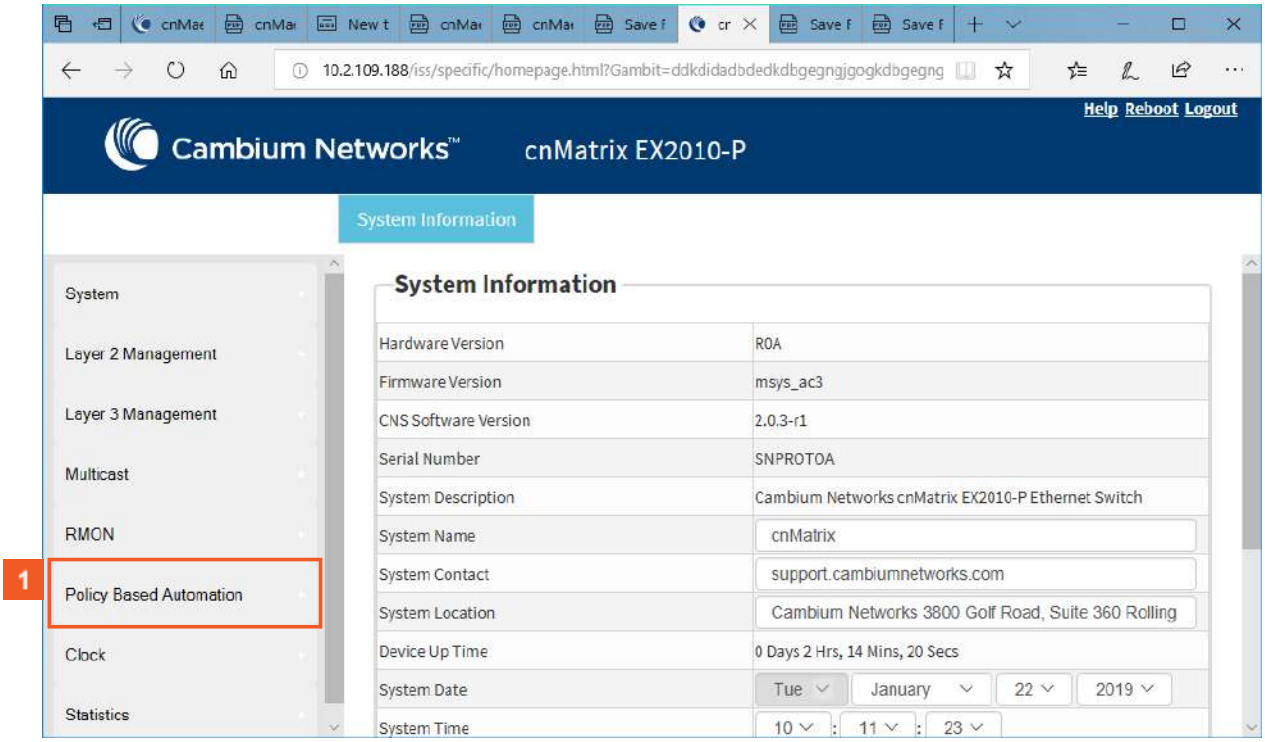
Feature Limitations:

- MAC-based device detection is not supported.
- Only core LLDP TLVs will be supported for device discovery.
- AA policies will not be applied to port channels in the first release.
- Switch port mode updates will be limited to ‘hybrid’ in the first release and updates will be static if data is saved by the user while dynamic updates are present.

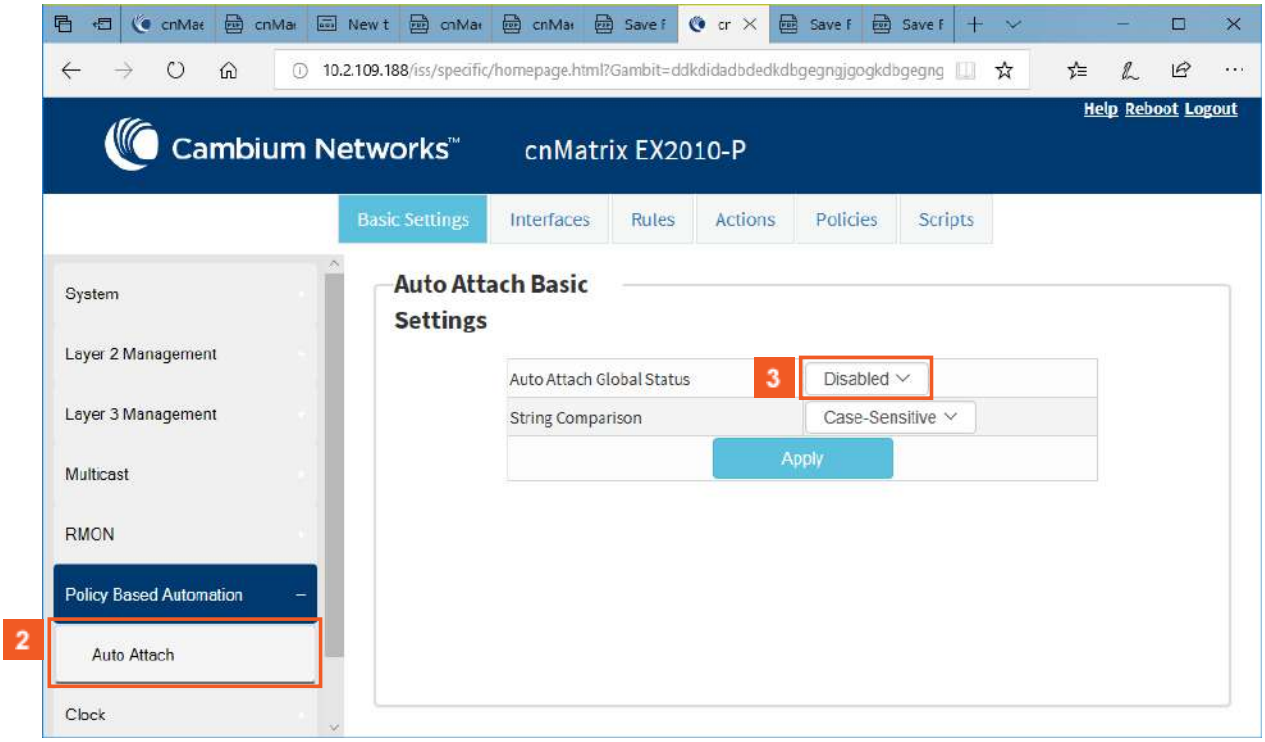
For more information, see Auto Attach Feature Description.

2.14.1.2 Network Diagram

2.14.2 Configuring Auto Attach Basic Settings WEB

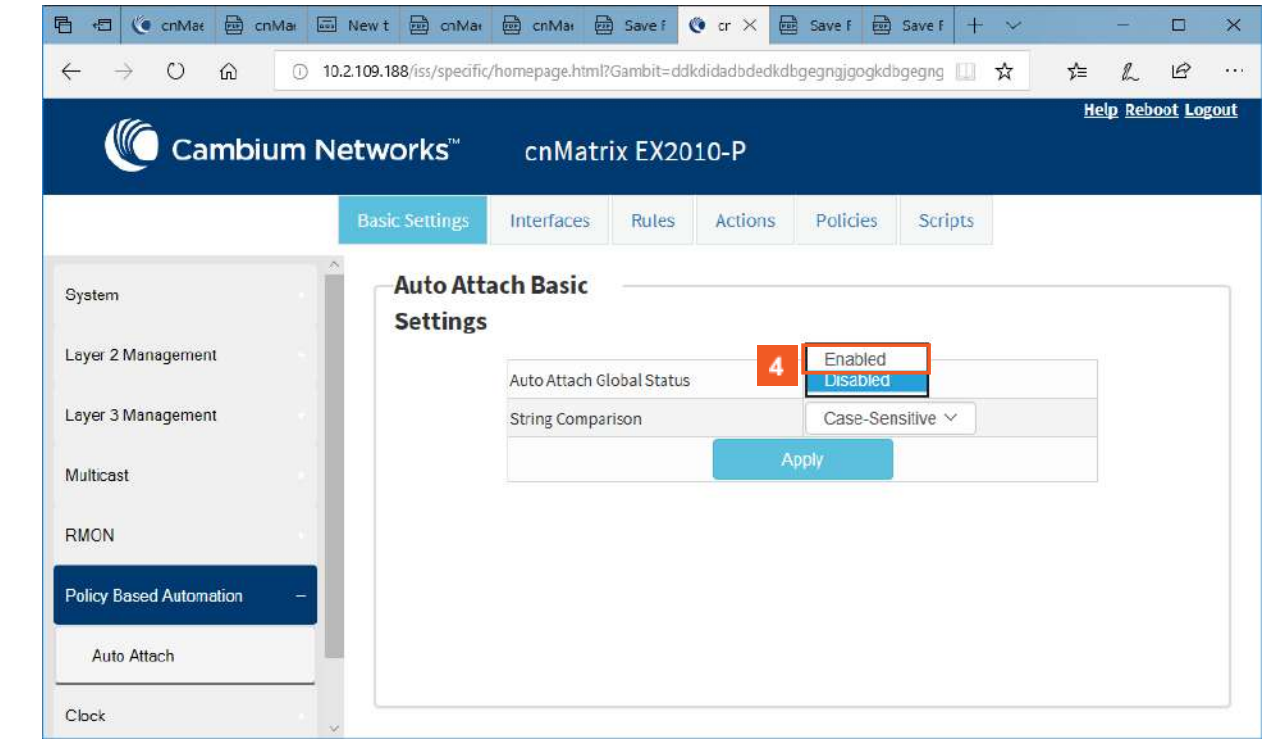


1 Click the **Policy Based Automation** menu item.

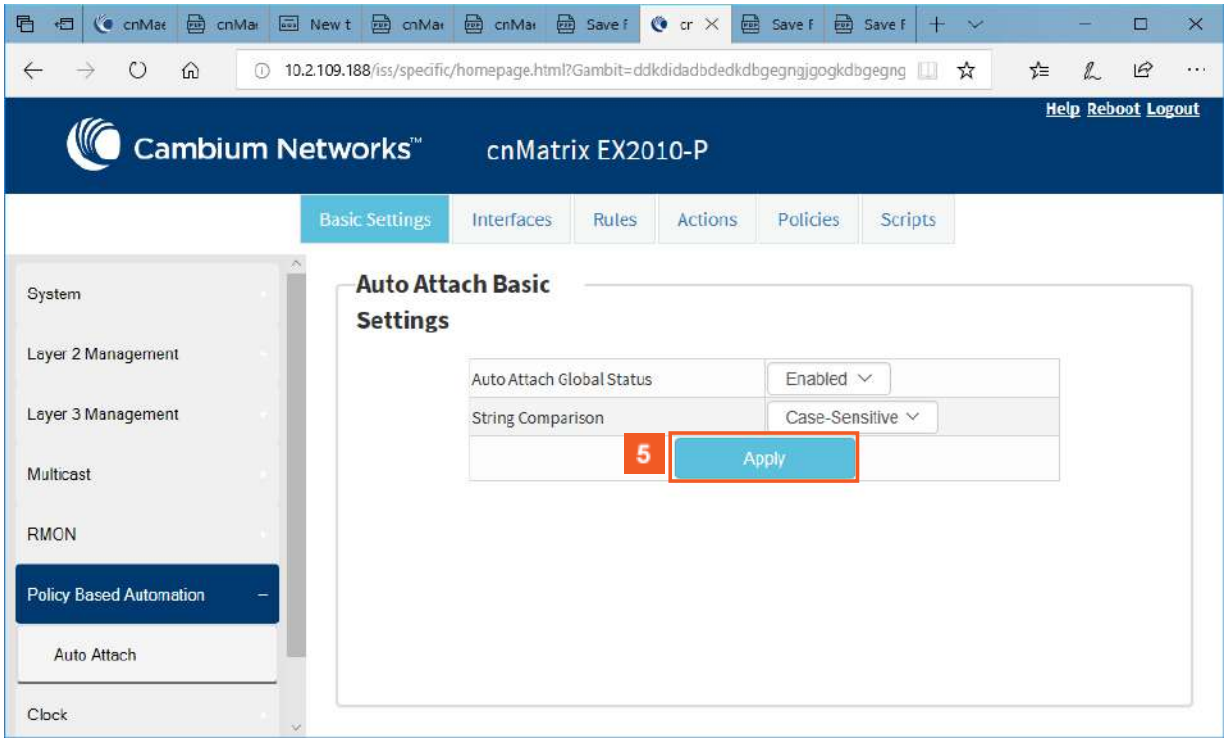


2 Click the **Auto Attach** menu item.

3 Click the **Auto Attach Global Status** drop-down button and select the Auto Attach global status.



4 Select the **Enabled** list item.



5 Click the **Apply** button.

The **Auto Attach** feature is enabled by default.

Section complete. Click X to close.

3 L3 Features

3.1 DHCP Relay

3.1.1 Managing DHCP Relay

3.1.1.1 Feature Description

DHCP relay agent allows the DHCP client and DHCP server in different subnets to communicate with each other so that the DHCP client can obtain its IP address and configuration. The relay agent receives packets from the Client, inserts information such as network details, and forwards the modified packets to the Server. The Server identifies the Client's network from the received packets, allocates the IP address accordingly, and sends a reply to the Relay. The Relay strips the information inserted by the Server and broadcasts the packets to the Client's network.

Standards

- RFC 3046
- RFC 2131

Scaling Numbers

- maximum 200 clients can use this feature simultaneously.

Limitations

- The cnMatrix switch cannot be a DHCP Relay and Server simultaneously.

- When enabled, the DHCP relay feature is active on all VLANs/networks.
- DHCP Snooping and DHCP Relay are mutually exclusive.

Default Values

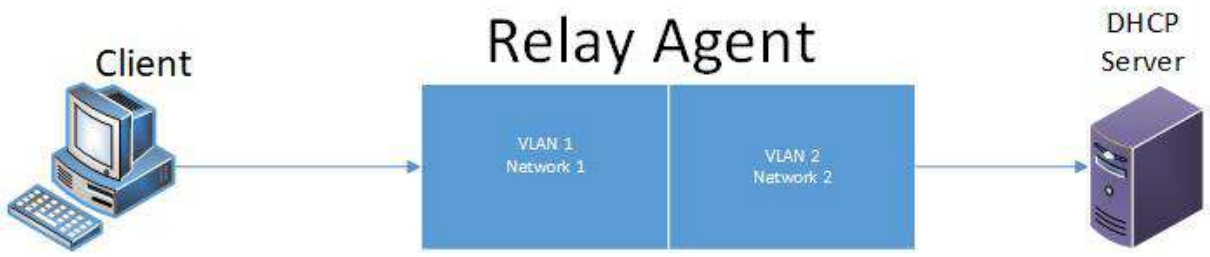
- The DHCP relay and also option 82 are disabled by default.

Prerequisites

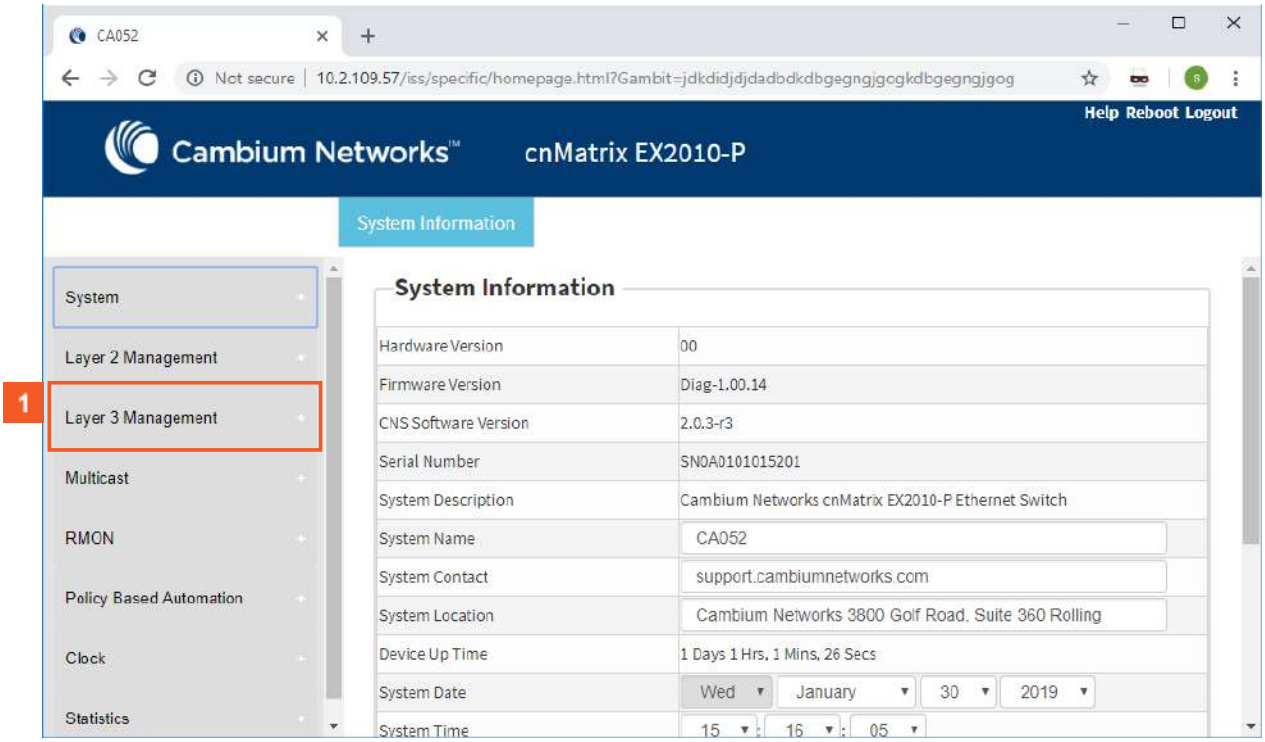
- Enable IP routing globally.
- Create VLANs and assign ports to VLANs.
- Assign IP addresses to the VLANs.

Even though the feature can be enabled on a VLAN or port, it will relay packets from all VLANs.

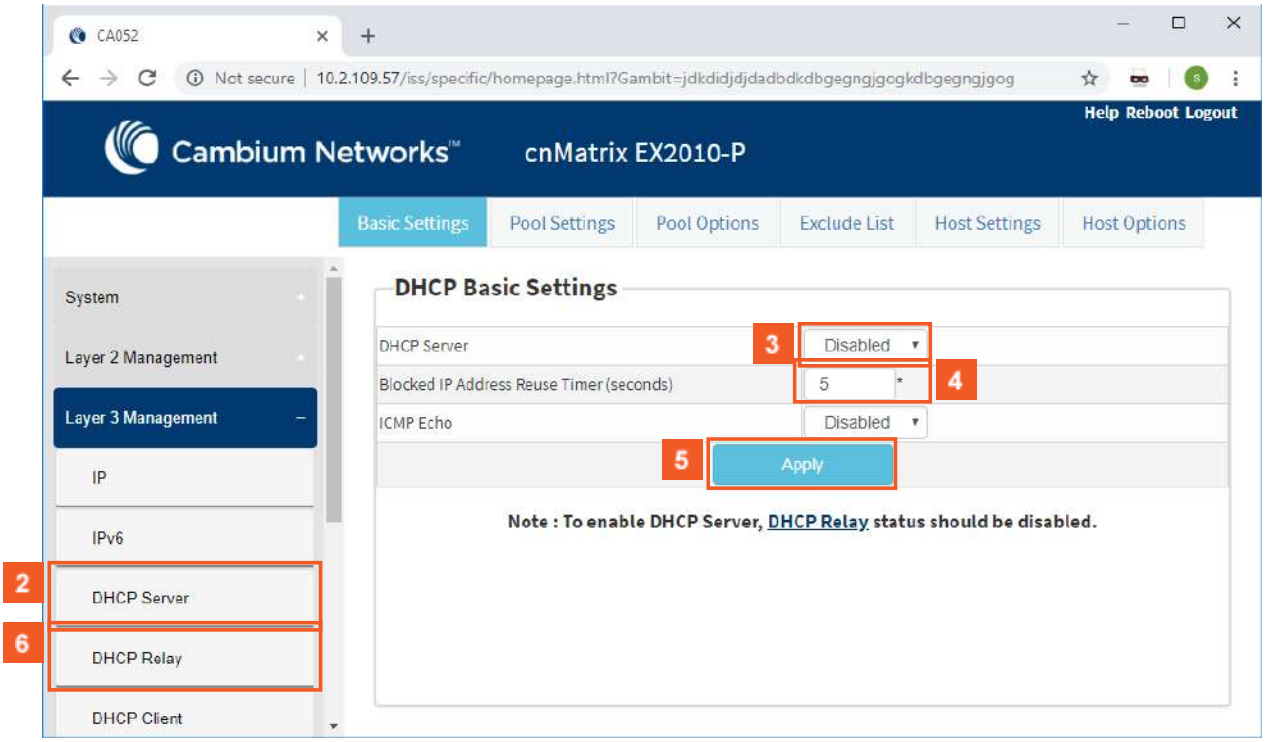
3.1.1.2 Network Diagram



3.1.2 Configuring DHCP Relay in WEB



1 Click the **Layer 3 Management** button. The **L3 Features** are displayed.



2 Click the **DHCP Server** menu item.

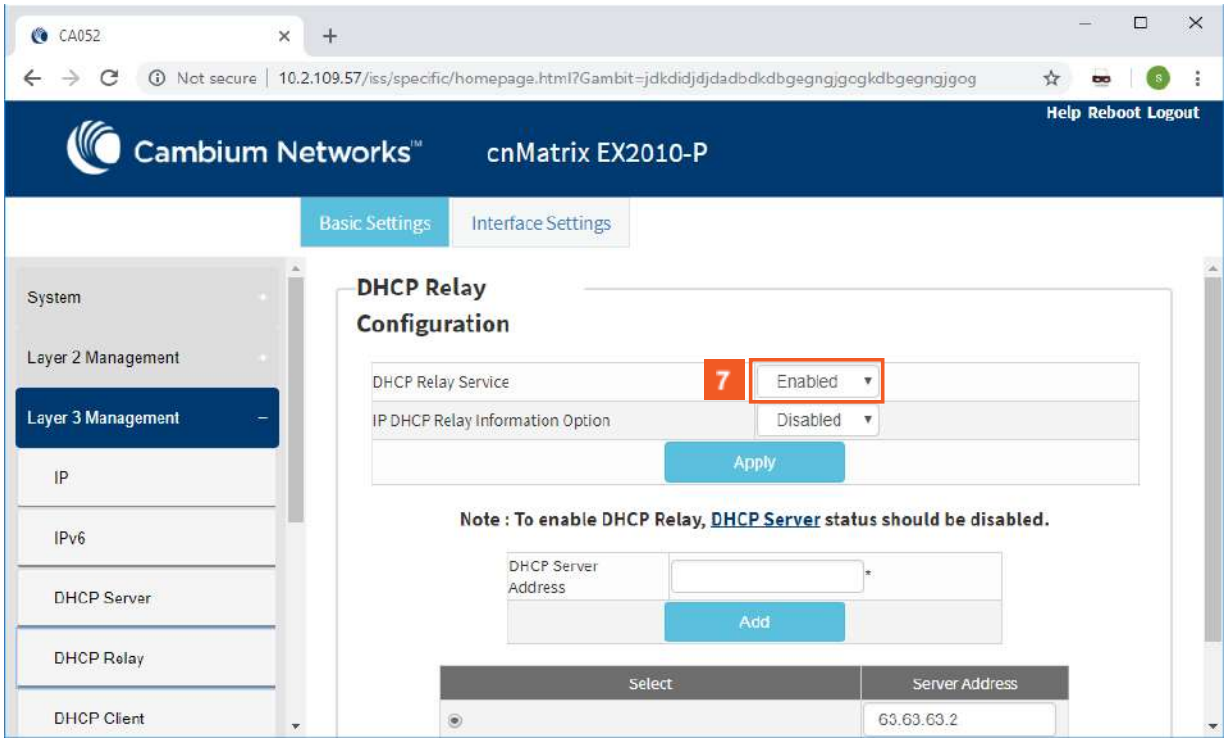
3 Click the **DHCP Server** drop-down button and select the DHCP server status in the router.

This is just an example so that you can see how to disable the DHCP Server feature (mandatory step when you want to enable the DHCP Relay feature). The DHCP Server feature is disabled by default.

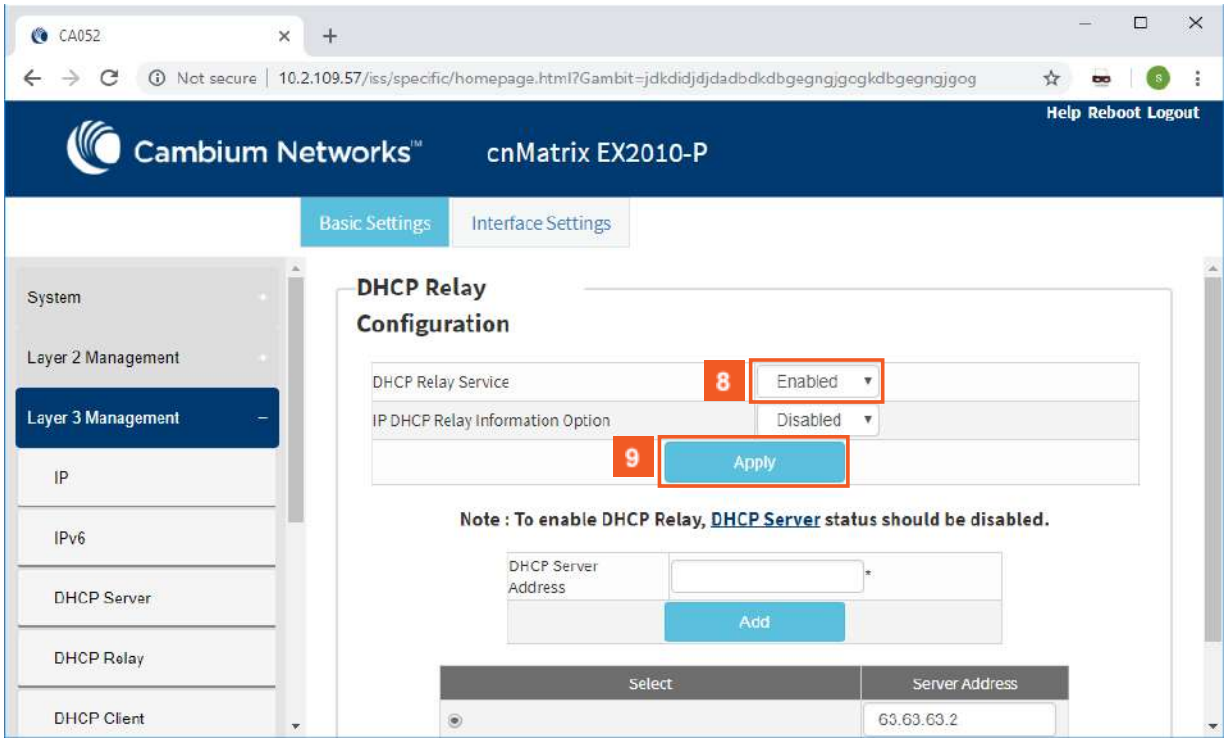
4 Select the **Disabled** list item.

5 Click the **Apply** button.

6 Click the **DHCP Relay** menu item.



7 Click the **DHCP Relay Service** drop-down button and select the DHCP Relay service status in the switch.



8 Select the **Enabled** list item.

9 Click the **Apply** button.

3.2 Routed Interface

3.2.1 Configuring Routed Interfaces WEB

The **Routed Interfaces** feature is not available in WEB interface.

3.3 IP Routing

3.3.1 Managing IP Routing

IPv4 Static Routing enables routing of IPv4 unicast traffic based on configured IPv4 Static Routes or programmed Directly Connected routes.

> Ip Interfaces must be created, and IP addresses and netmasks should be assigned to them.

IPv4 Static Routing enables routing of IPv4 unicast traffic based on configured IPv4 Static Routes or programmed Directly Connected routes.

Standards

- RFC791

Scaling Numbers

- A maximum of 64 IPv4 interfaces is supported.

Limitations

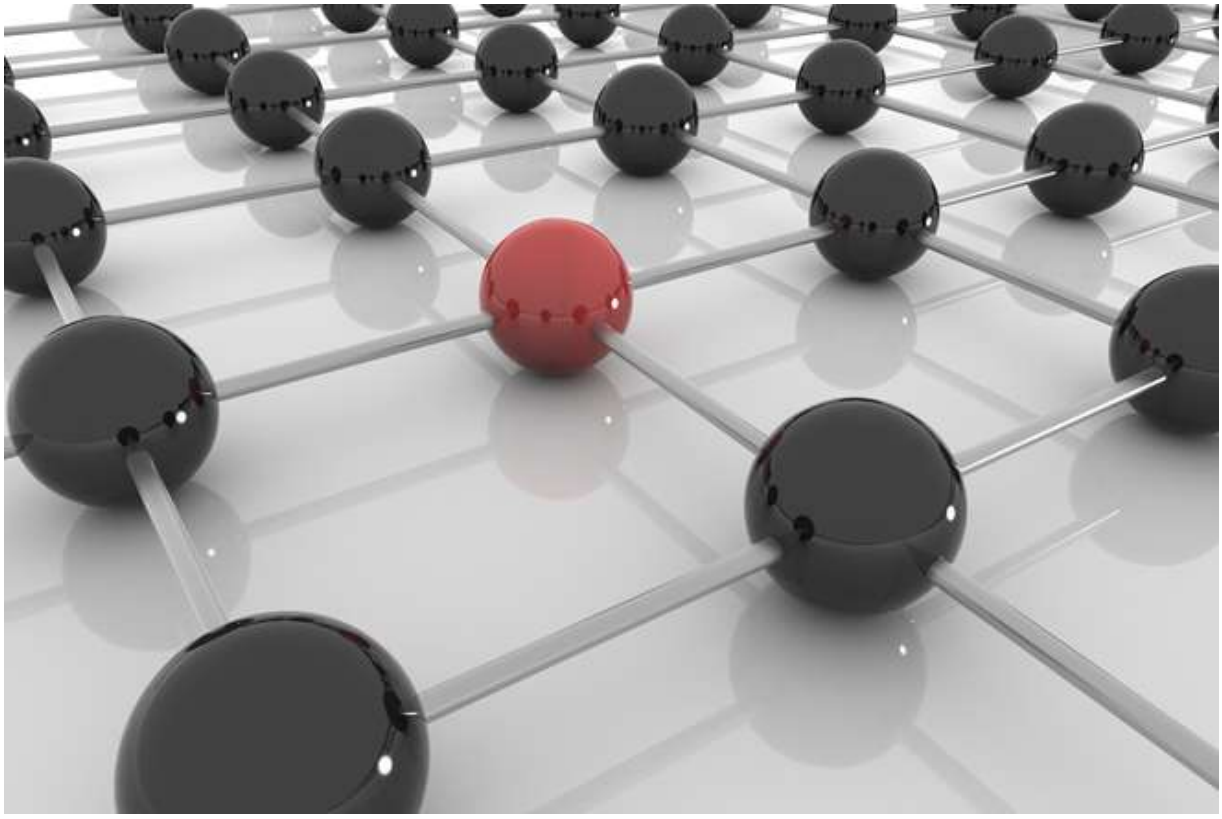
- IP routing cannot be disabled on the system.

Default Values

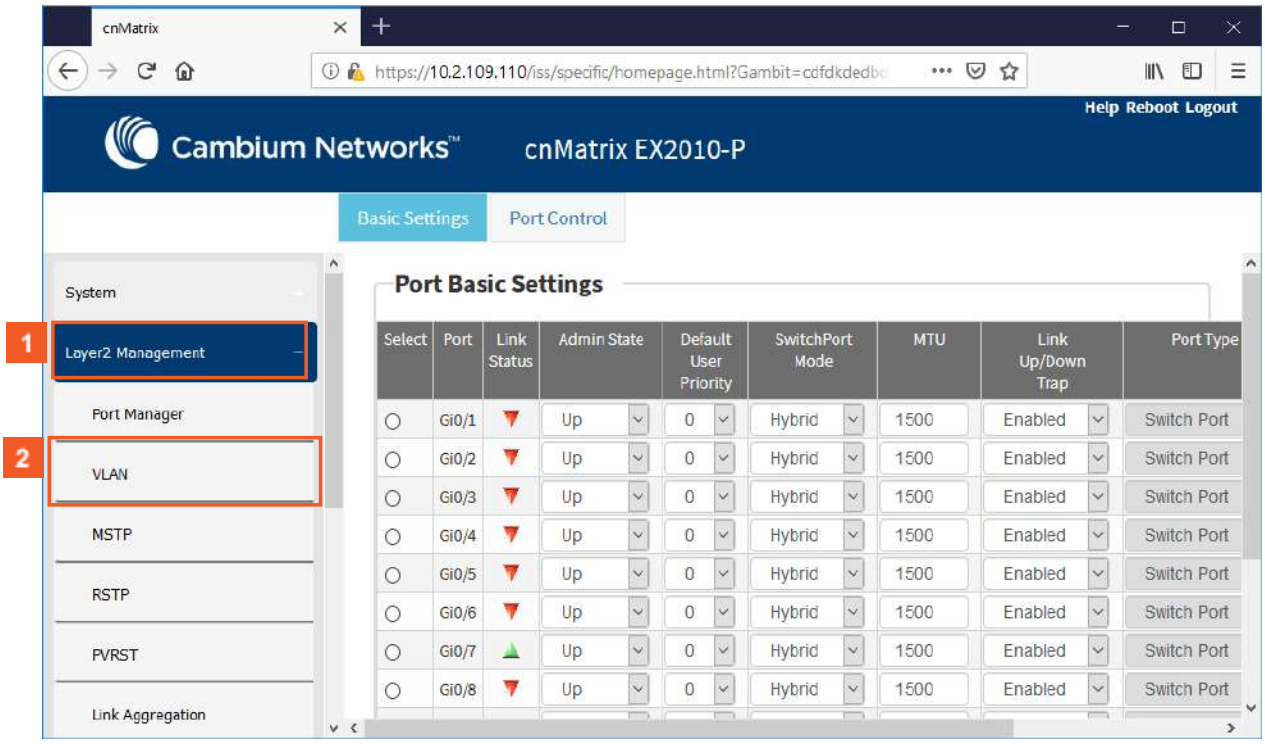
- IP Routing is enabled by default.
- TTL value is 64 by default.
- ICMP redirect option is enabled by default.
- ICMP unreachable option is enabled by default.
- ICMP echo reply option is enabled by default.
- ICMP mask reply option is enabled by default.
- Path MTU discovery is disabled by default.

Prerequisites

- N/A

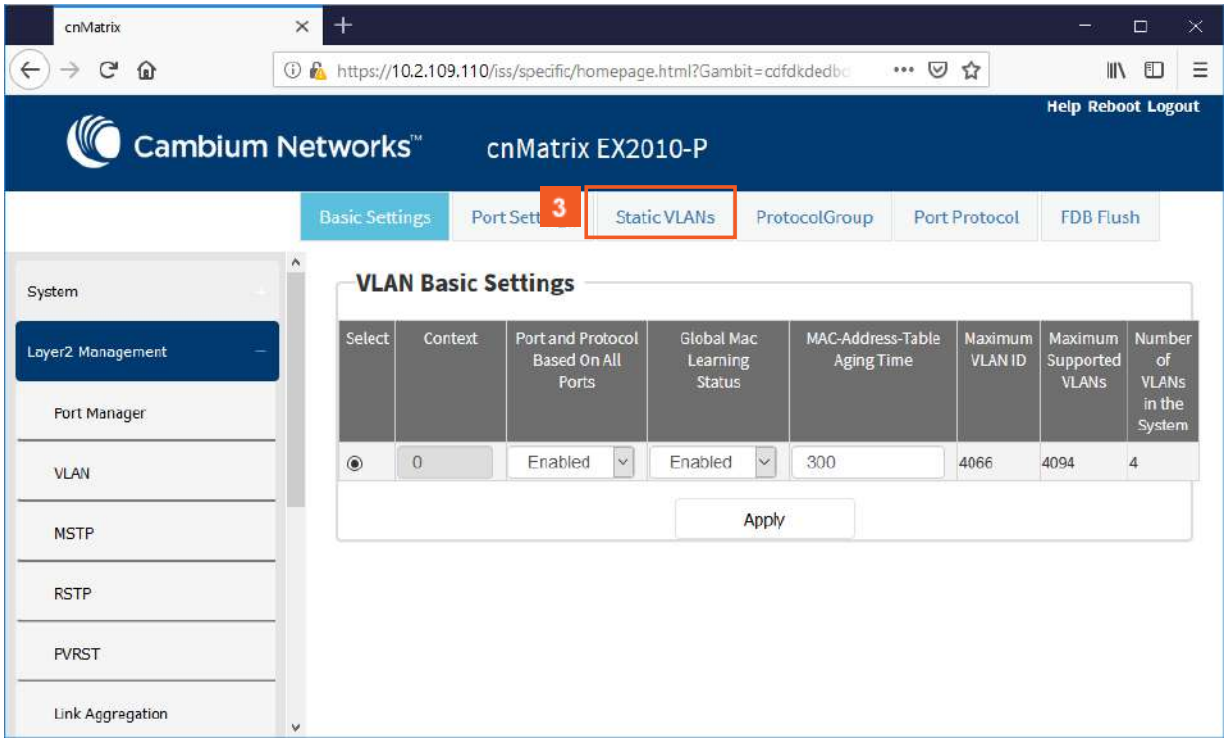


3.3.2 Configuring IP Routing WEB

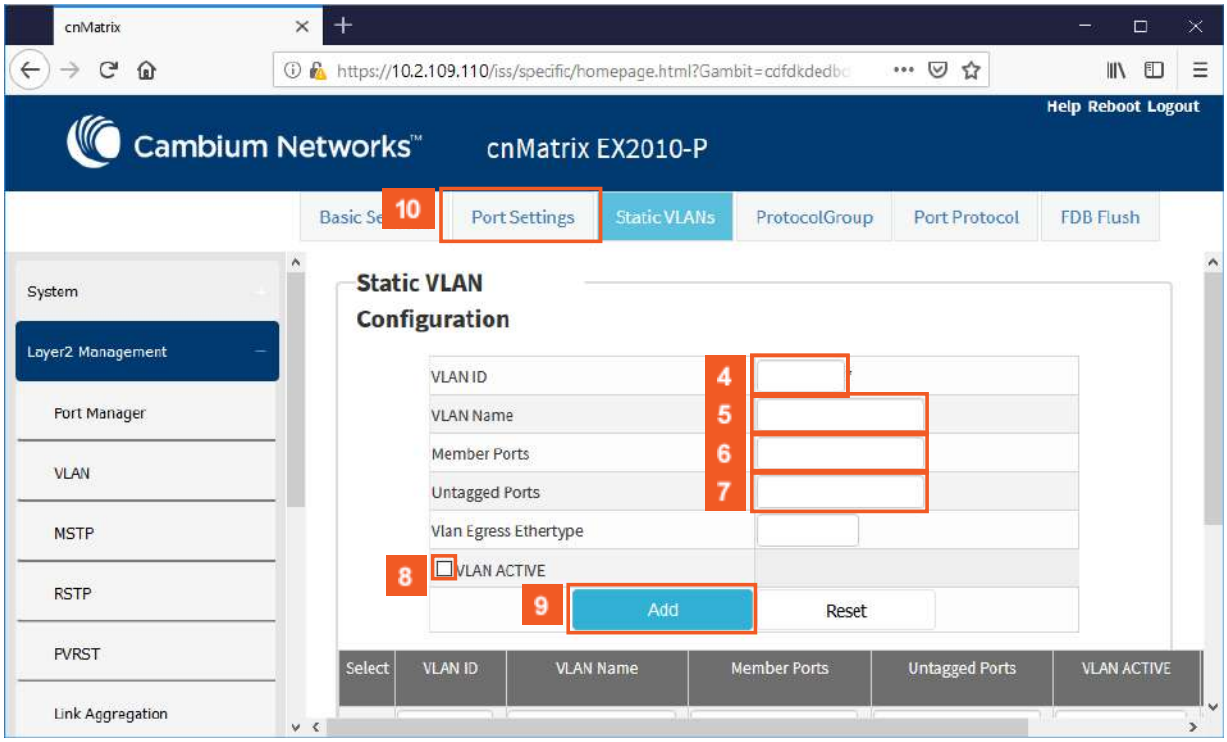


1 Click the **Layer2 Management** menu item. The **L2 Features** are displayed.

2 Click the **VLAN** menu item.



3 Click the **Static VLANs** tab. The **Static VLAN Configuration** window is displayed.



4 Enter **100** in the **VLAN ID** field.

Number **100** represents the **VLAN ID** that uniquely identifies a specific VLAN. the maximum value for VLAN ID is: 4066

5 Enter **vlan100** in the **VLAN Name** field.

The **vlan100** value represents an administratively assigned string, used to identify the VLAN.

6 Enter **Gi0/1-3** in the **Member Ports** field.

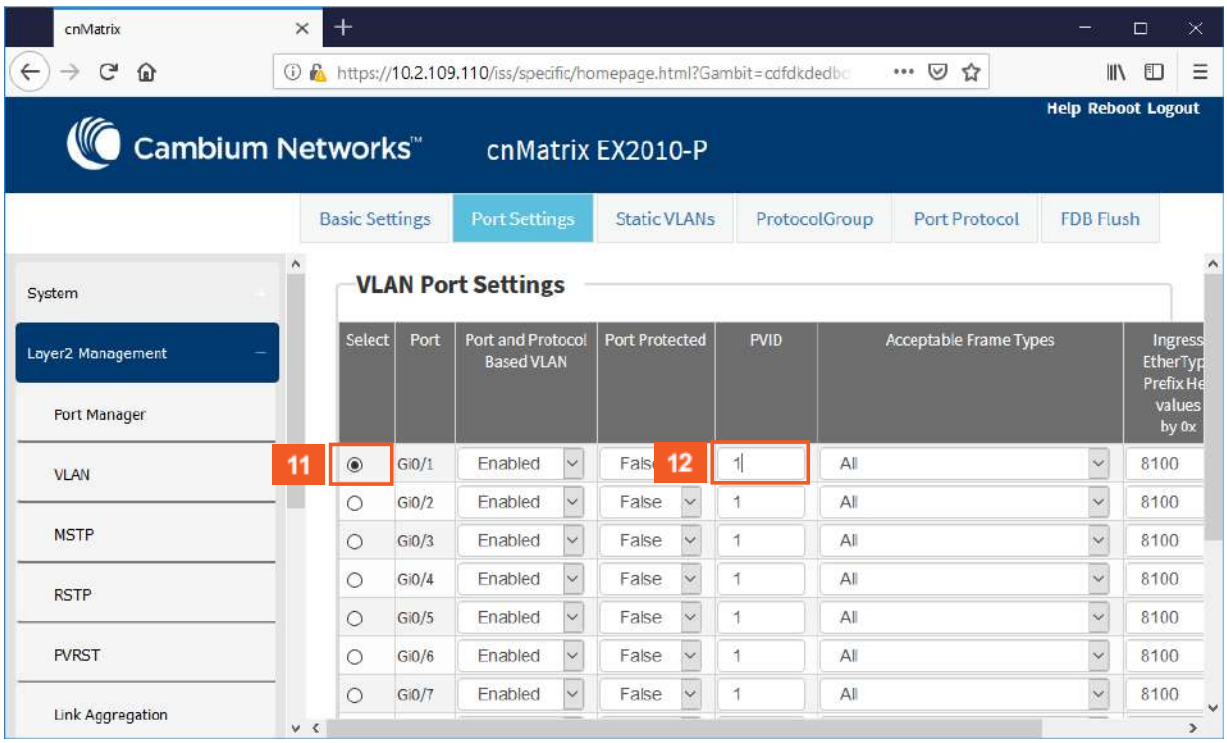
7 Enter **Gi0/1-3** in the **Untagged Ports** field.

> The **Gi0/1-3** value represents a port or set of ports, which should transmit egress packets for the VLAN as untagged packets.

8 Click the **VLAN ACTIVE** check box.

9 Click the **Add** button.

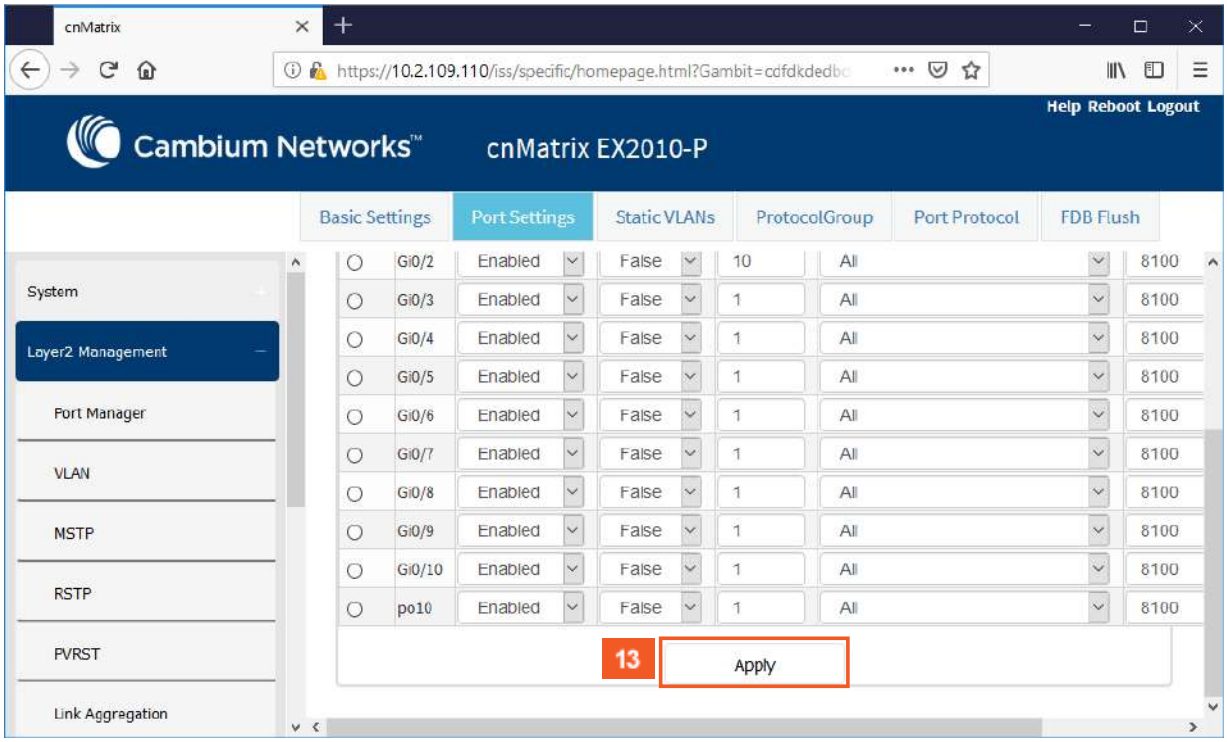
10 Click the **Port Settings** tab. The **VLAN Port Settings** window is displayed.



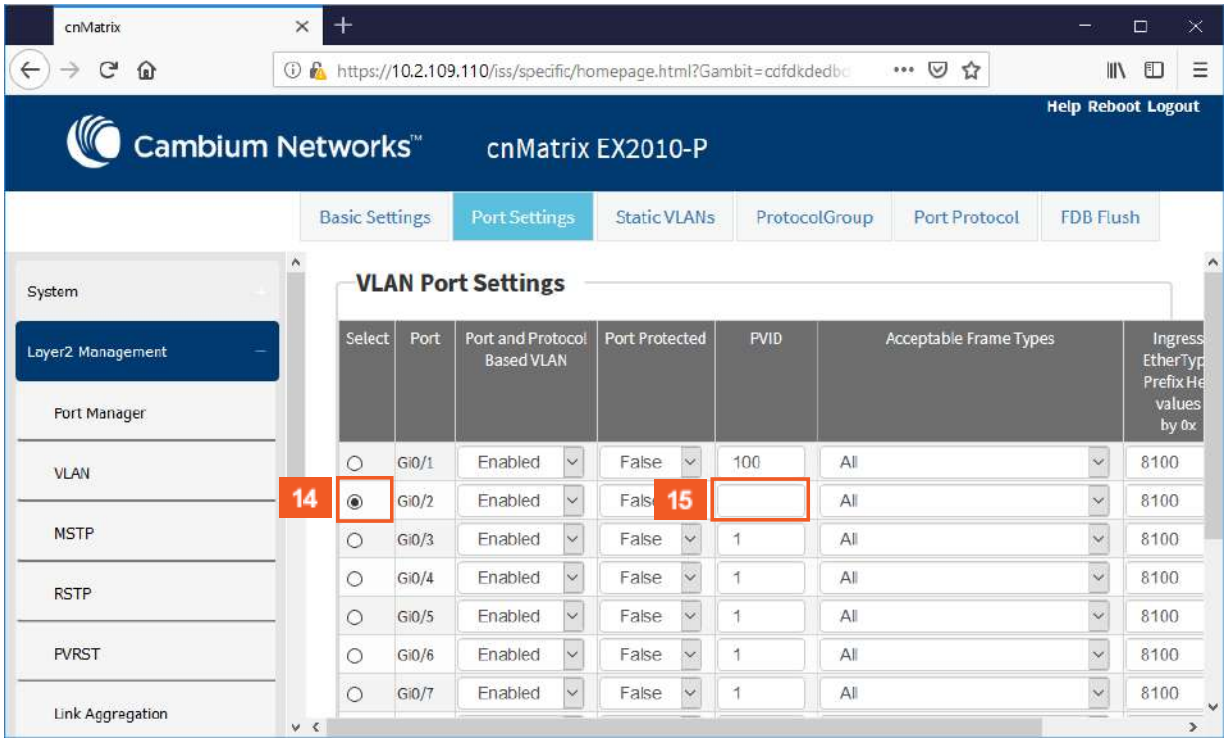
11 Click the **Select** radio button and select the port for which the configuration needs to be done. For example, Click the **Gi0/1** radio button.

12 Enter **100** in the PVID field.

> The value **100** represents the VLAN ID assigned to untagged frames or priority-tagged frames received on the port.

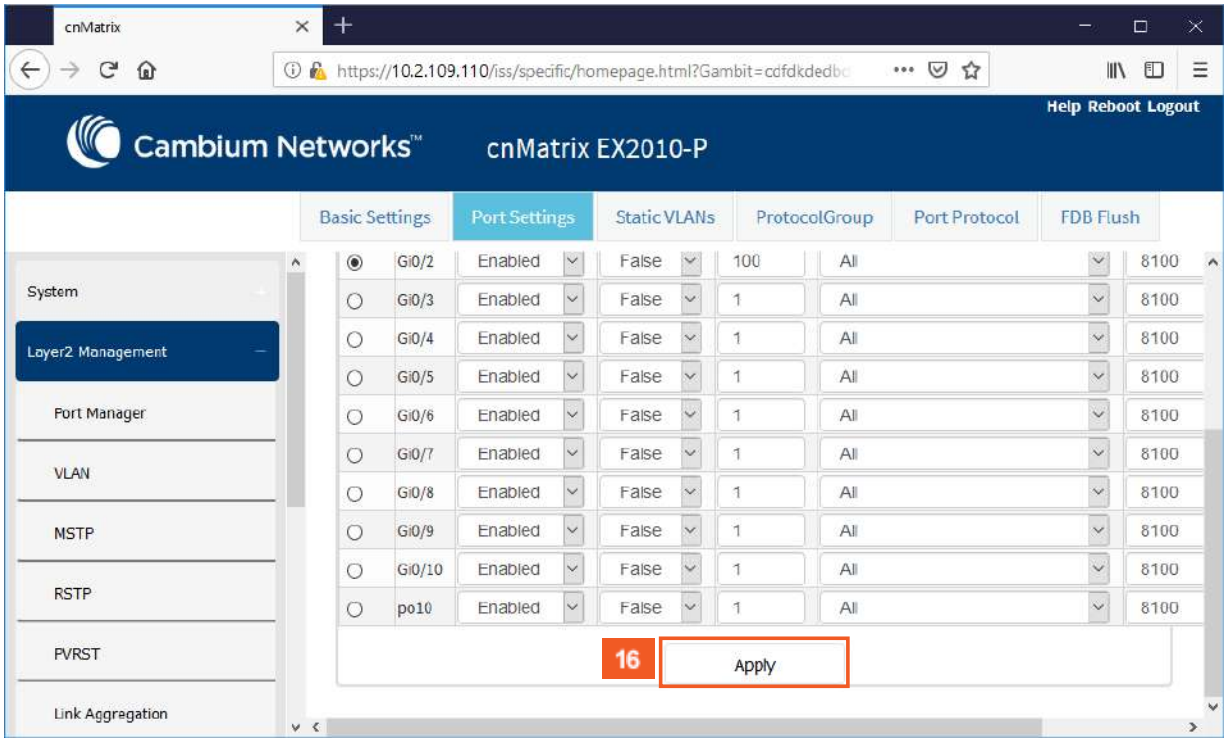


13 Click the **Apply** button.

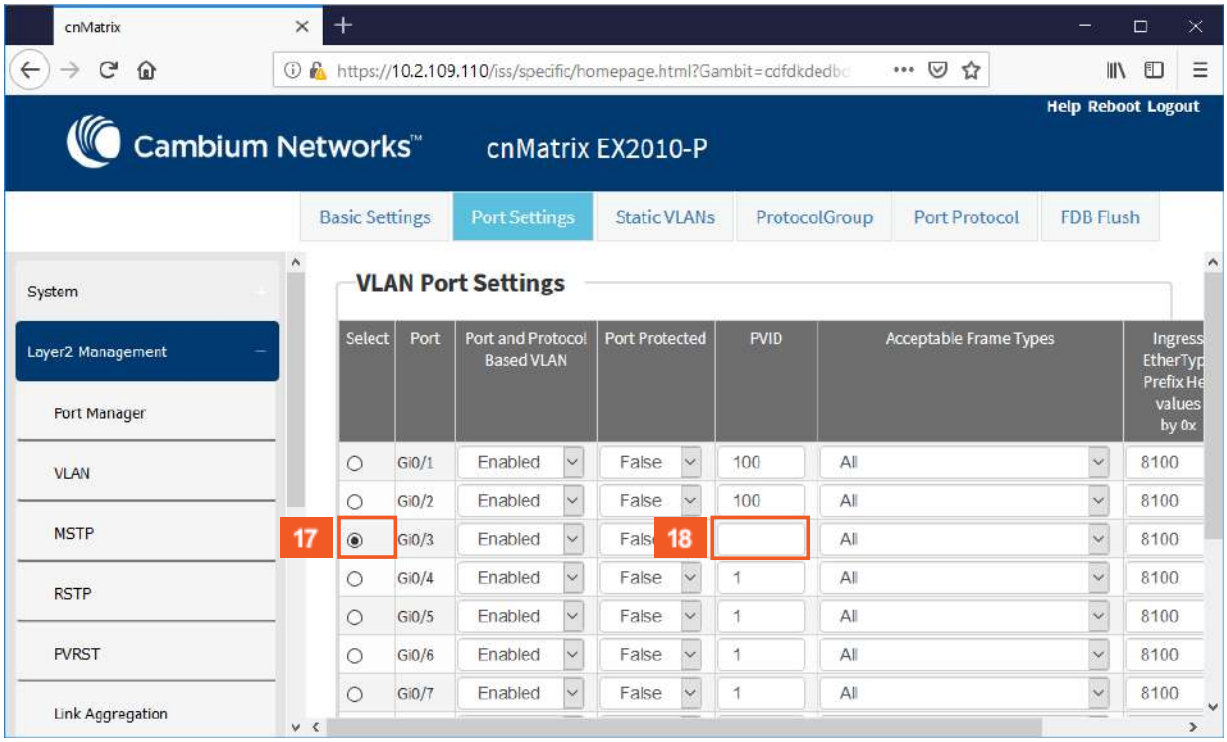


14 To add more ports, click the **Select** radiobutton and select the port for which the configuration needs to be done. For example, click the **Gi0/2** radio button.

15 Enter **100** in the PVID field.

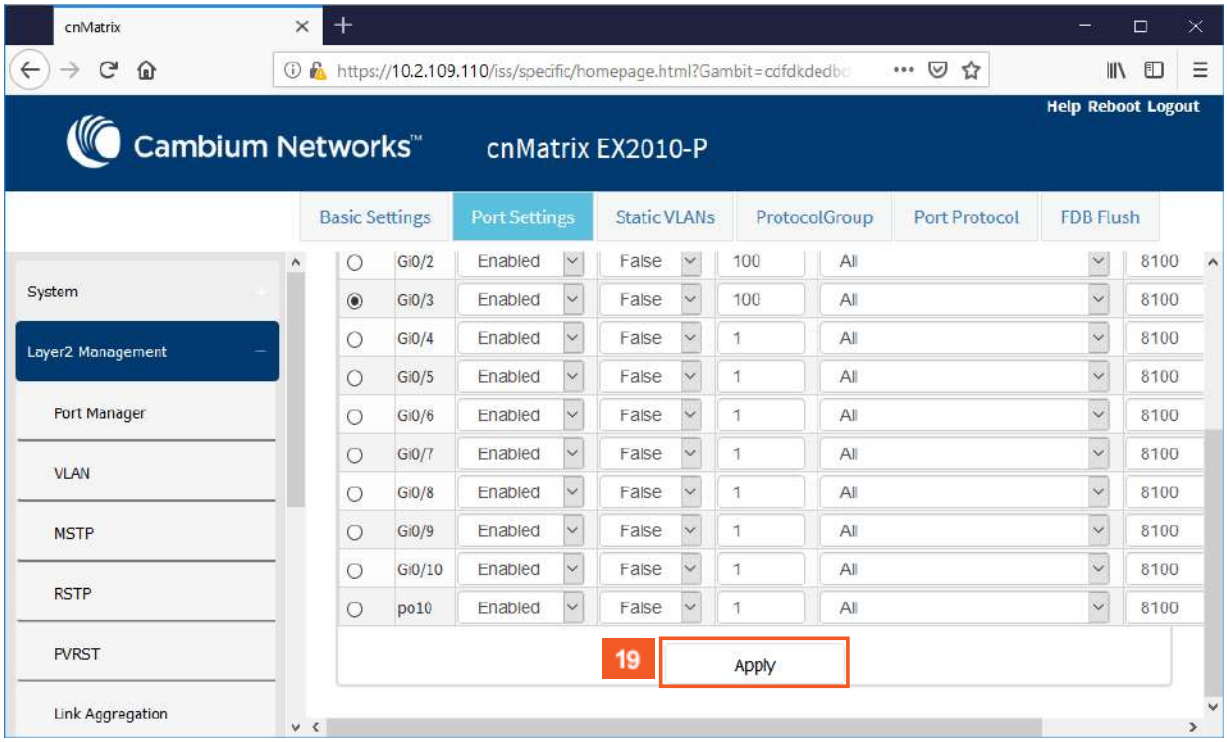


16 Click the **Apply** button.

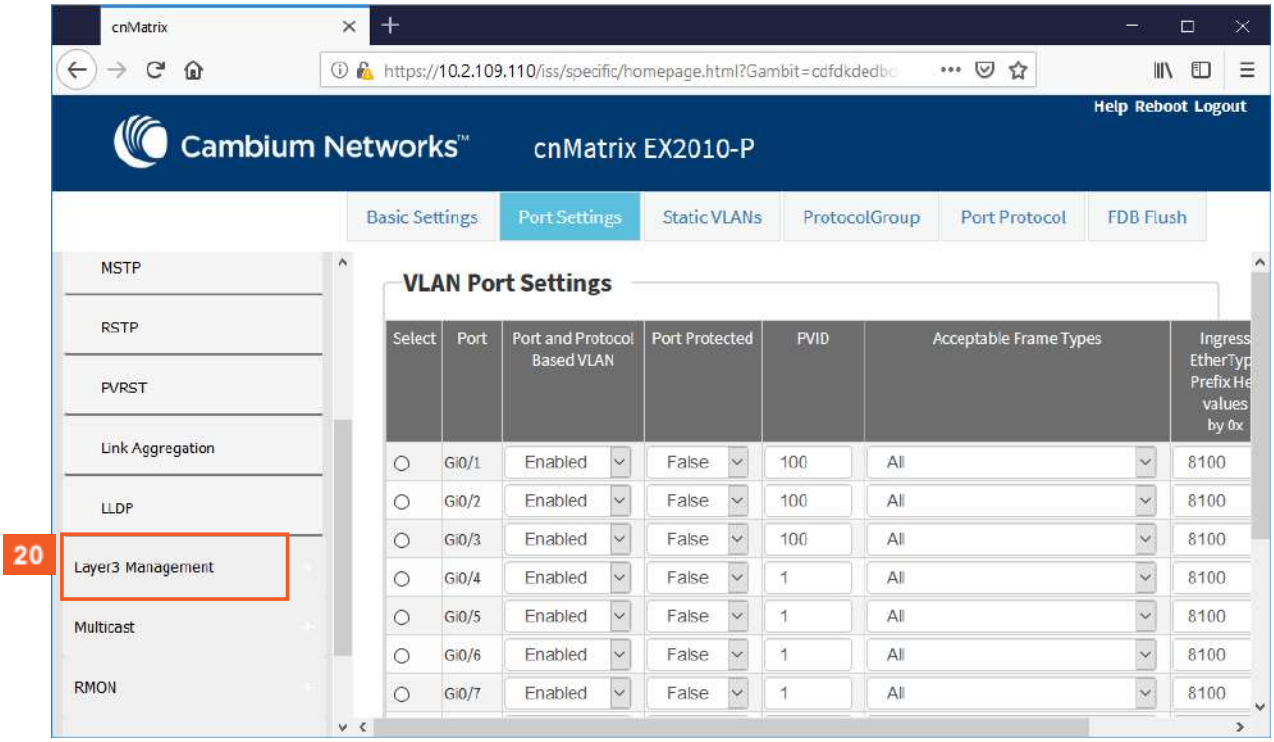


17 In order for you to add more ports, click the **Select** radio button and select the port for which the configuration needs to be done. For example, click the **Gi0/3** radio button.

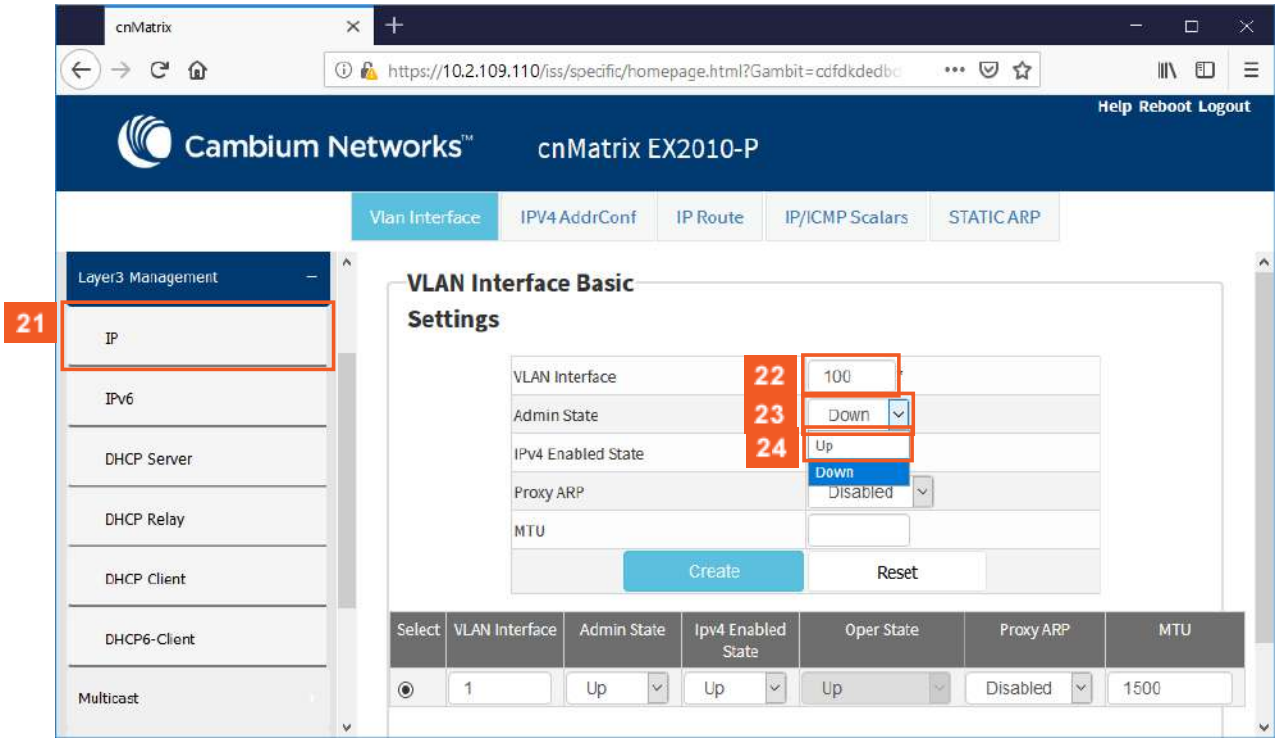
18 Enter **100** in the **PVID** field.



19 Click the **Apply** button.



20 Click the **Layer3 Management** menu item.



21 Click the **IP** menu item.

22 Enter **100** in the **VLAN Interface** field.

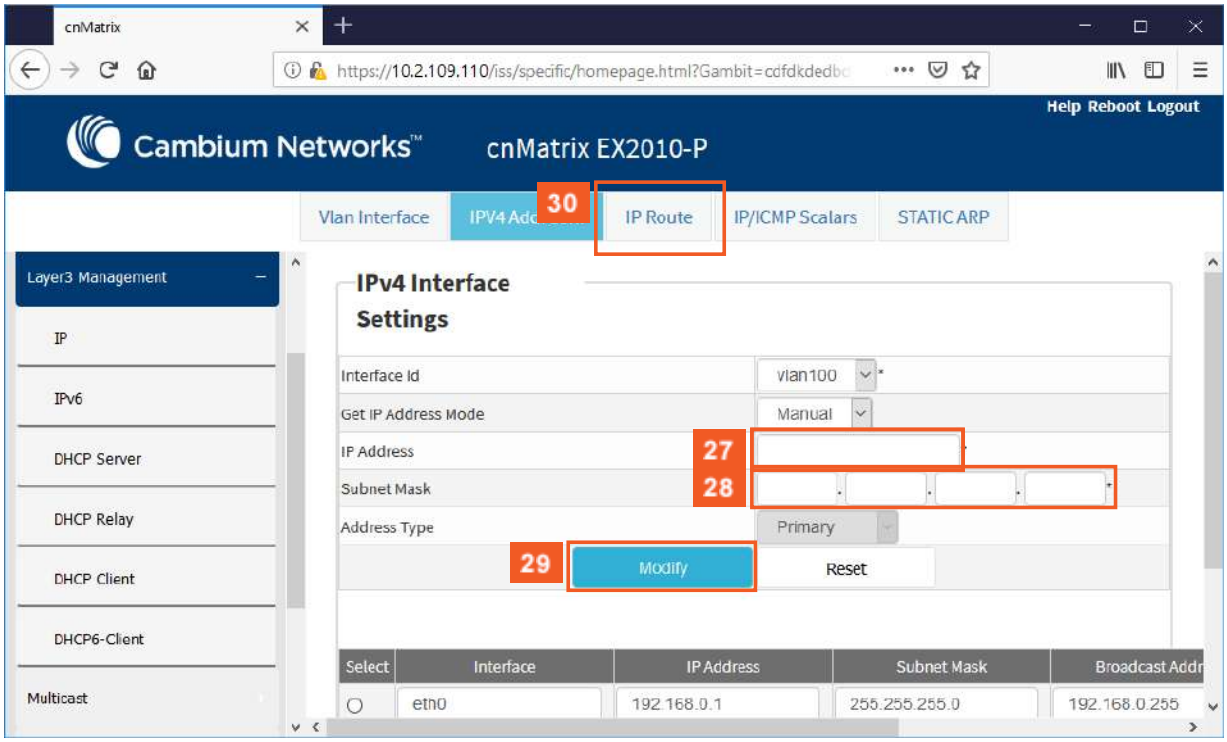
The value **100** represents the VLAN ID for the interface to be created.

23 Click the **Admin State** drop-down button and select the admin status of the VLAN interface..

24 Select the **Up** list item.

25 Click the **Create** button.

26 Click the **IPV4 Address Configuration** tab. The **IPv4 Interface Settings** window is displayed.

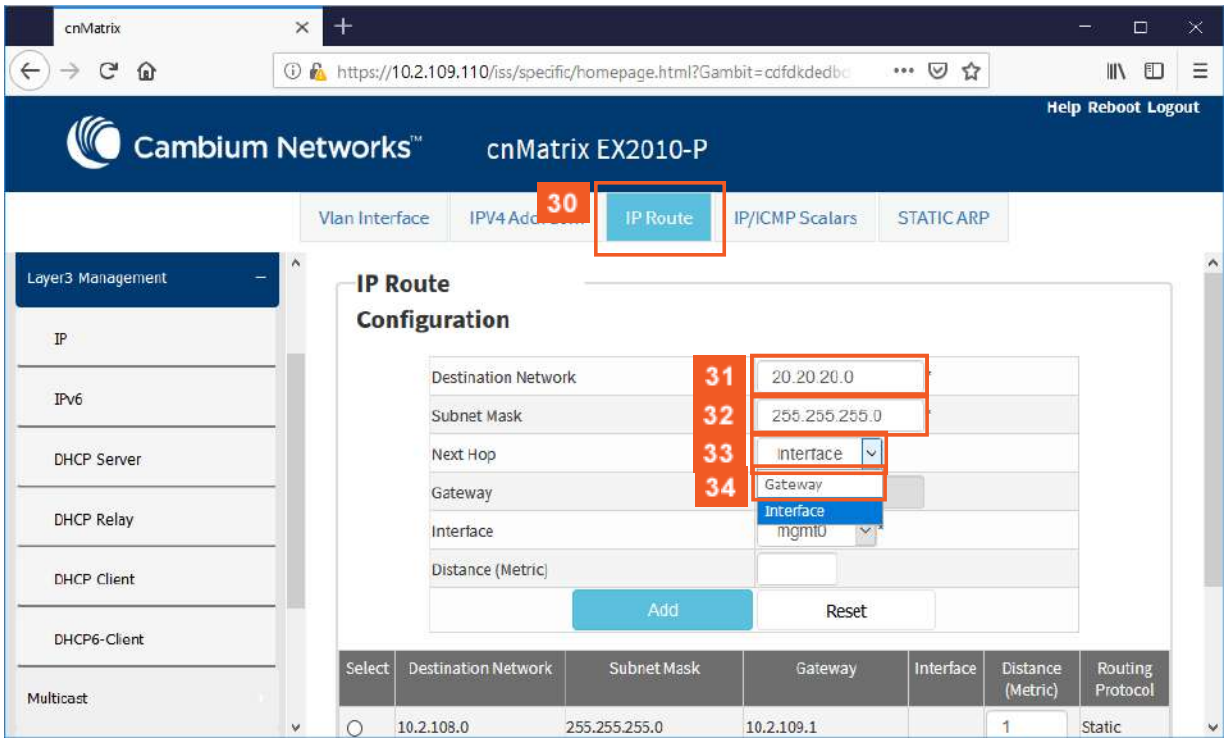


27 Enter **10.10.10.1** in the **IP Address** field.

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

29 Click the **Modify** button.

30 Click the **IP Route** tab. The **IP Route Configuration** window is displayed.

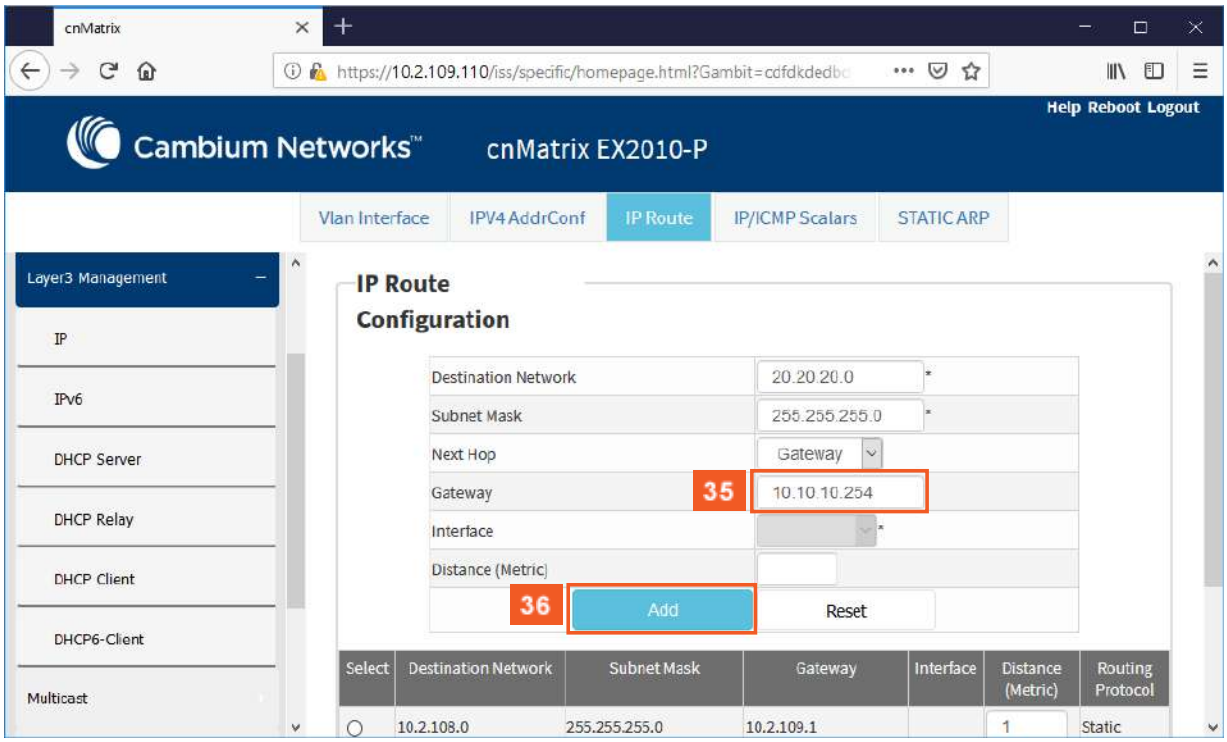


31 Enter **20.20.20.0** in the **Destination Network** field. (IP address of the route)

32 Enter **255.255.255.0** in the **Subnet Mask** field. (Subnet mask for the Destination Network address)

33 Click the **Next Hop** drop-down button.

34 Select the **Gateway** list item.



35 Enter **10.10.10.254** in the **Gateway** field.

The **10.10.10.254** value represents the next hop gateway to reach the destination network.

36 Click the **Add** button.

4 Management Features

4.1 DHCP Client

4.1.1 Managing DHCP Client

Feature Overview

DHCP Client uses DHCP protocol to temporarily receive a unique IP address for it from a DHCP server. It also receives other network configuration information such as default gateway IP address, DNS Server IP address, SNTP Server IP address from the DHCP server.

DHCP Client can be enabled on any IPv4 interface associated to existing VLANs, on Routed Interfaces or on the Out of Band interface.

Standards

- RFC 2131

Scaling Numbers

- DHCP Client can be enabled on 64 IPv4 Interfaces.

Limitations

N/A

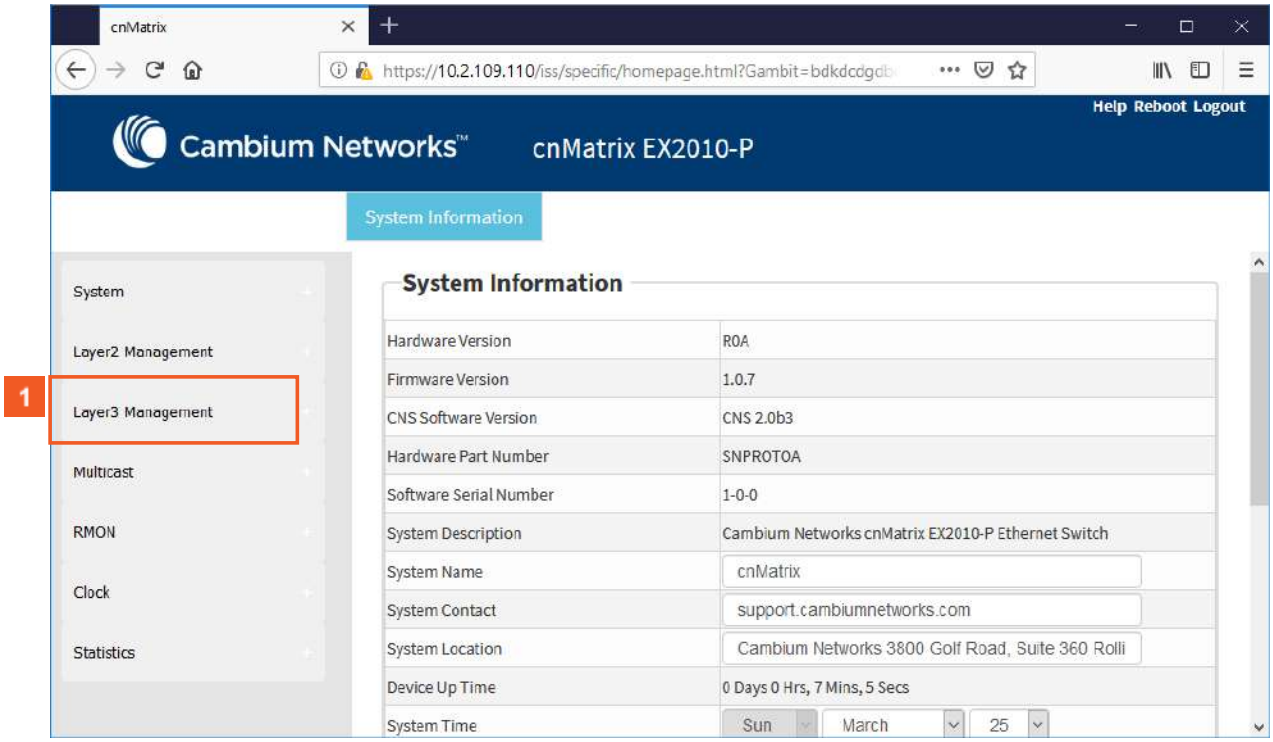
Default Values

- DHCP Client is enabled by default on VLAN 1.
- If DHCP fast mode is enabled, the default DHCP Client Discovery timer is 5.
- If DHCP fast mode is disabled, the default DHCP Client Discovery timer is 15.
- Tracking of the DHCP client operations is disabled.
- If DHCP fast mode is enabled, the default DHCP Client ARP check timer is 1.
- If DHCP fast mode is disabled, the default DHCP Client ARP check timer is 3.

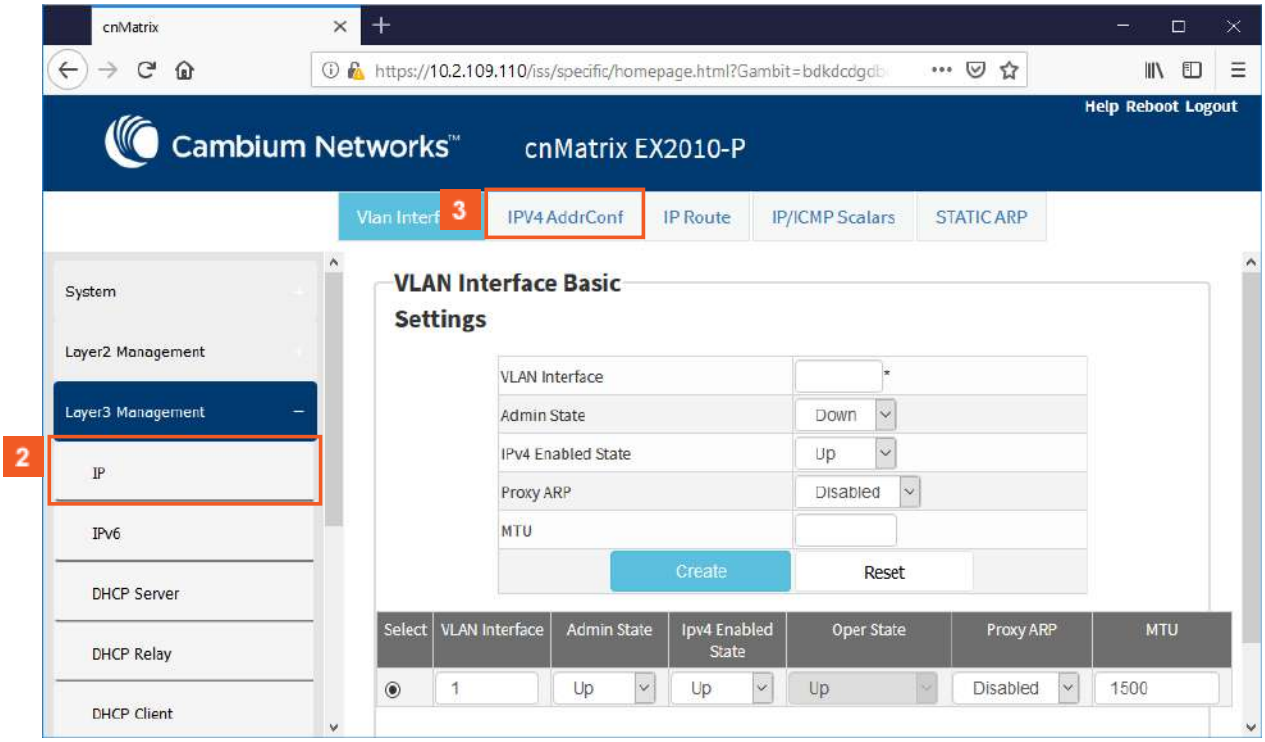
Prerequisites

N/A

4.1.2 Configuring DHCP Client Web

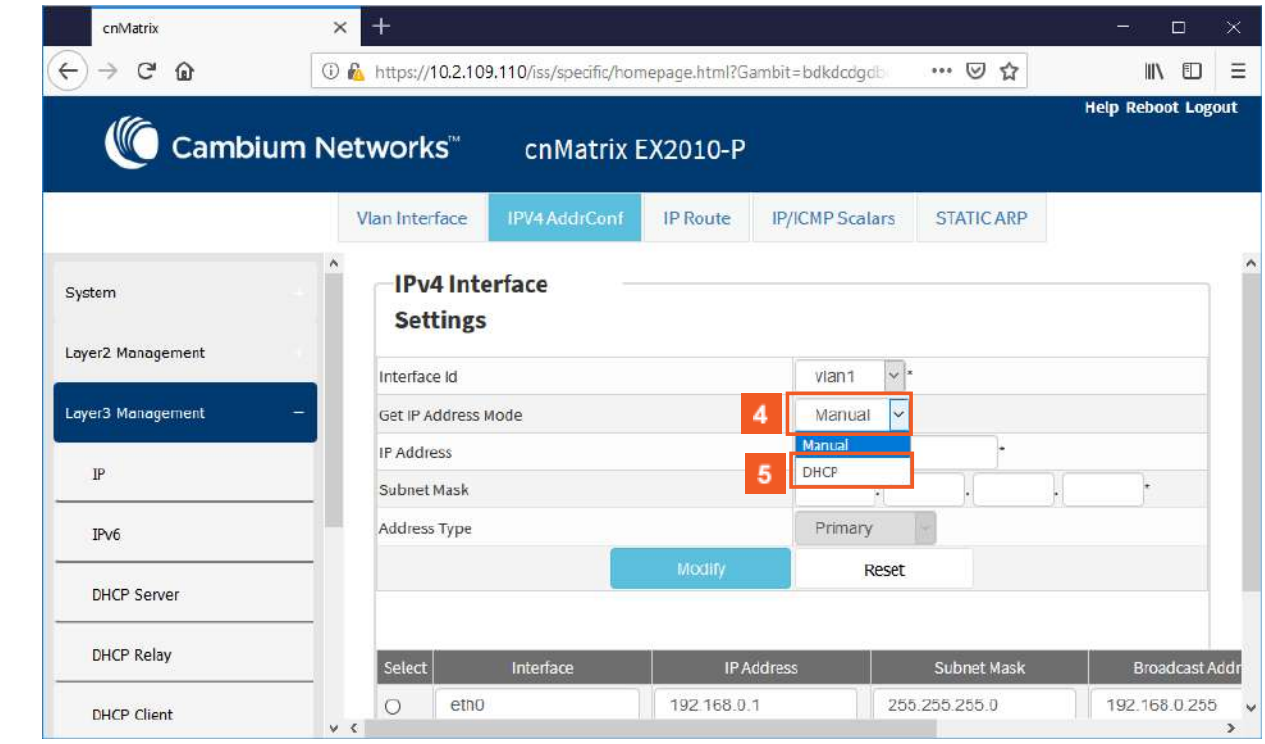


1 Click the **Layer3 Management** menu item. The **L3 Features** are displayed.



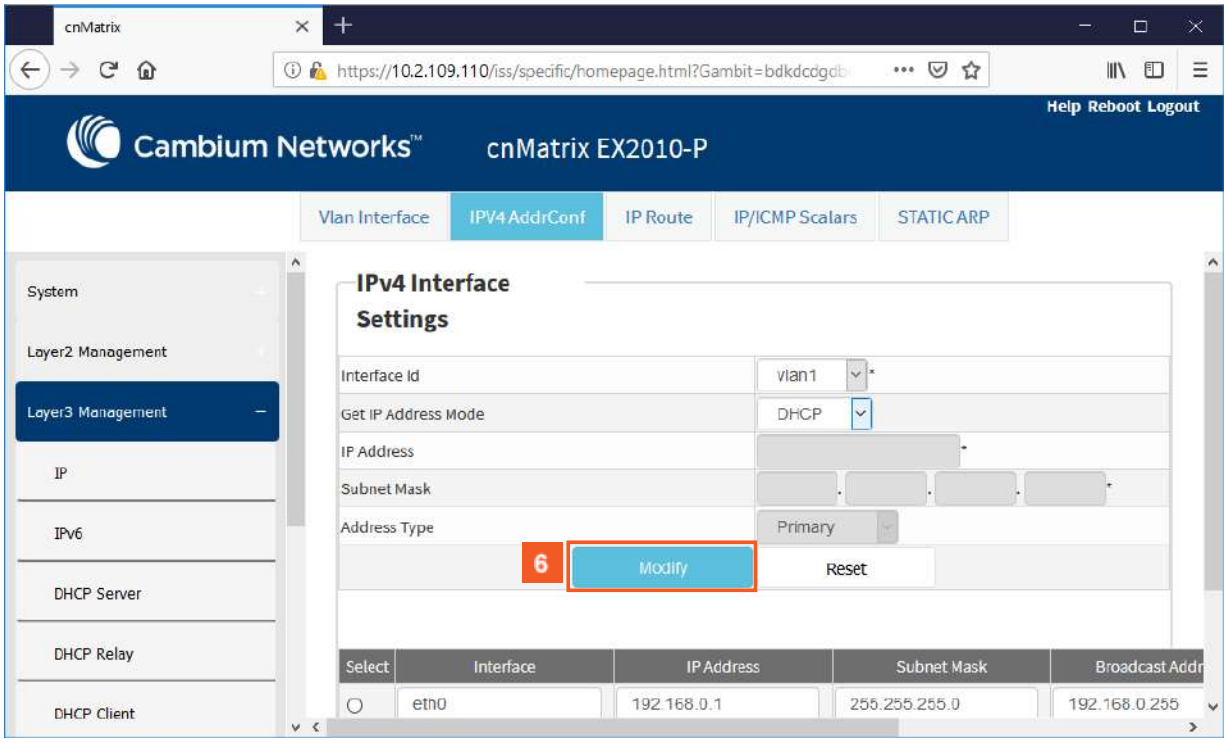
2 Click the **IP** menu item.

3 Click the **IPV4 Address Configuration** tab. The **IPv4 Interface Settings** window is displayed.



4 Click the **Get IP Address Mode** drop-down button and select the protocol to be used to obtain the IP address from the interface.

5 Select the **DHCP** option.



6 Click the **Modify** button.

4.2 DHCP Server

4.2.1 Managing DHCP Server

4.2.1.1 Feature Description

Feature Overview

DHCP Server maintains a configured set of IP address pools from which IP addresses are allocated to the DHCP Clients, whenever they request the Server dynamically.

Once the IP address is allocated, the Server will keep this IP as reserved until the lease time for that IP expires. If the Client does not renew the IP before the lease time expiry, this will be returned into the free pool and will be offered to new clients.

Standards

- RFC 2131
- RFC 2132

Scaling Numbers

- A maximum of 16 Address Pools can be configured.
- A maximum of 256 DHCP Clients per pool are supported.

Limitations

DHCP Relay must be disabled before enabling the DHCP server.

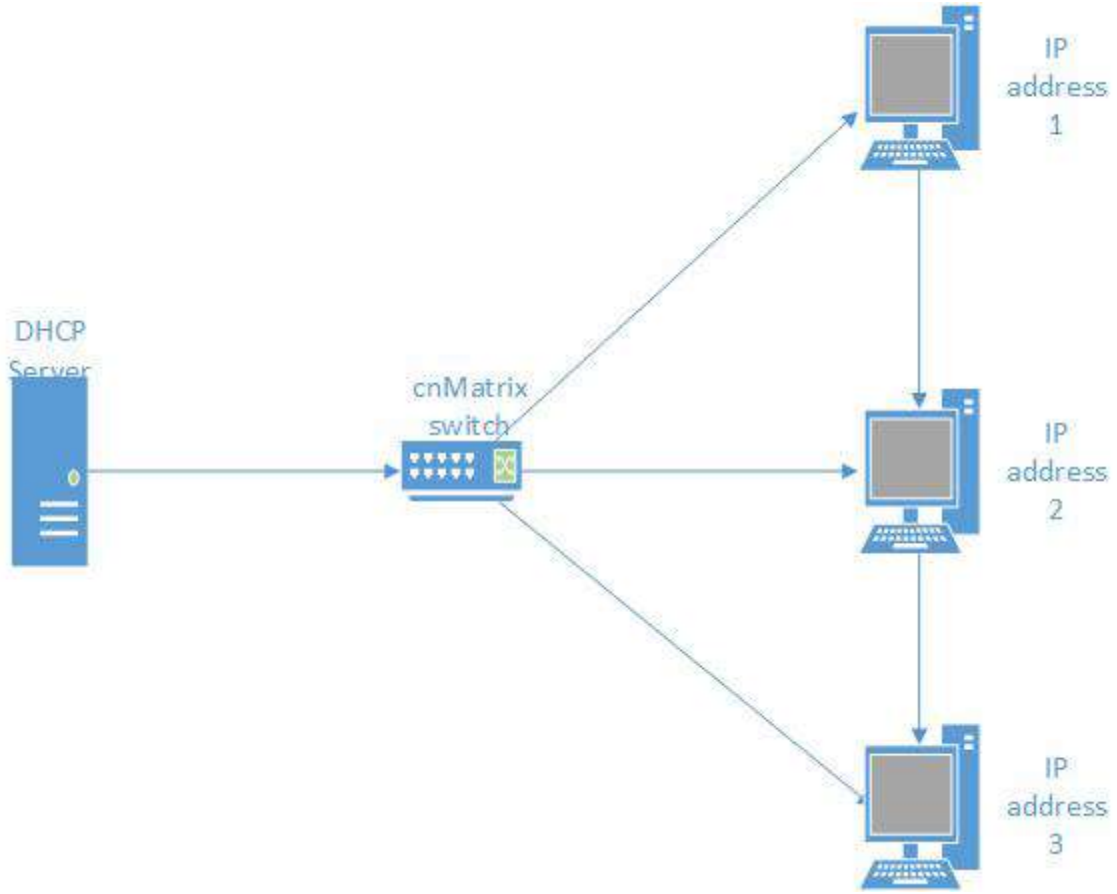
Default Values

- DHCP Server is disabled by default.
- ICMP echo is disabled by default.
- Offer reuse time out has a value of 5 seconds.
- DHCP server pool lease time is of 3600 seconds.
- DHCP server pool utilization threshold is 75%.

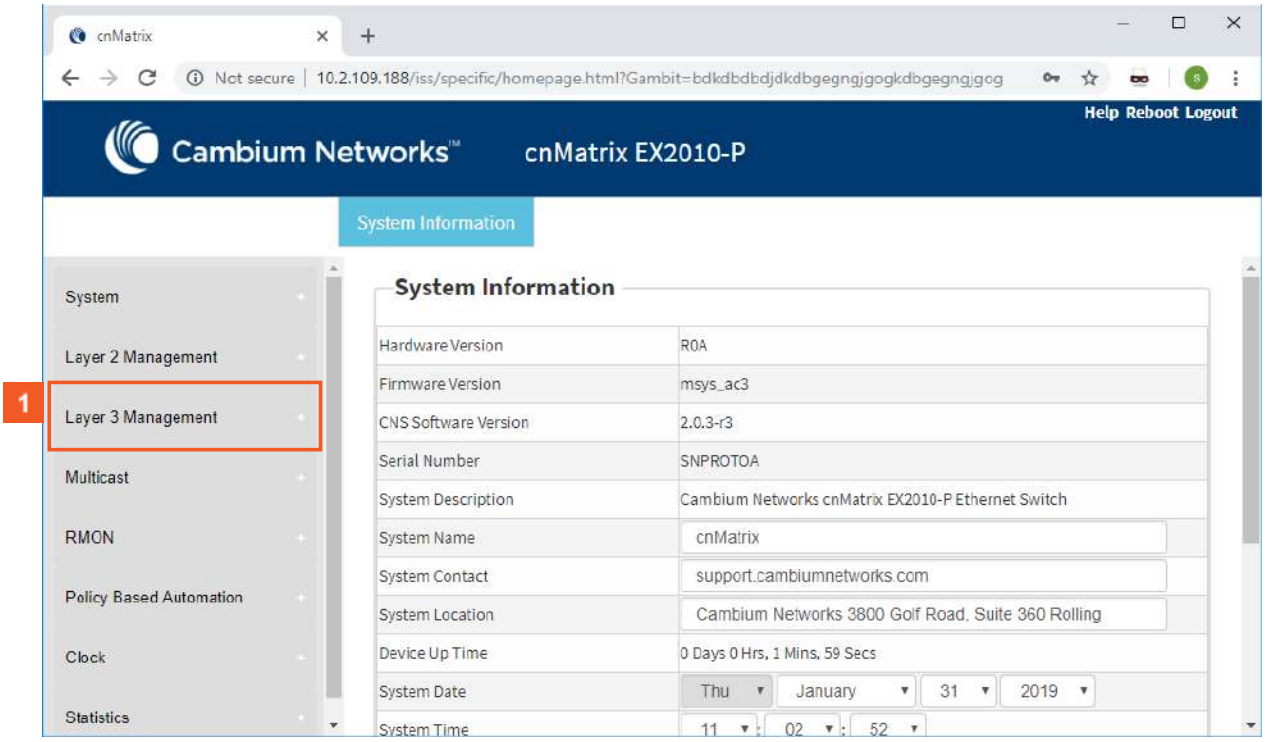
Prerequisites

- In order for the DHCP Server to respond to DHCP Clients requests from a certain subnet, the administrator must create a VLAN and a IPv4 interface with configured address associated to the DHCP Clients subnet.

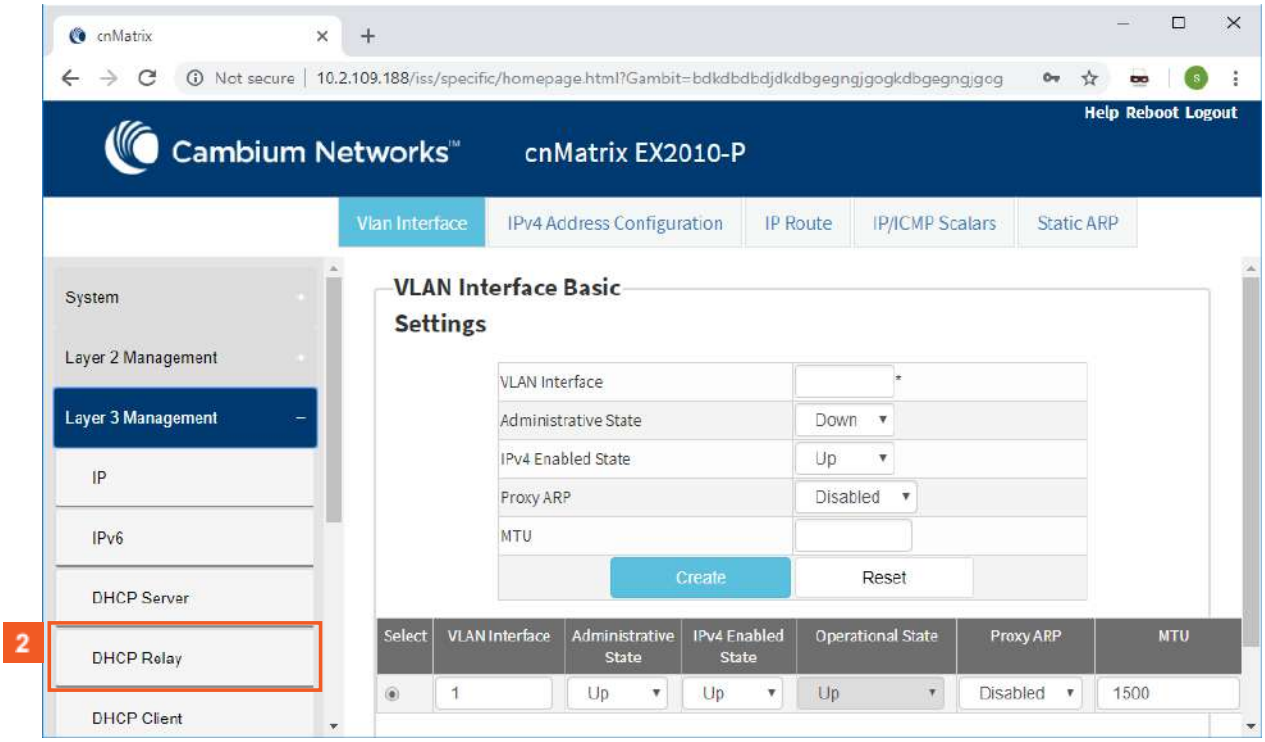
4.2.1.2 Network Diagram



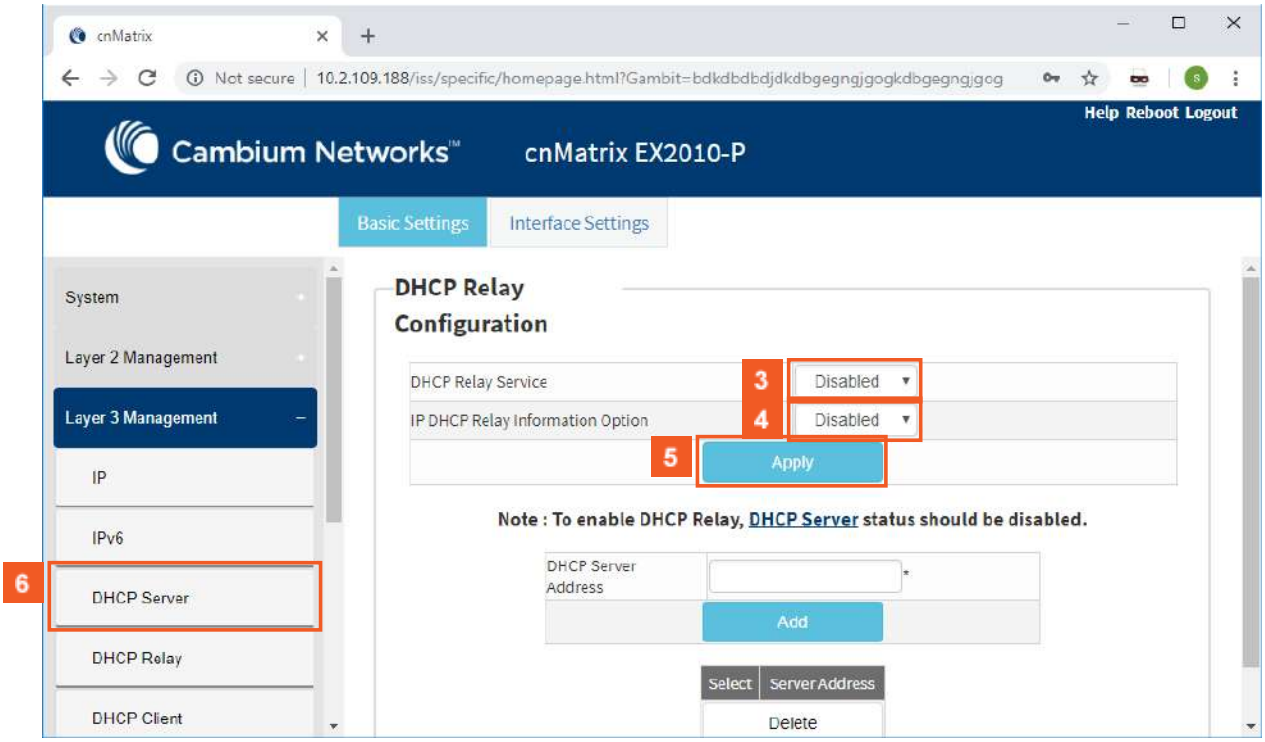
4.2.2 Configuring DHCP Server in WEB



1 Click the **Layer3 Management** menu item. The **L3 Features** are displayed.



2 Click the **DHCP Relay** menu item.

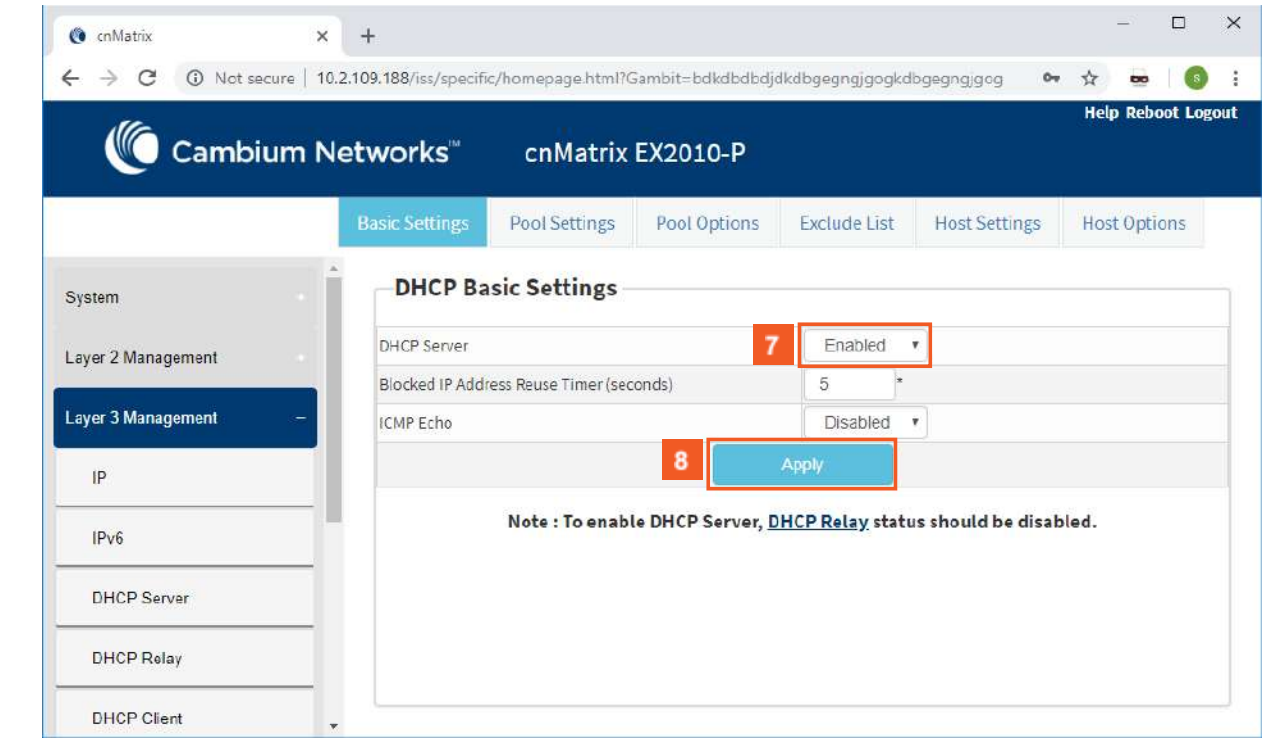


3 Click the **DHCP Relay Service** drop-down button and select the DHCP Relay service status in the switch.

4 Select the **Disabled** list item.

5 Click the **Apply** button.

6 Click the **DHCP Server** menu item. The **DHCP Basic Settings** window is displayed.



7 Click the **DHCP Server** drop-down button and select the **Enabled** option for the new DHCP server status in the router.

8 Click the **Apply** button.

Session complete. Click X to close.

4.3 Out-of-Band Management

4.3.1 Managing Out-of-Band Ethernet Management

4.3.1.1 Feature Description

The Out Of Band (OOB) dedicated port provides management connectivity isolated from user – data plane - traffic.

Benefits:

- Separating user and management traffic provides extra security and reliability for the management traffic.
- Offers redundancy in management connectivity (dedicated network resources).
- Prevents data plane misconfiguration from impacting management connectivity.

Disadvantages of using OOB rather than in-band ports for management:

- Extra cost and effort are required for maintaining a separate network for management purposes only.
- IPv6 not supported yet on OOB port.

Standards

N/A

Scaling Numbers

N/A

Limitations

- IPv6 not supported on OOB port.

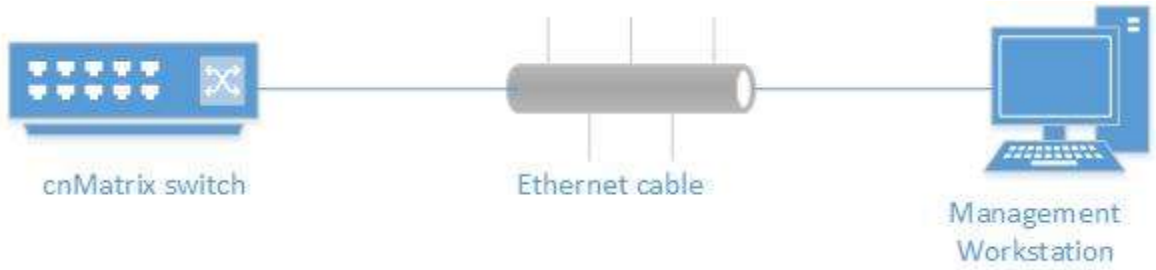
Default Values

- Default IP address on OOB port is 192.168.0.1, with a prefix length of 24.

Prerequisites

N/A

4.3.1.2 Network Diagram



4.3.2 Configuring Out-of-Band Ethernet Management WEB

The **Out-of-Band Ethernet Management** feature is not available in WEB interface.

4.4 Telnet Client

4.4.1 Managing Telnet Client

Telnet Client is an industry standard tool for remote connectivity using TCP protocol. This tool is used to connect to a remote system and open a CLI or Shell session.

Standards

- RFC 854

Scaling Numbers

- 1 session

Limitations

- It is recommended to open only one Telnet Client session.
- Telnet client doesn't work with IPv6 link local addresses.

Default Values

- The Telnet Client feature is enabled by default.
- Remote TCP port value is 23.

Prerequisites

N/A

4.4.2 Configuring Telnet Client WEB

The **Telnet Client** feature is not available in WEB interface.

4.5 System Resource Monitoring

4.5.1 Managing System Resource Monitoring

Feature Overview

The **System Resource Monitoring** feature enables the users to monitor the general status of the devices.

Standards

N/A

Scaling Numbers

N/A

Limitations

- Fan and temperature information is available only on EX2028-P.

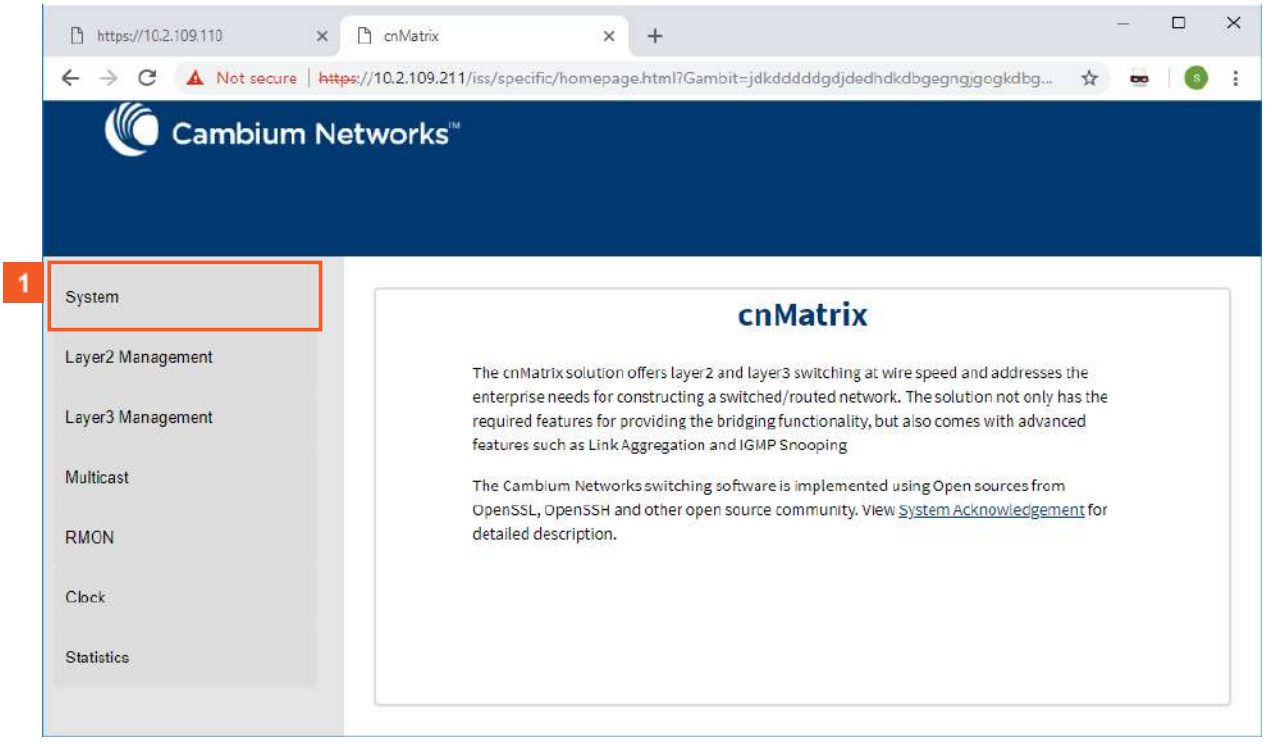
Default Values

- The default threshold RAM, CPU and Flash value is 100% by default.

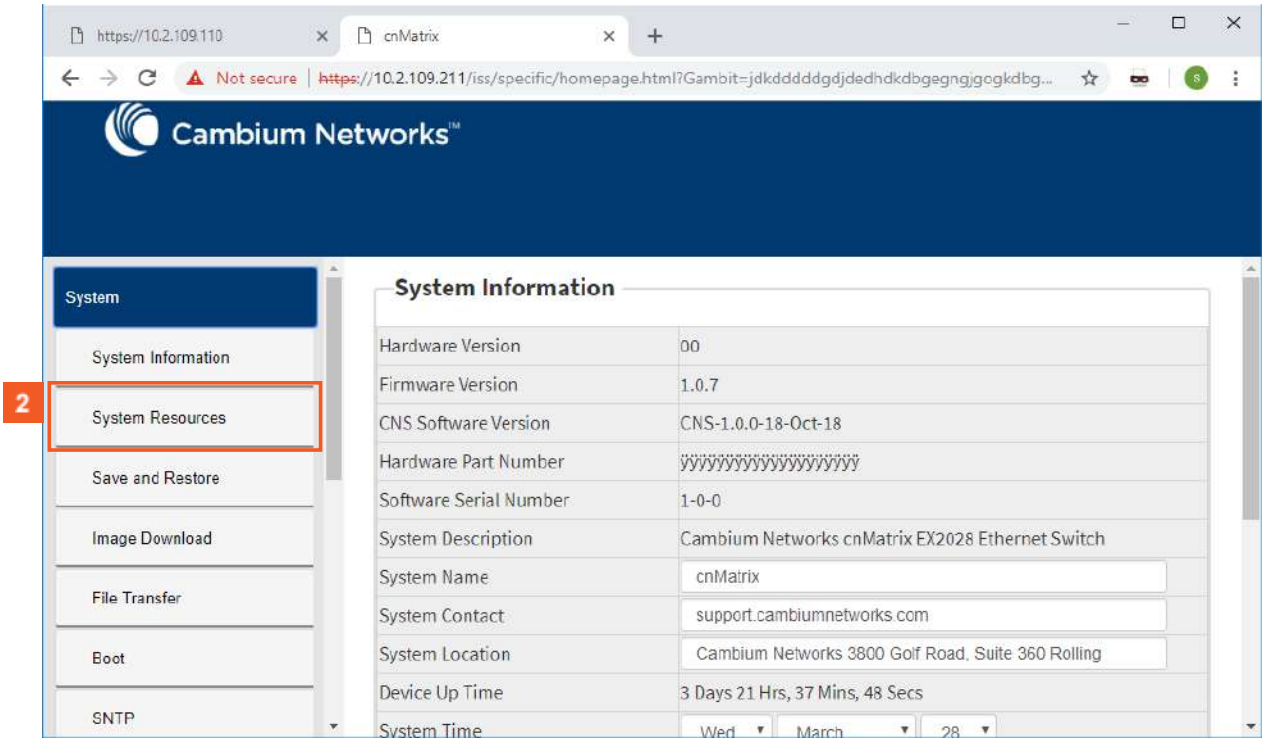
Prerequisites

N/A

4.5.2 Configuring System Resource Monitoring WEB



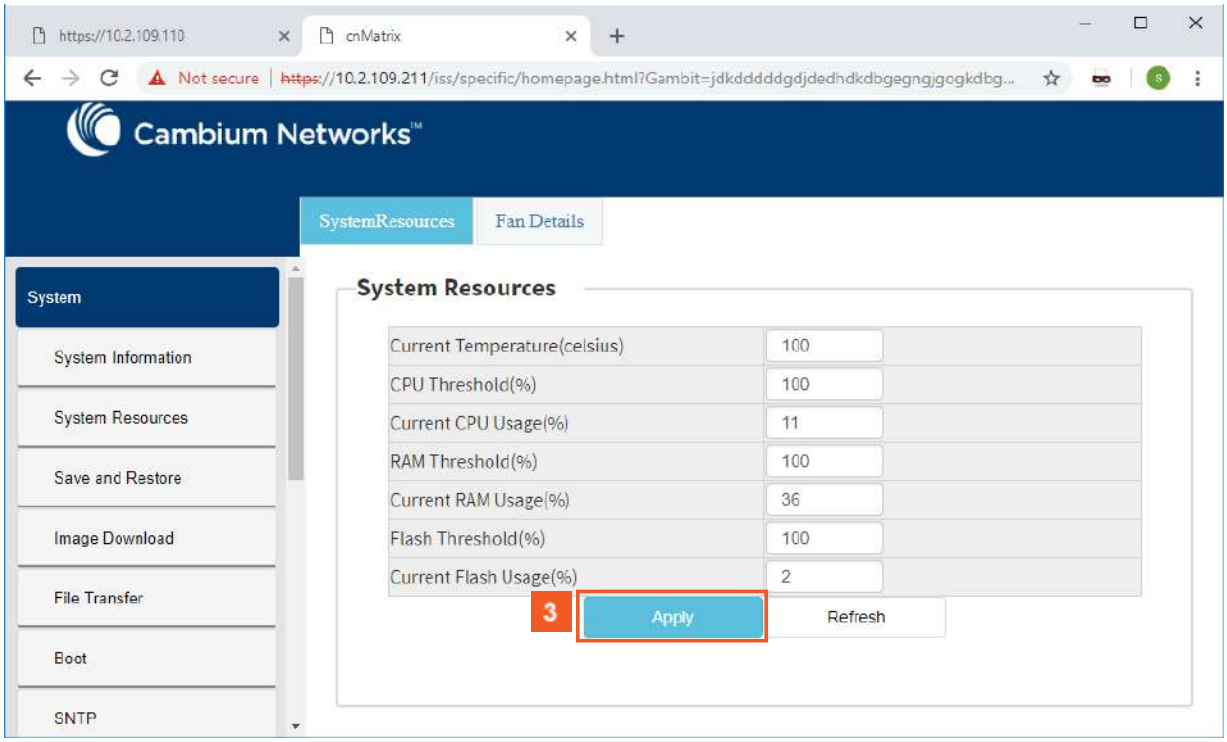
1 Click the **System** menu item.



2 Click the **System Resources** menu item.

In the CPU Threshold (%) field, set the desired threshold.

Threshold can be set for CPU, RAM and Flash



3 Click the **Apply** button.

For more information, see [System Resources WEB Fields](#).

4.6 Syslog

4.6.1 Managing Syslog

Feature Overview

Syslog is a protocol used for capturing log information for devices on a network. The syslog protocol provides a transport to allow a machine to send event notification messages across IP networks to event message collectors, also known as syslog servers. The protocol is simply designed to transport the event messages.

Standards

- The syslog protocol is described in RFC5424.

Scaling Numbers

- There are 8 severity levels (alerts, emergencies, critical, error, warnings, informational, notification, debugging).
- There are 8 available facilities (local0-7).

Limitations

- A maximum of 8 logging entries can created
- The maximum length of the DNS host name is 64 characters.

Default Values

- Syslog logging is enabled by default.
- Console logging is enabled by default.
- Severity logging is set to critical by default.
- Buffered size: 50 entries by default.

- The TimeStamp option is enabled by default.

Prerequisites

- Before configuring a Cambium device to send syslog messages, the right time and date should be configured. When using NTP, a correct and synchronized system clock on all devices within the network is guaranteed.
- Before configuring a Cambium device to send syslog messages, the device should be able to reach the external device on which the messages will be stored.

4.6.2Configuring Syslog Web

The **Syslog** feature is not available in WEB interface.

4.7 SNMP

4.7.1 Managing SNMP

4.7.1.1 Feature Description

Feature Overview

SNMP (Simple Network Management Protocol) is the most widely used network management protocol on TCP/IP based networks. SNMPv3 is designed mainly to overcome the security shortcomings of SNMPv1/v2. USM (User based Security Model) and VACM (View based Access Control Model) are the main features added as a part of the SNMPv3 specification. USM provides both encryption and authentication of the SNMP PDUs, while VACM specifies a mechanism for defining access policies for different users with different MIB trees. In addition, SNMPv3 specifies a generic management framework, which is expandable for adding new Management Engines, Security Models, Access Control Models, etc. With SNMPv3, the SNMP communication is completely safe and secure.

4.7.1.2 Network Diagram

Standars

- RFC 1157
- RFC 1901
- RFC 1908
- RFC 3416
- RFC 3410-3417

Scaling Numbers

- N/A_

Limitations

- N/A

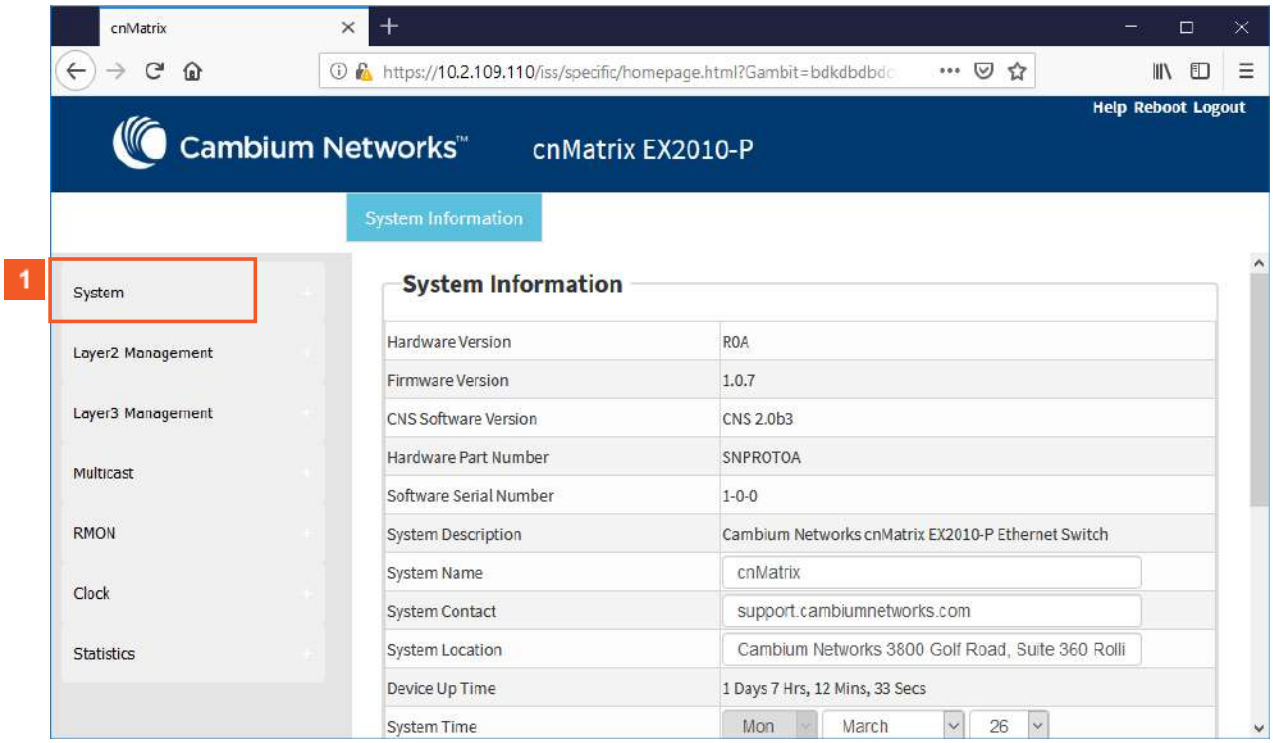
Default Values

- SNMP agent is enabled by default.
- SNMP Coldstart trap is enabled by default.
- Storage Type: Non-Volatile by default.
- Row Status : Active by default.
- Sub-tree OID: 1 by default.
- Sub-tree Mask: 1 by default.
- Community names: private, public.

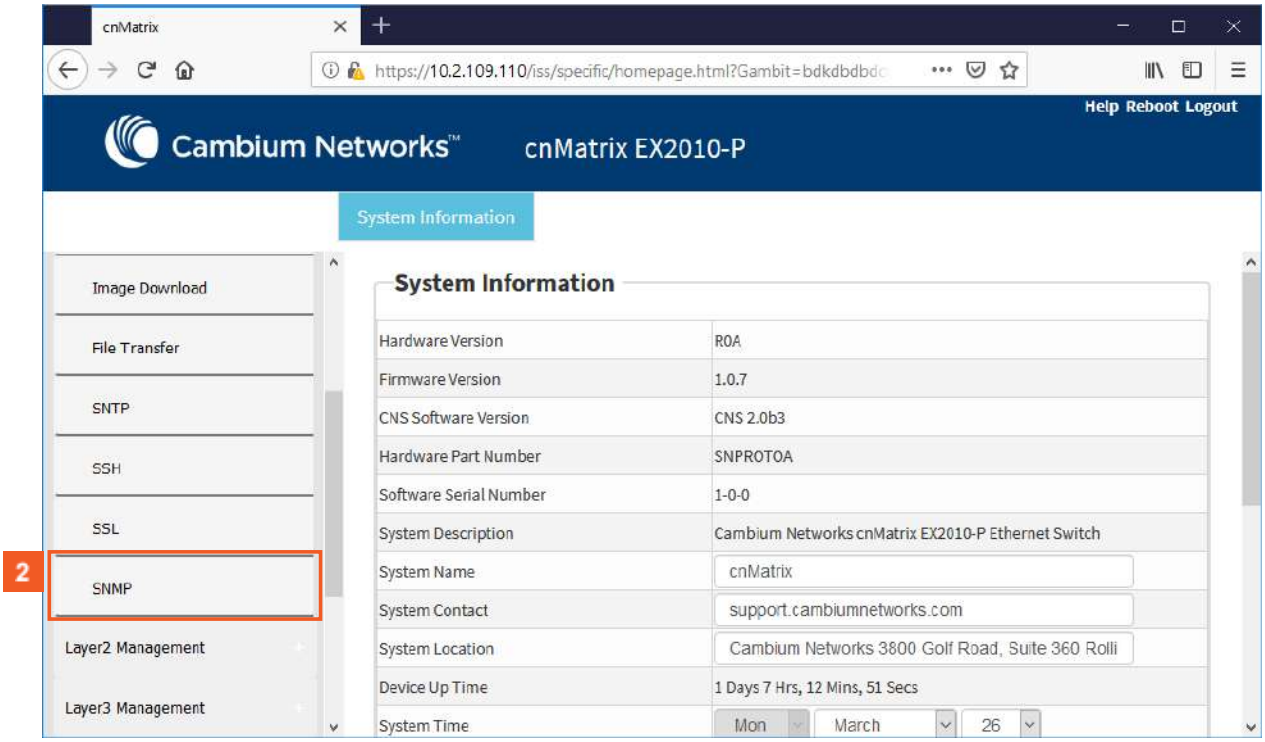
- Group security models: v1, v2c, v3.

4.7.2 Configuring SNMP V2 WEB

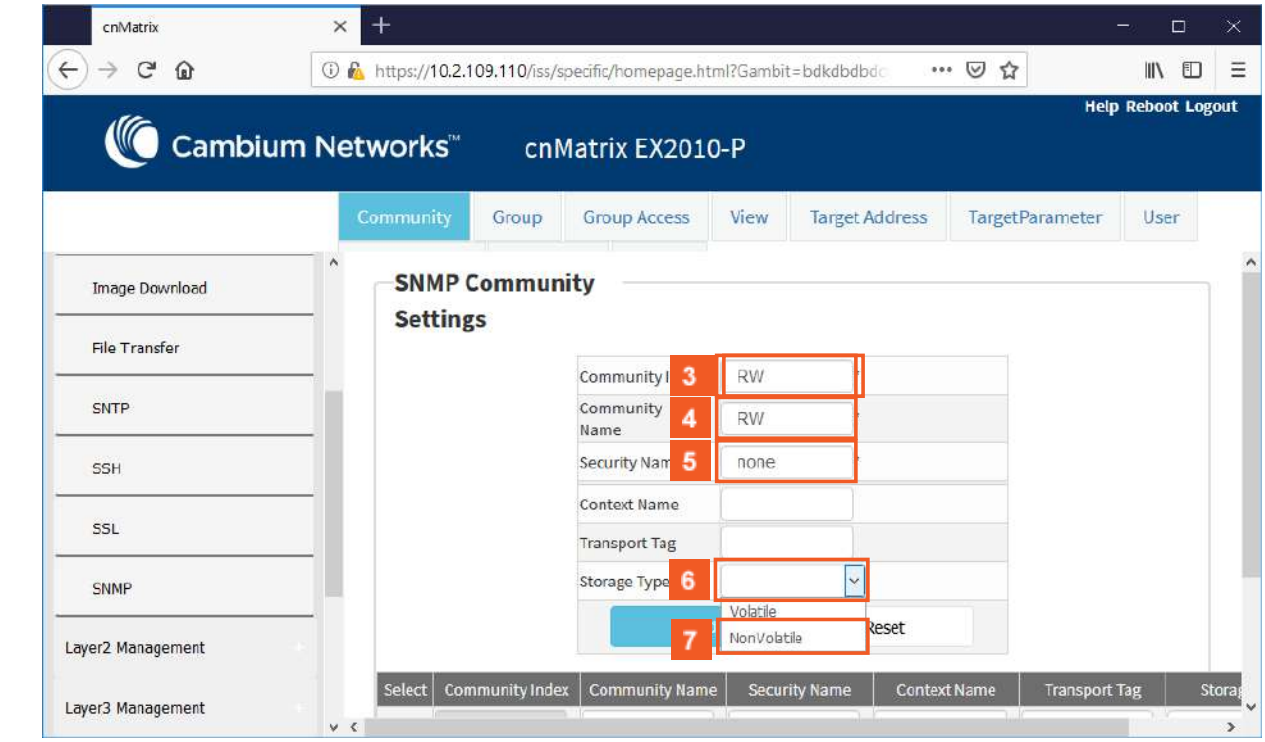
4.7.2.1 Configuring SNMP V2



1 Click the **System** menu item.



2 Click the **SNMP** menu item. The **SNMP Community Settings** window is displayed.



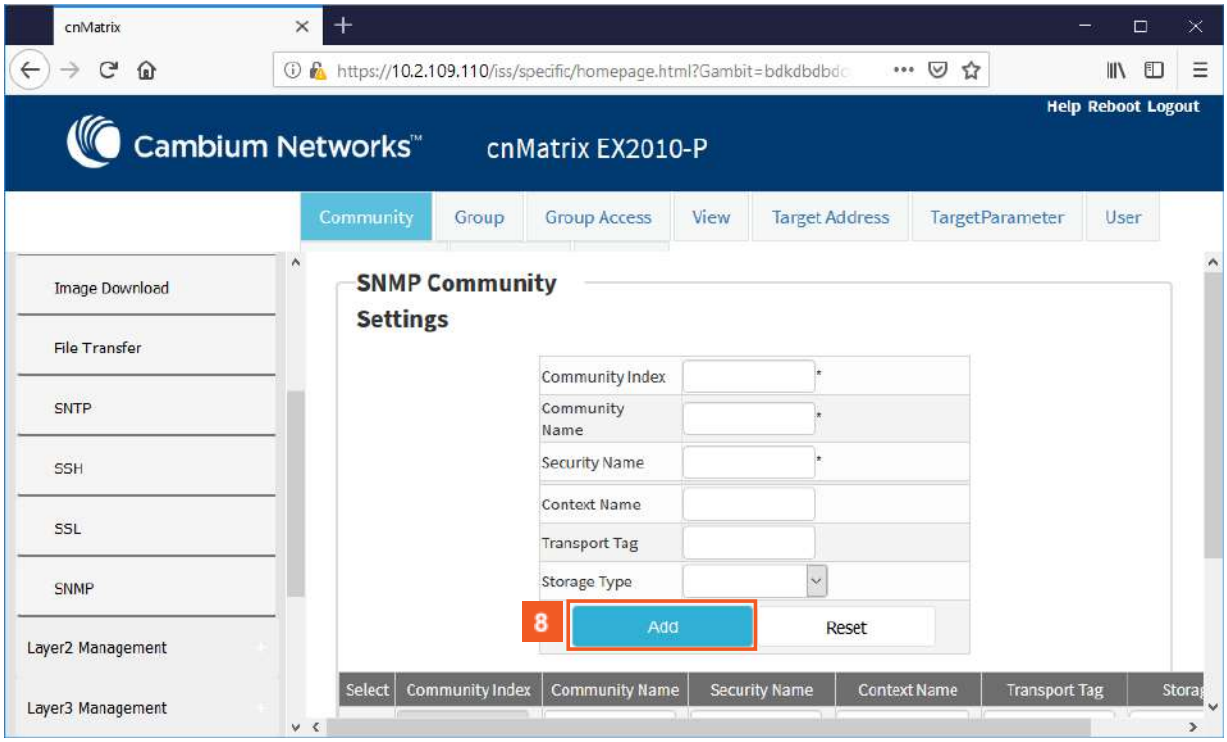
3 Enter a community index. For example, **RW** into the **Community Index** field.

4 Enter a community name to reference. For example, **RW** into the **Community Name** field.

5 Enter **none** into the **Security Name** field.

6 Click the **Storage Type** drop-down button and select the required storage type for the community.

7 Select the **NonVolatile** list item.



8 Click the **Add** button.

Section complete. Click X to close.

4.8 SSH

4.8.1 Managing SSH

4.8.1.1 Feature Description

Secure Shell is a protocol for secure remote login and other secure network services over an insecure network. It runs on top of the transport layer and is basically a replacement for insecure telnet services to the switch.

The SSH protocol uses a client server model. cnMatrix contains both SSH server and SSH client implementations. The SSH server implementation is the OpenSSH version 5.1 server integrated into the cnMatrix software. The SSH server interoperates with the following SSH clients.

- PuTTY SSH 0.53 for Windows 95/98/2000/NT.
- TTSSH (TeraTerm) 1.5.4 for Windows 95/98/2000/NT.
- OpenSSH client for Linux.

Standards

- The SSH (IPv4/IPv6) client is RFC 1321 compliant.
- The SSH (IPv4/IPv6) server is RFC 4250 RFC 4251 RFC 4252 RFC 4253 RFC 4254 and RFC 4256 compliant.

Scaling Numbers

- The number of simultaneous supported SSH sessions is 8.

Default Values

- The SSH server and SSH client are enabled by default.
- The debugging option is disabled by default.

- The maximum number of bytes allowed in an SSH transport connection is set to 32768 by default.
- The default primary port number: 22.
- The following cipher algorithms are set by default: AES128-CBC, 3DES-CBC and DES-CBC.
- The default MAC algorithm is HMAC-SHA1.

Limitations

- Normally the SSH protocol allows cipher algorithms for the incoming and the outgoing direction to be configured independently. But in cnMatrix, SSH cipher configuration must be the same for both directions. This is to ensure that the configuration is simple
- Compression is not supported
- The key exchange algorithm, and the public key algorithm have default values and cannot be configured
- The SSH server is fairly resistant to any kind of security attack. But the Cipher Block Chaining (CBC) mode reveals information about the plain text if two cipher text blocks encrypted under the same key are equal. Since rekeying is not supported prolonged active session may lead to a security threat.
- The SSH server may be susceptible to the man-in-the-middle attacks when the server communicates with the client for the first time. When the server sends its public key for the first time to the client, the client does not have any binding of the server's public key to the identity of the server. In that case, an attacker can substitute his public key and signature in place of server's public key. The user in turn will send his password to the attacker thus resulting in a security break.
- The SSH client session cannot be established by providing the hostname. Also, SSH client does not support all the options available in normal SSH Client feature.
- cnMatrix does not store the keys used for creating SSH client sessions.
- The SSH client sessions cannot be established via SNMP and Web.

The SSH server provides a secure channel over which cnMatrix CLI is accessed and offers the following:

- Protocol version exchange for version compatibility check.
- Data integrity by including Message Authentication Code with each packet.
- Cipher and key exchange algorithms negotiation between two communicating entities.
- Key exchange mechanism.
- Encryption and server authentication.

The cnMatrix SSH server implementation supports the following:

- Algorithms:
  - Cipher algorithms – AES128-CBC, 3DES-CBC and DES-CBC
  - MAC algorithms - HMAC-MD5 and HMAC-SHA1.
  - Version compatibility flag (SSH 1.0 support) – a user can use this to change the protocol version support to SSH 1.0 or SSH 2.0.
  - The key exchange algorithms supported are Diffie-hellman-group1sha1 and Diffie-hellman-group14-sha1. The SSH server uses the key generated during the key exchange for data encryption and providing data integrity.
  - The Public Key algorithms supported are ssh-rsa and ssh-dss.

- Authentication using username and password.

- Timer for authentication and sends a disconnect message in case the timer expires. The timeout period is 10 minutes. The SSH server allows a maximum of 10 authentication attempts by the user. If the threshold is reached, the server sends a disconnect message to the client.

The SSH server implementation does not support the following:

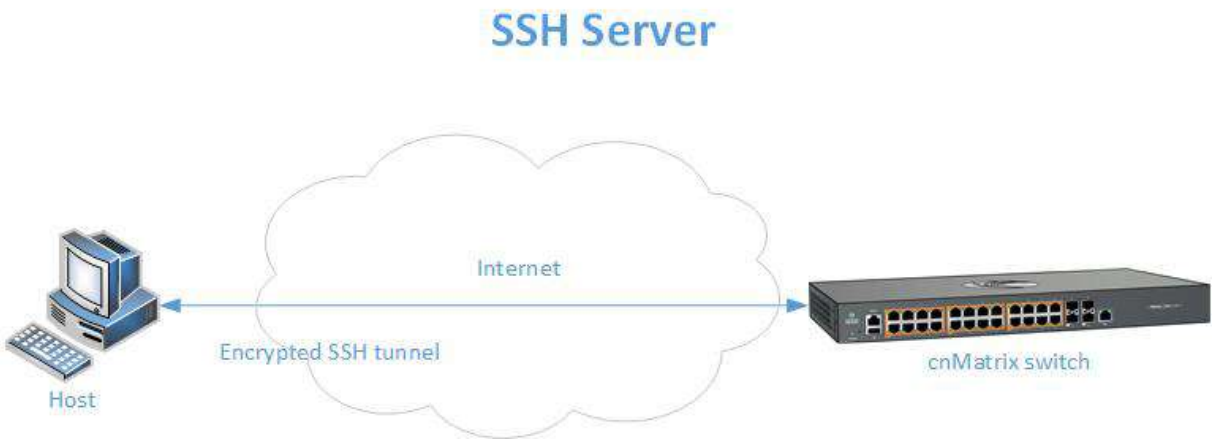
- Certificates for server and user authentication.
- Session re-keying after a specified time interval or after a specified amount of data transfer.
- User authentication using public key, because it is mandatory for the server to validate the public key and also to verify the signature sent by the client. This is not possible without 'out of band transfer' of client's public key to the server or some trusted authority like certificate authorities.
- Host based authentication.
- TCP/IP forwarding or X11 forwarding.

The SSH Client functionality is implemented in cnMatrix by integrating PuTTY (version 0.60) open source code. The SSH client session to any reachable host can be established from cnMatrix through CLI. SSH client feature can be enabled or disabled through SNMP and CLI. SSH client supports both Ipv4 and Ipv6 addresses.

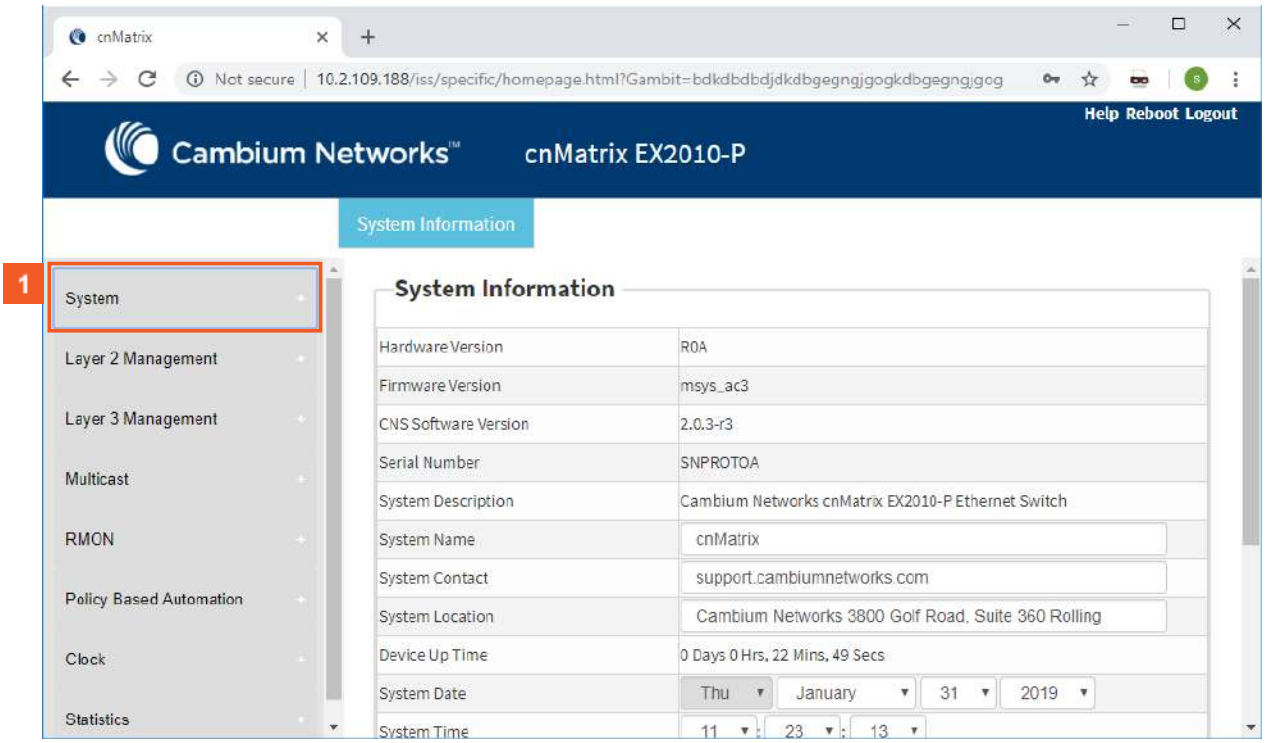
Options supported in SSH client :

- - 1 - Forces SSH to try protocol version 1 only.
- - 2 - Forces SSH to try protocol version 2 only.
- - 4 - Forces SSH to use Ipv4 addresses only.
- - 6 - Forces SSH to use Ipv6 addresses only.
- - A - Enables forwarding of the authentication agent connection.
- - a - Disables forwarding of the authentication agent connection.
- - C - Requests compression of all data.
- -N - Do not execute a remote command.
- - s - The subsystem is specified as the remote command. (SSH-2 only).
- - T - Disables pseudo-tty allocation.
- - t - Enables pseudo-tty allocation.
- -v - show verbose messages.
- -V - print version information.
- -i identity_file – Specifies the private key file for authentication.
- -l login_name - Specifies the user to log in as on the remote machine.
- -p port - Specifies the port to connect on the remote host.

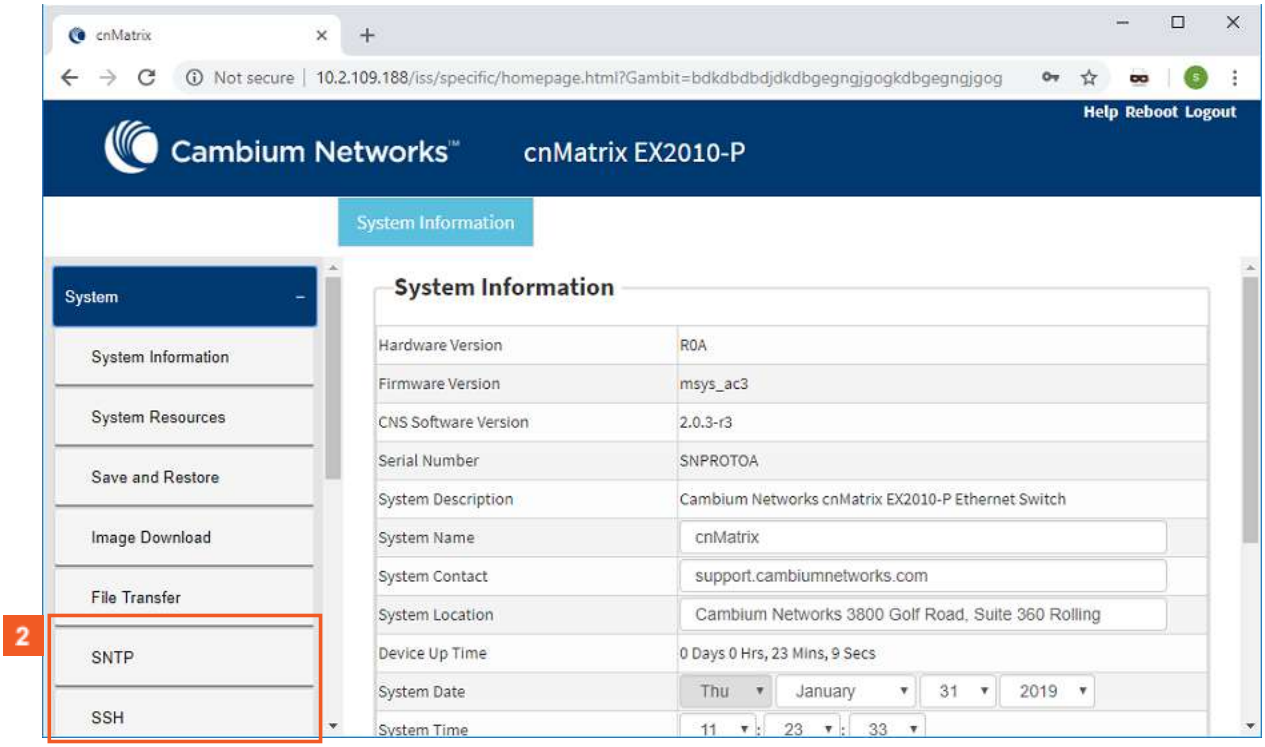
4.8.1.2 Network Diagram



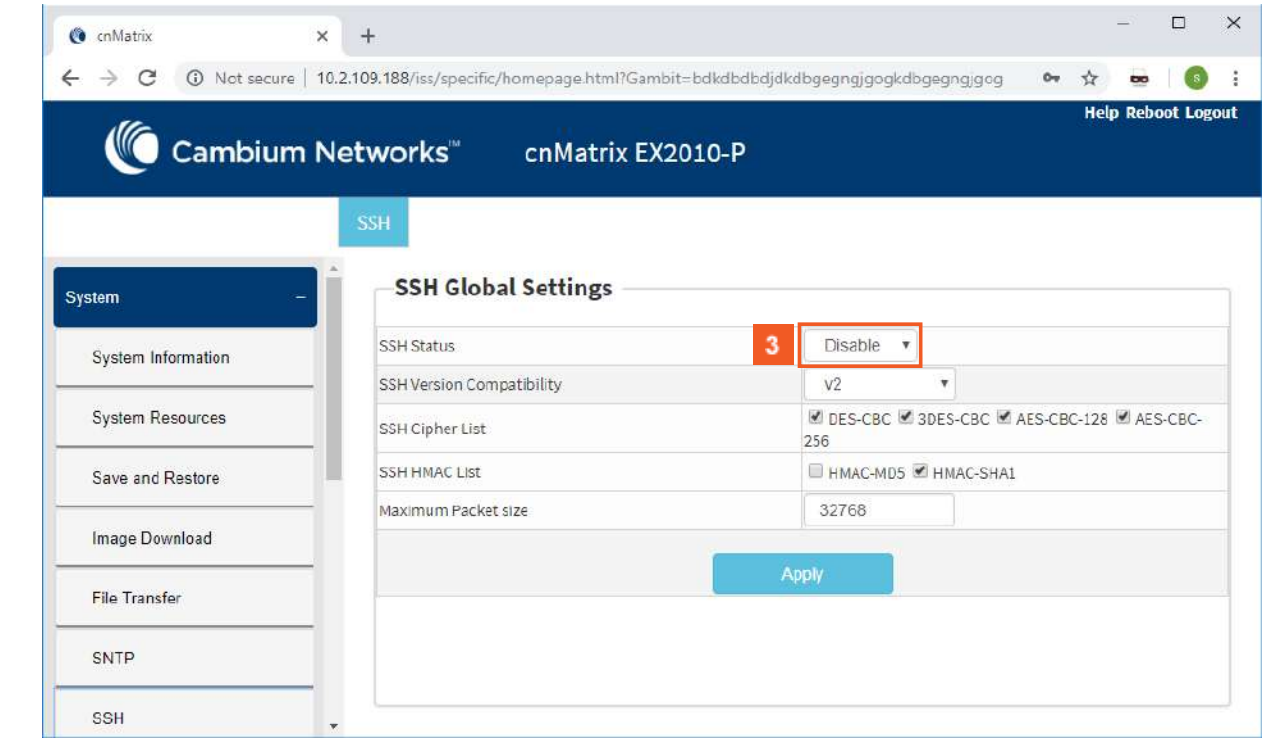
4.8.2 Configuring SSH in WEB



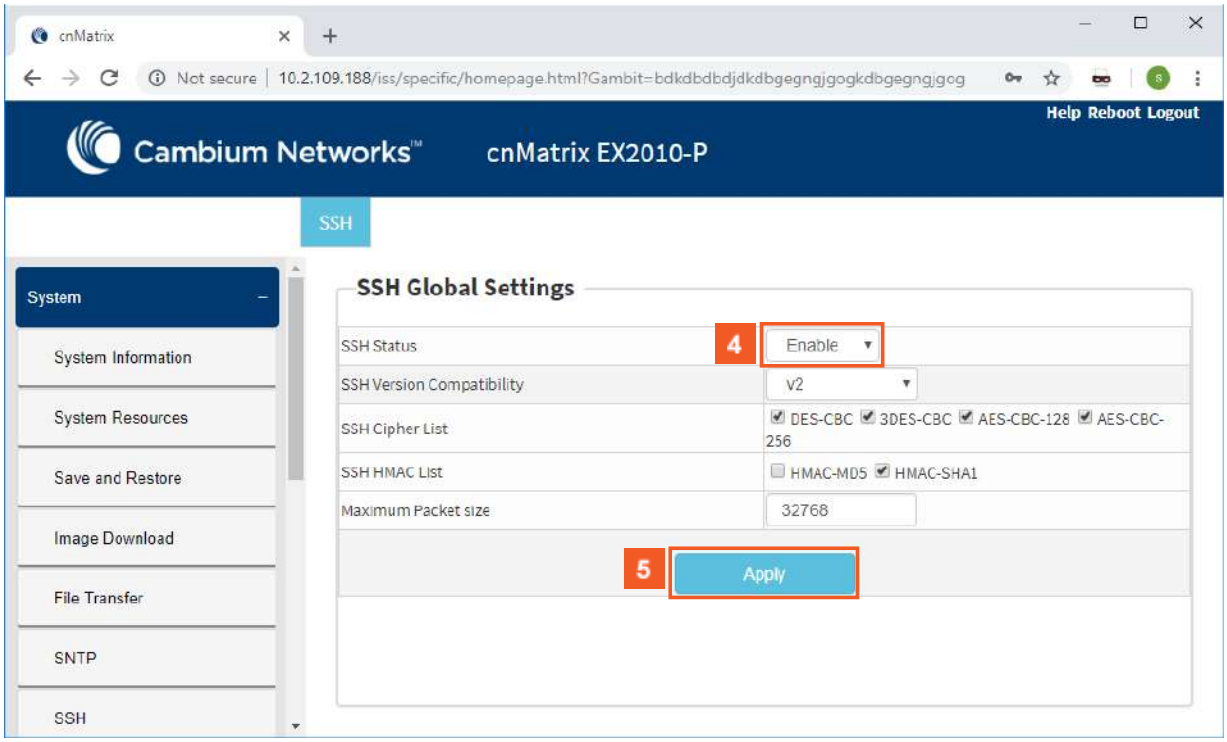
1 Click the **System** menu item.



2 Click the **SSH** menu item.



3 Click the **SSH Status** drop-down button to select the status of the SSH module.



4 Select the **Enable** list item.

5 Click the **Apply** button.

Section complete. Click X to close.

4.9 IPv6 Management

4.9.1 Managing IPv6 Management

Feature Overview

IPv6 (IP version 6), a new version of IP (Internet Protocol), adopted by the IETF (Internet Engineering Task Force) is designed as a successor to IPv4 (IP version 4).The IPv6 feature has been created in response to the explosive growth of the Internet that has resulted in exhaustion of the IP address space and enormous growth of the routing tables.

Standards

- RFC2460

Scaling Numbers

- One IPv6 interface is supported.

Limitations

- IPv6 is not supported on routed interfaces.

Default Values

- ICMPv6 Error Rate Limiting option is enabled.
- ICMPv6 Rate-Limit interval value is 100.
- ICMPv6 Error Rate-Limit Bucket size is 10.
- ICMPv6 Redirect option is disabled.

Prerequisites

For the IPv6 interface to run in HOST mode and SLAAC to work properly, the administrator needs to perform the following command:

```
no ipv6 unicast-routing
```

If the switch is linked to an IPv6 Router, capable of sending IPv6 Router Advertisements, an IPv6 address will be automatically configured. In order for you to assign a specific IPv6 address, you need to perform the following configuration: " ipv6 unicast-routing".

5 Security Features

5.1 RADIUS

5.1.1 Managing RADIUS

5.1.1.1 Feature Description

Radius (Remote Authentication Dial-In User Service) is a networking protocol that provides centralized Authentication, Authorization, and Accounting (AAA or Triple A) management for users who connect and use a network service.

The **cnMatrix Radius (IPv4/IPv6) client** is a security feature that offers the ability for cnMatrix to communicate with a Radius central server with the purpose of **authenticating** users and **authorizing** their access to the system or a specific service. cnMatrix Radius (IPv4/IPv6) client is used with the login and PNAC features.

Standards

- cnMatrix Radius (IPv4/IPv6) client is RFC 2138, RFC 286, and RFC 2618 compliant.

Scaling Numbers

- cnMatrix Radius (IPv4/IPv6) is a client feature used for user authentication and authorization. Scalability falls on the server response capabilities.

Limitations

- cnMatrix Radius client (IPv4/IPv6) uses only the authentication and authorization subfeature of the Radius client feature. Accounting is not implemented.
- The number of Radius servers which can be programmed to be used by cnMatrix is limited to 5.
- Only one server is used in the authentication and authorization process. This one is called a primary server. If this server fails, only then another one will be used.

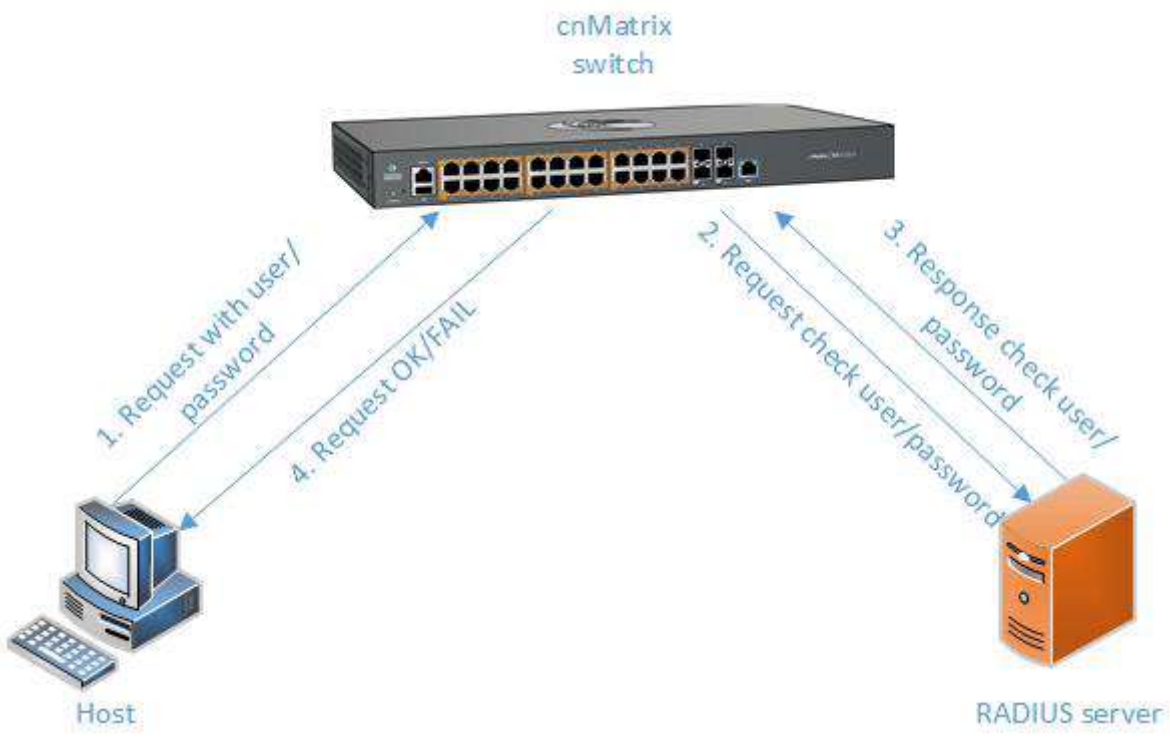
Default Values

- The default value for the time period in seconds for which a client waits for a response from the server before retransmitting the request: 10 seconds.
- The default value for the maximum number of attempts to be tried by a client to get response from the server for a request: 3 attempts.
- The default Authentication Port: 1812.
- The default Accounting Port: 1813.
- The debugging option is disabled by default.

Prerequisites

N/A

5.1.1.2 Network Diagram



5.1.2 Configuring RADIUS WEB

The **RADIUS** feature is not available in WEB interface.

5.2 TACACS

5.2.1 Managing TACACS

5.2.1.1 Feature Description

TACACS (Terminal Access Controller Access-Control System) is a protocol used in handling remote authentication and other related services for network access control through a centralized server. For a reliable delivery, TACACS uses the TCP transport protocol.

cnMatrix TACACS+ client(IPv4/IPv6) is a security feature that offers the switch the ability to communicate with a TACACS+ central server with the purpose of **authenticating** users. Therefore, TACACS works closely with the login feature.

Standards

- cnMatrix TACACS+ client (IPv4/IPv6) is in accordance with draft-grant-tacacs-02.

Scaling Numbers

- cnMatrix TACACS is a client feature used for user authentication at login. Scalability falls on the server response capabilities.

Limitations

- cnMatrix TACACS+ client (IPv4/IPv6) uses only the authentication subfeature of the TACACS+ client feature.

- cnMatrix TACACS+ client (IPv4/IPv6) uses only PAP(password authentication protocol) for the user authentication.
- The number of TACACS server which can be programmed to be used in the authentication process is limited to 5.
- Only one server is used in the authentication process. This one is called a primary server. If this server fails, only then another one will be used.

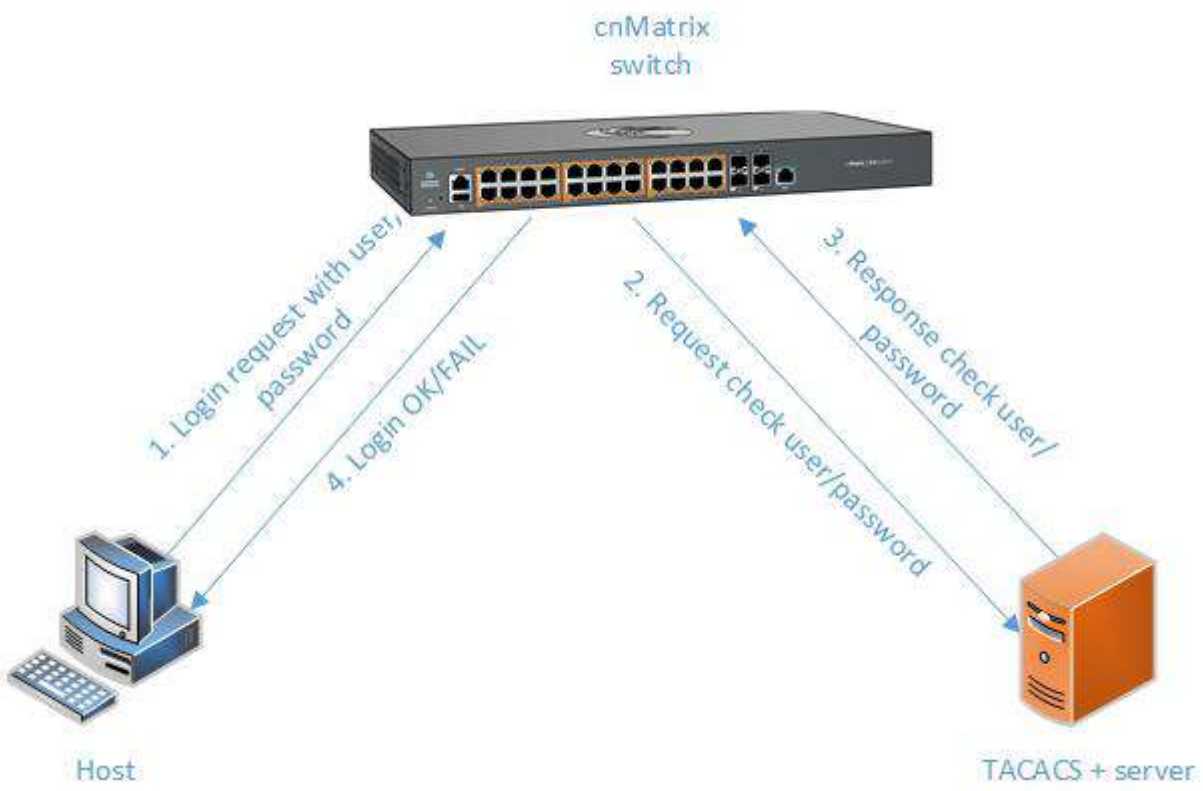
Default Values

- The default TCP port number: 49.
- The default timeout: 5 seconds.
- The default retransmit time: 2.
- The debugging option is disabled by default.
- The single-connection parameter is set to no by default.

Prerequisites

N/A

5.2.1.2 Network Diagram



5.2.2 Configuring TACACS in WEB

The **TACACS** feature is not available in WEB interface.

5.3 IGMP Snooping

5.3.1 Managing IGMP Snooping

5.3.1.1 Feature Description

The **IGMP Snooping** feature enables the cnMatrix switch to transmit multicast traffic to all ports in a broadcast domain.

IGMP Snooping allows a switch to snoop or capture information from IGMP packets being sent back and forth between hosts and a router. Based on this information, the switch adds/deletes the multicast addresses from its address table, thereby enabling/disabling multicast traffic from flowing to individual host ports.

Standards

N/A

Scaling Numbers

N/A

Limitations

- A maximum of 256 IGMP groups are supported.

Default Values

- The IGMP snooping feature is globally disabled.
- The fast leave processing is disabled by default.
- The debugging functionality is disabled by default.

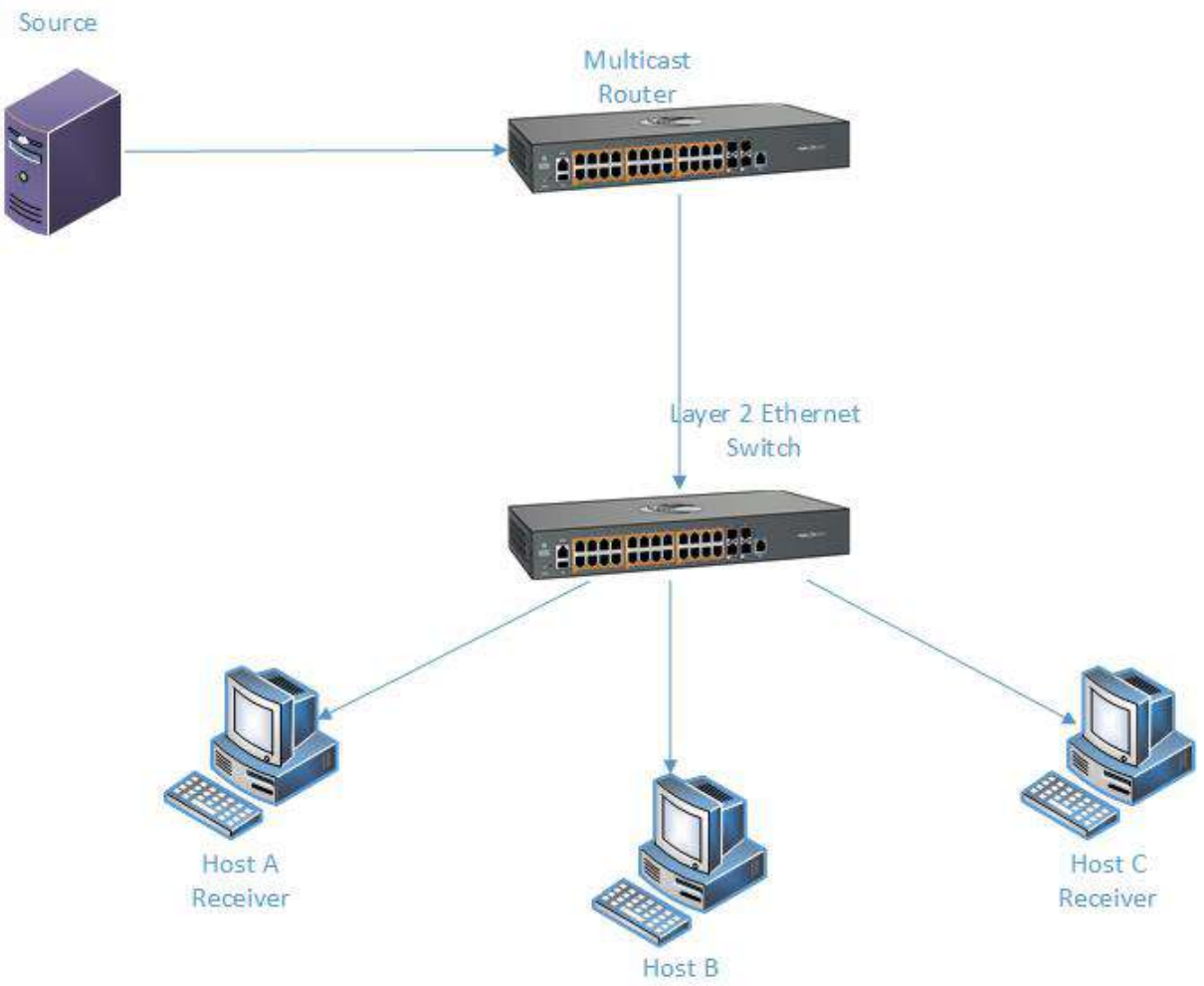
Prerequisites

```
cnMatrix# config terminal
cnMatrix(config)# ip igmp snooping
cnMatrix(config)# ip igmp snooping vlan x
```

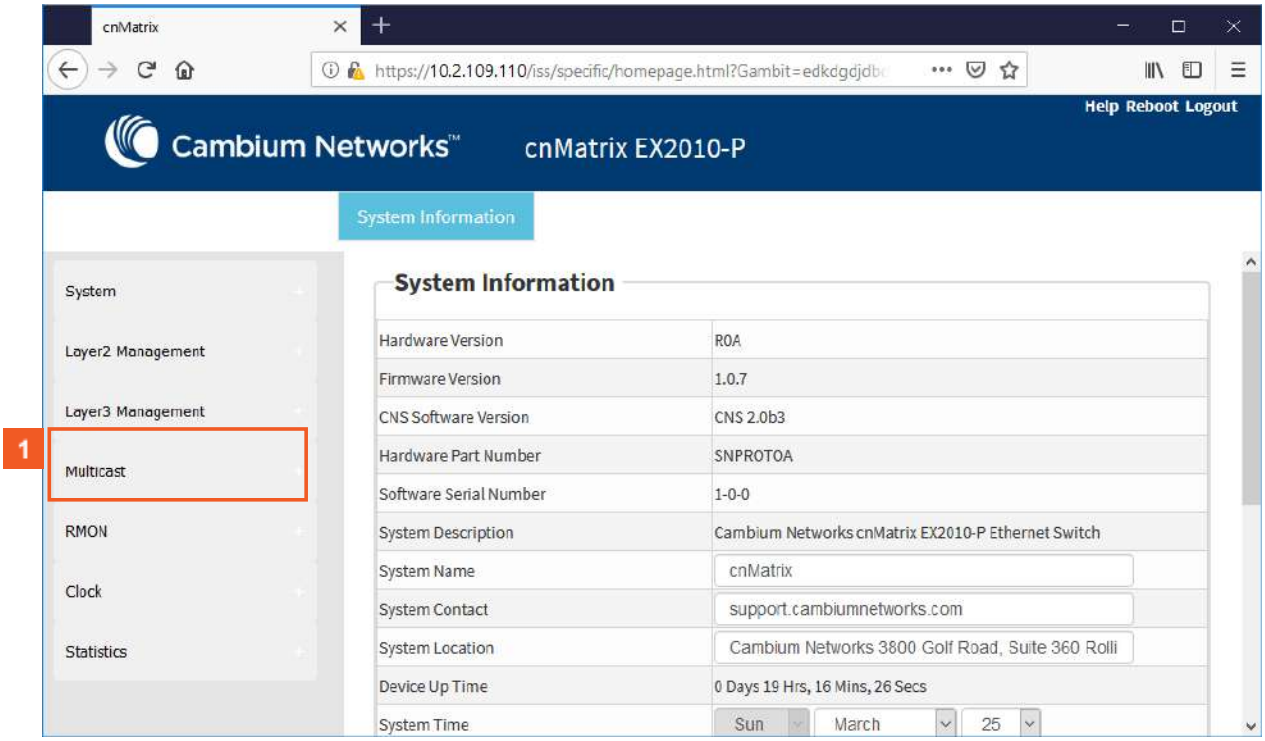
SNMP

- The IGMP Snooping feature can be configured using the SNMP tool.

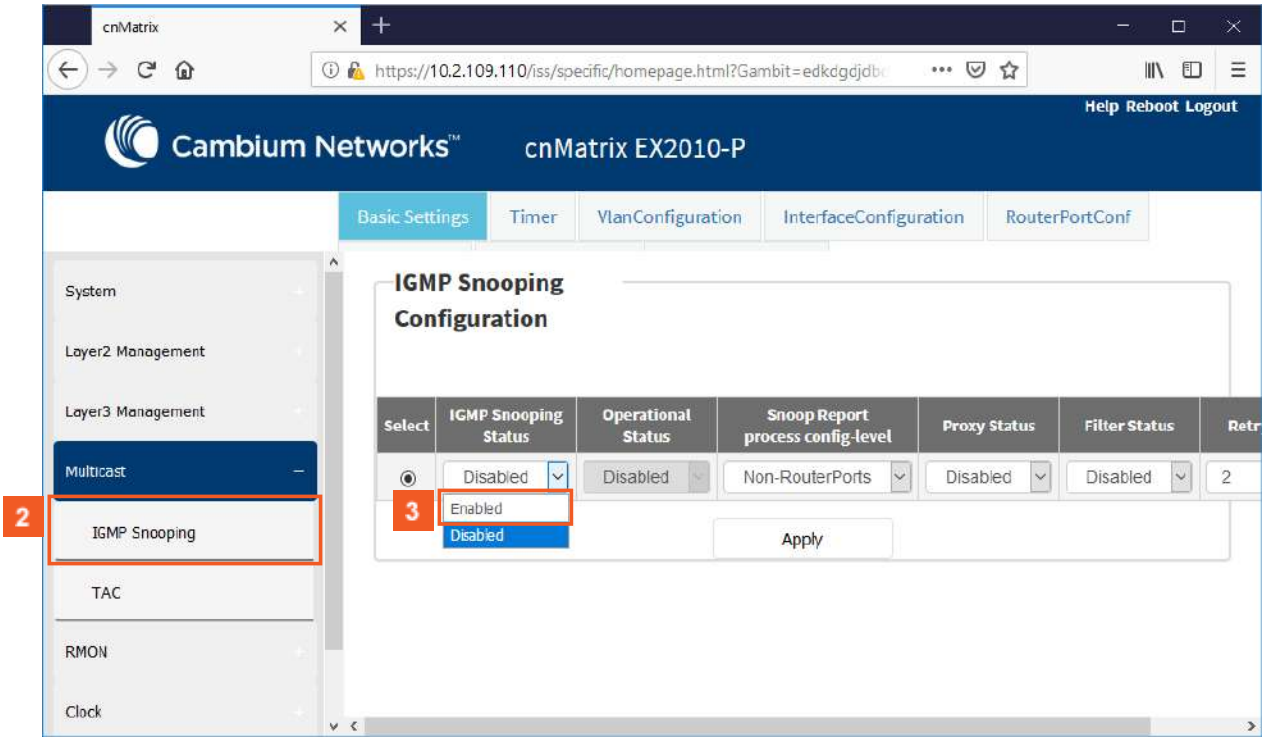
5.3.1.2 Network Diagram



5.3.2 Configuring IGMP Snooping WEB

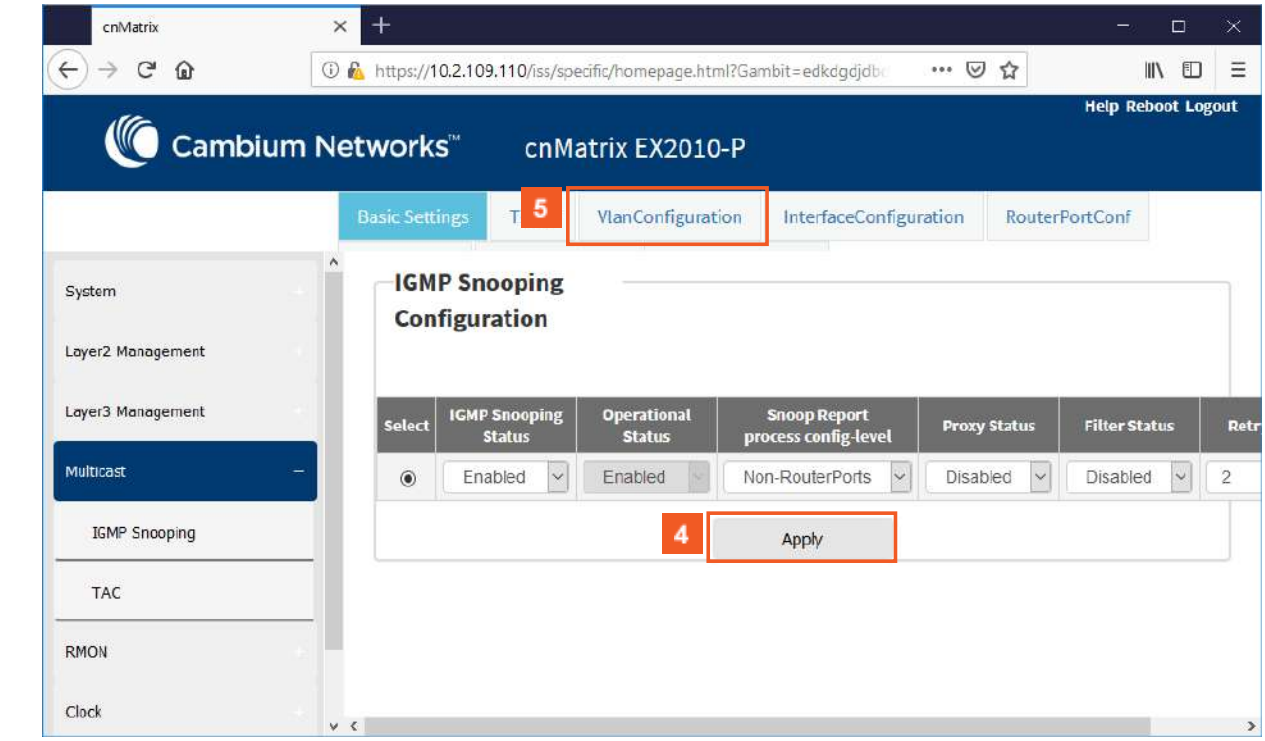


1 Click the **Multicast** menu item.



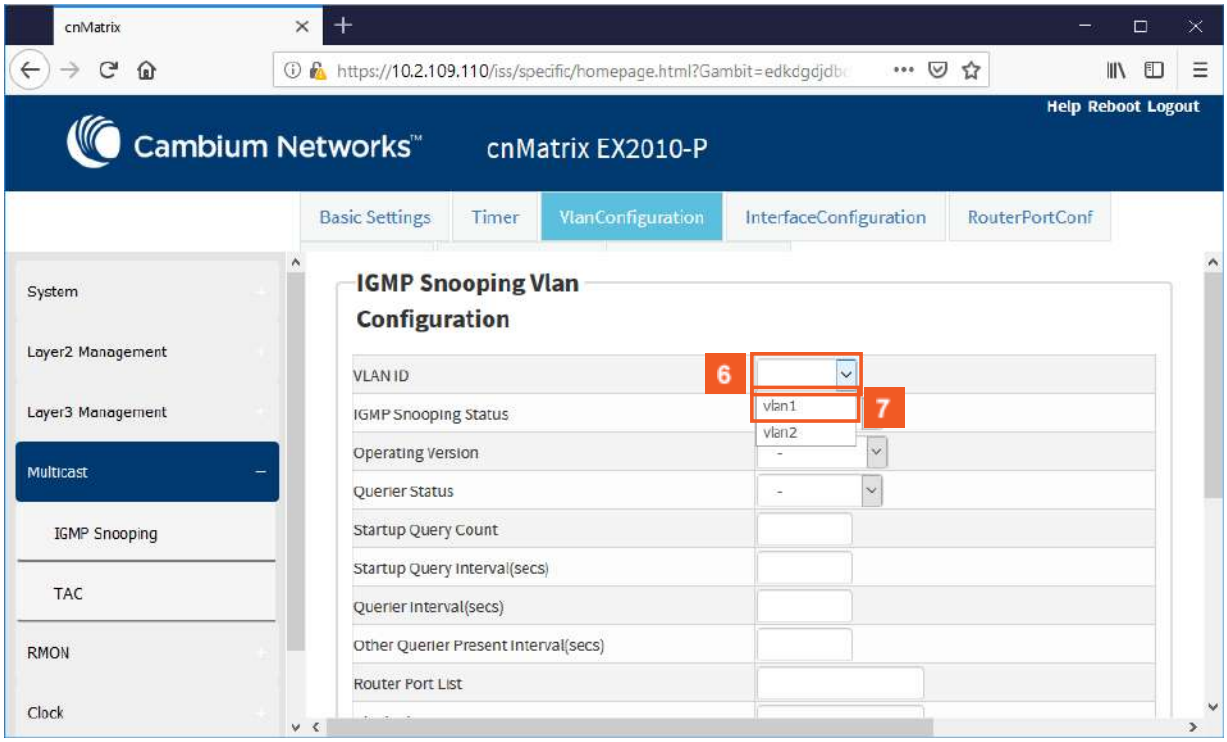
2 Click the **IGMP Snooping** menu item.

3 In the **IGMP Snooping Status** column, select the **Enabled** list item (the global status of IGMP Snooping in the switch).



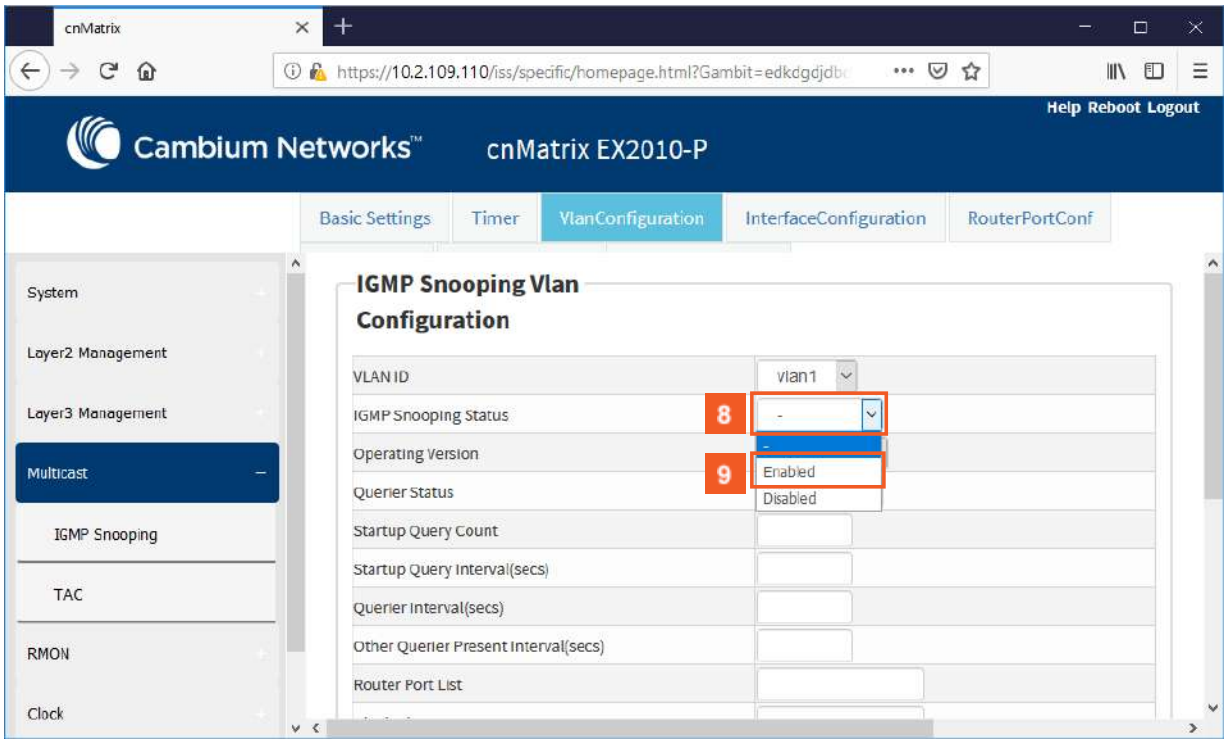
4 Click the **Apply** button.

5 Click the **VlanConfiguration** tab. The **IGMP Snooping VLAN Configuration** window is displayed.



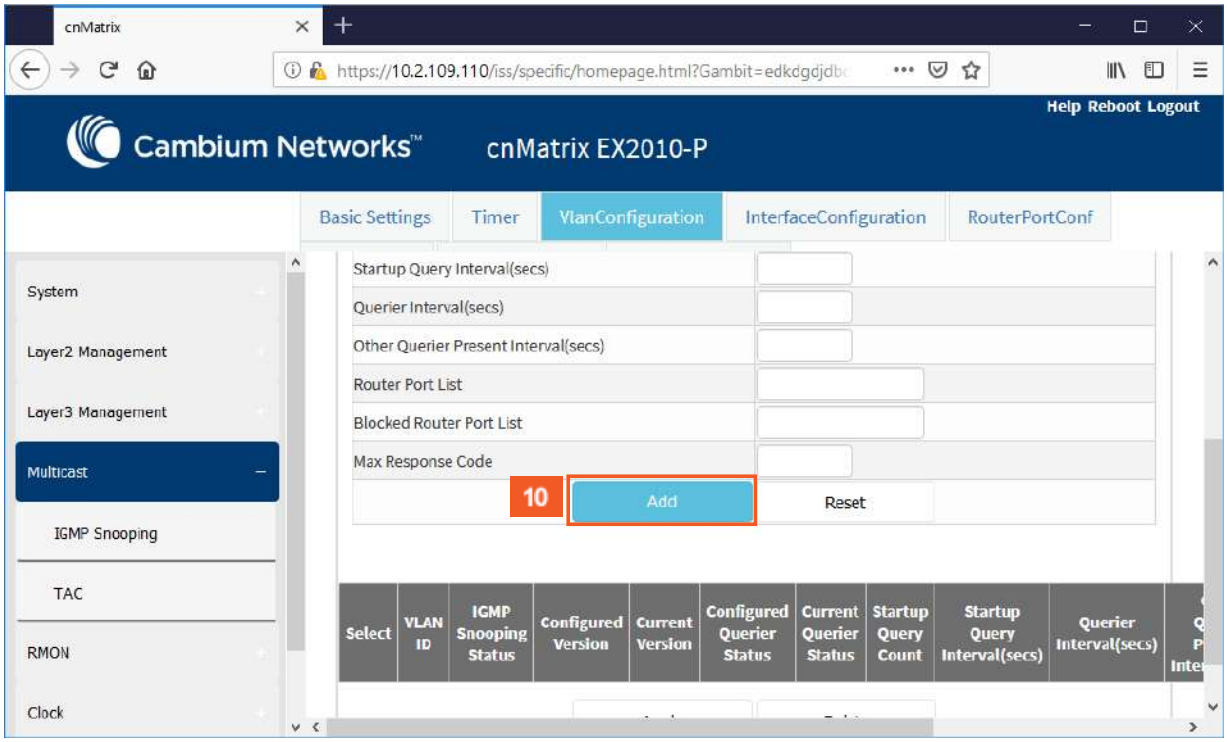
6 Click the **VLAN ID** drop-down button and select the VLAN identifier that uniquely identifies a specific VLAN from the available list.

7 For example, select the **vlan1** list item.

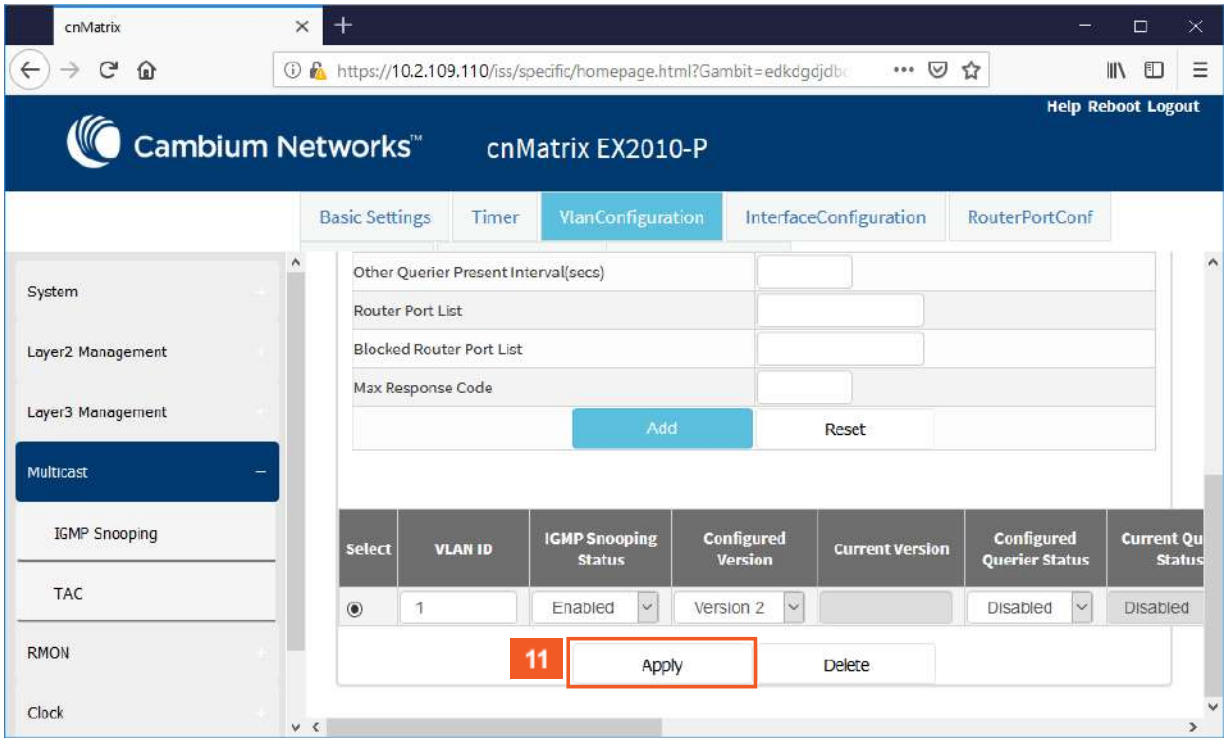


8 Click the **IGMP Snooping Status** drop-down button and select the status of the IGMP SNooping feature on the selected VLAN.

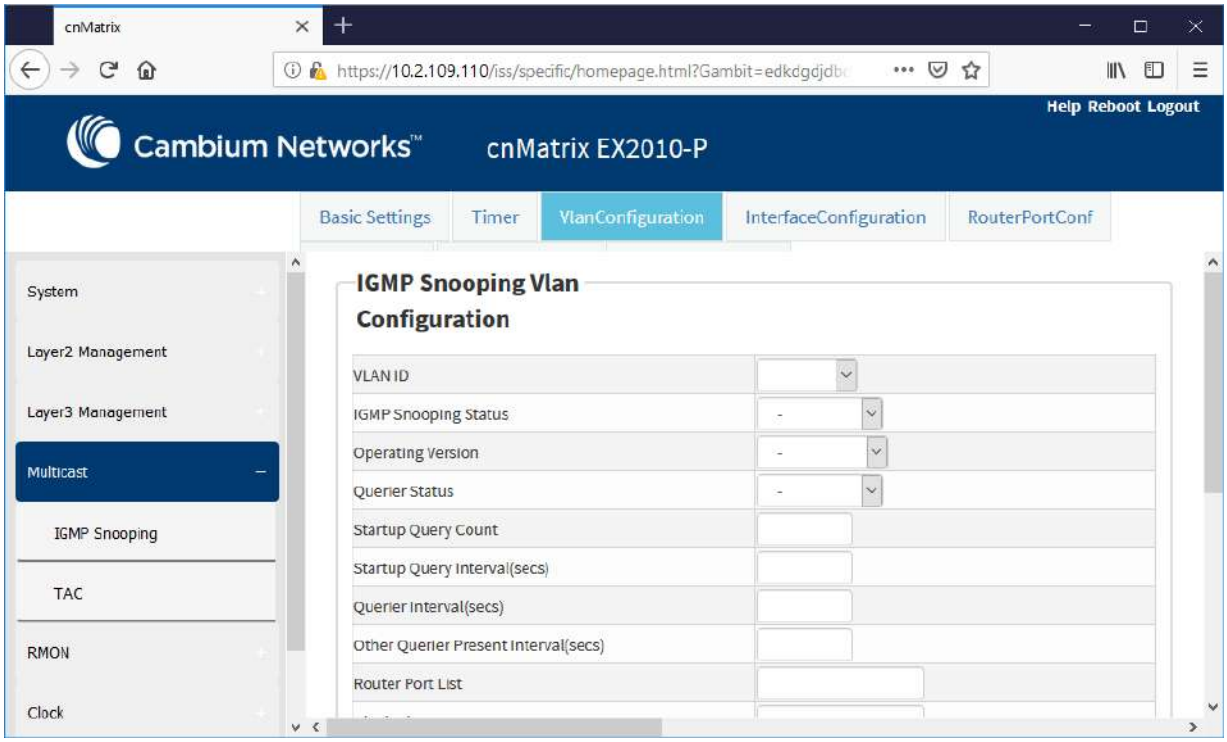
9 Select the **Enabled** list item.



10 Click the **Add** button.



11 Click the **Apply** button.



5.4 IGMP Snooping Filtering

5.5 DHCP Snooping

5.5.1 Managing DHCP Snooping

5.5.1.1 Feature Description

The **DHCP Snooping** feature intercepts all DHCP packets from untrusted ports and after inserting the port specific information (option 82), forwards the DHCP client side packets on trusted ports. This option 82 will be used to redirect the DHCP responses from a server to the appropriate untrusted port. DHCP snooping binding table will be updated when a valid IP address is allocated for a host.

DHCP Snooping is a feature who filters untrusted DHCP messages and builds a binding database table. It acts as a firewall between untrusted hosts and DHCP servers. These untrusted messages are sent from devices outside a network and are usually sources of traffic attacks.

Standards

- The DHCP snooping feature has been built in accordance with RFC7513.

Scaling Numbers

N/A

Limitations

- DHCP snooping is limited by the internal binding table. There is a maximum of 254 binding table entries. Beyond this number, the table will not be updated anymore, but the DHCP offers will be forwarded to the clients.

Default Values

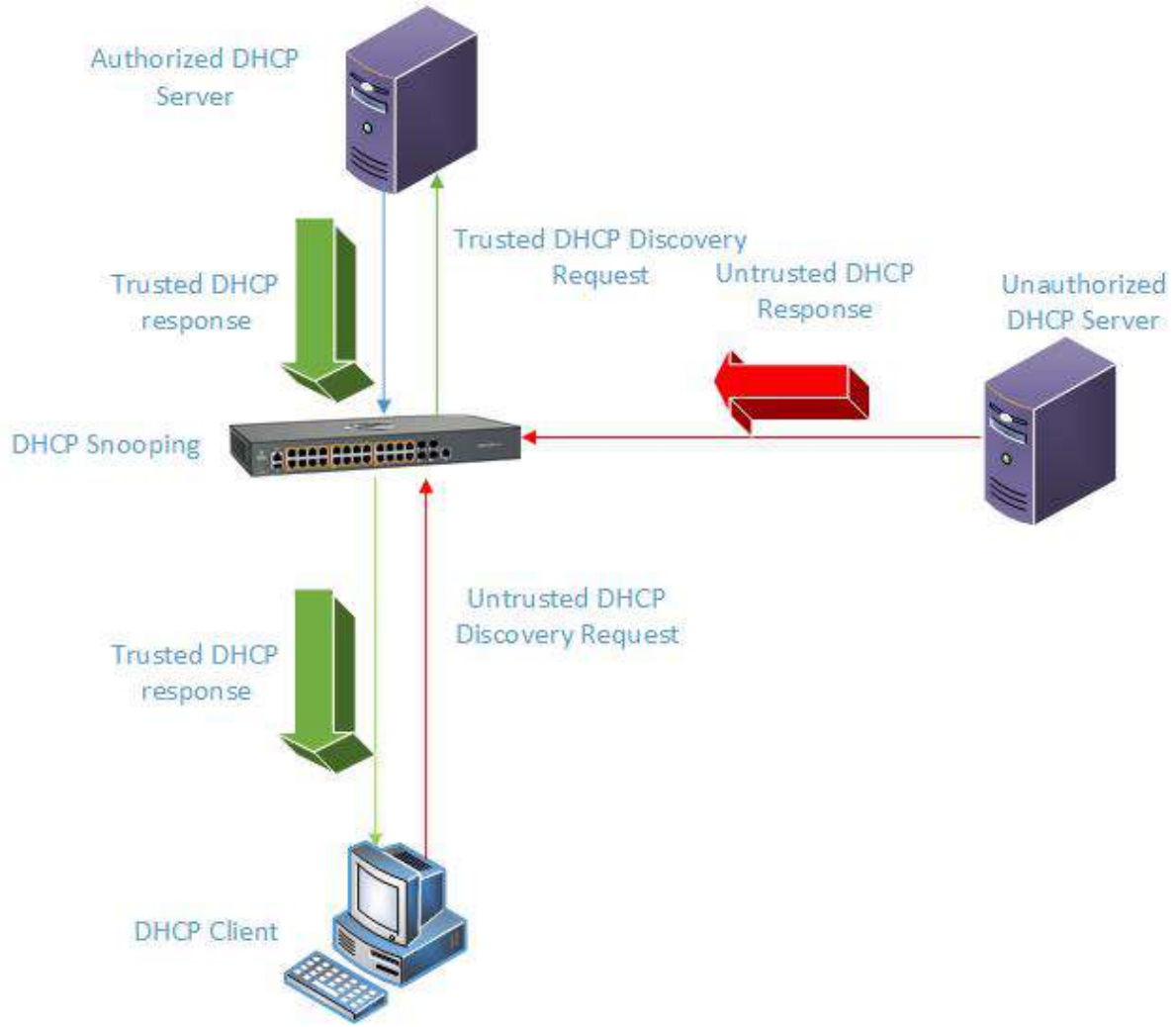
- The DHCP Snooping feature is inactive by default on all VLANs.
- The DHCP MAC address verification is inactive by default.

- All ports are considered as untrusted by default.

Prerequisites

N/A

5.5.1.2 Network Diagram



5.5.2 Configuring DHCP Snooping Web

The **DHCP Snooping** feature is not available in WEB interface.

5.6 ACL

5.6.1 Managing ACL

The **ACL** feature provides the means for the user to create rules to match specific traffic based on the information in the packets. The packets matched by the rules can then be dropped, allowed or redirected, or they can be fed to the QoS engine to have them policed. Matched packets can be mirrored to a specific interface in order for them to be analyzed by a network administrator.

An ACL consists of three parts:

- **Rule** – a set of fields from the packet, and a set of values that the selected fields have to match

- **Action** – what to do with the packets that match the rule (permit, deny, redirect)
- **Interface** - where the rule is applied (on ingress or egress direction)

There are three types of ACLs:

- **IP ACLs** – the rule can consist of the source IP and the destination IP
- **MAC ACLs** – the rule can consist of the source and destination MAC addresses, Ethernet type and the VLAN information
- **IP extended ACLs** – the rule can consist of the source IP and the destination IP, as well as Layer-4 information for protocols such as UDP (source/destination ports), TCP (ports, TCP flags), ICMP (message code, message type) or any IP type, specified by the IP protocol number, as defined by the Internet Assigned Numbers Authority (IANA).

There are two modes of configuring the ACL feature:

Consolidated	User configures the entire set of rules, then he commits them to the hardware.
Immediate	User configures the rules, and they are committed to hardware one-by-one, as the user inputs them. In the immediate mode, the priorities assigned by the users are ignored by the switch and are assigned in the order in which they are configured. This mode is not recommended for scenarios with complex rules, in which priorities are relevant.

Standards

N/A

Scaling Numbers

- The maximum number of ACLs that can be configured on a system is 145 extended and 128 standard. Also, take into consideration that when one ACL is applied to multiple ports, the available number of ACLs is reduced with the number of ports on which the rule is applied.

Limitations

- IPV6 access list only work when they are applied to the *ingress* of a port.
- If it is necessary to configure multiple ACL types on the same port, note that their priorities will not be respected in this case. Priorities only assign higher or lower precedence of rules of the same type.
- On *egress*, only one type of ACLs is supported at one time: either IP or MAC ACLs. This type can be set globally via the “egress access-list mode” command.
- The "redirect" action is not supported for IPv4 ACLs

Default Values

- The default provisioning mode: immediate.
- No ACLs are preconfigured on the switch.
- Default egress access-list mode: ip.

5.6.2 Configuring ACL WEB

The **ACL (Access Control Lists)** feature is not available in WEB interface.

5.7 Static MAC

5.7.1 Managing Static MAC

The switch allows the user to configure a static MAC address and assign it to a specific VLAN id and to a specific port. The MAC addresses configured in this manner are immune to automatic MAC address aging and migration.

Normally, with a dynamically learned MAC address, traffic that enters the switch through a different port than the one currently present in the mac-address-table will be forwarded, and the entry's port will be migrated to the new value.

Traffic that enters the switch through a port and has a source MAC address that is statically configured to a different port will be dropped, and its source address will not be migrated.

Standards

- IEEE 802.1q.

Scaling Numbers

- 256 static MAC addresses can be configured on the switch.

Limitations

- Only unicastMAC addresses can be configured using this switch.
- A valid entry in the mac-address-table is a MAC/VLAN id pair, and assigning the same pair to more than one port will cause the switch to retain only the value configured last.

Default Values

- The status of the static unicast entry is set to permanent by default.

Prerequisites

- The VLAN to which the MAC address is assigned must be already created at the time the static MAC is configured, or an error message will be displayed.

SNMP

- SNMP support is available via dot1qStaticUnicastEntry in Q-BRIDGE-MIB.

5.7.2 Configuring Static MAC WEB

The Static MAC feature is not available in WEB interface.

5.8 Local Management User Name and Password

5.8.1 Managing Locally Managed Username and Password

The CLI or Web interfaces can be accessed using locally configured user/password pair. By default, the switch has two users created with read-only and read-write rights.

Password complexity can be configured by setting the minimum number of lowercase, uppercase, numeric and symbols which are accepted.

Standards

- N/A

Scaling Numbers

- A maximum of 15 users is supported.

Limitations

- Only the **admin** user can create new users using this command.
- The **admin** user cannot be deleted.

Default Values

- Two users are active by default: **admin** and **guest.**
- **admin** has root privileges (15) and can access configuration commands.
- **guest** user has lower privileges (1), which grant access only to **'clear', 'debug', 'ping'** and **'show'** commands.
- Password expiration: by default the max-life-time value is set to 0, which indicates that the password will not expire.

Prerequisites

- N/A

5.8.2 Configuring Locally Managed Username and Password WEB

The **Local Management User Name Password** feature is not available in WEB interface.

5.9 HTTPS

5.9.1 Managing HTTPS

5.9.1.1 Feature Description

The **cnMatrix HTTP** server works in such a way that it can be reached securely using TLS, or normally using the standard transport layer. A configuration option specifies whether HTTP or HTTPS is active.

SSL (Secure Sockets Layer), is a protocol developed for transmitting private information through an Internet connection. It works by using a public-private key mechanism to encrypt/decrypt data that is transferred over the SSL connection.

HTTPS (Hypertext Transfer Protocol Secure) is an extension of HTTP for secure communication over an encrypted SSL/TLS connection.

Standards

- The cnMatrix SSL/TLS(IPv4/IPv6) feature is RFC 2246 compliant.

Scaling Numbers

- The maximum number of simultaneous HTTPS WebUI sessions is 4.
- The maximum number of HTTPS sessions supported is 10.

Limitations

- The SSL/TLS server is not compatible with Microsoft Edge and IE 10 browser.
- The crypto key pair that can be generated is either of 512 or of 1024 bits.

Default Values

- The SSL feature is enabled by default and uses a self-signed certificate.
- The default ciphers suite is rsa-des-sha:rsa-3des-sha:rsa-exp1024-des-sha.

Prerequisites

N/A

The cnMatrix SSL/TLS(IPv4/IPv6) feature provides Transport Layer Security as specified in RFC 2246 and is based on the SSL protocol specification supporting both SSL 3.1 and TLS v1.0. The SSL functionality is implemented using the open source OpenSSL version 0.9.8i.

The TLS protocol is composed of two layers: a TLS Record Protocol and a TLS Handshake protocol The SSL server and the SSL client authenticate each other and negotiate encryption algorithm and cryptographic keys before the application transmits or receives data.

cnMatrix offers the capability of using a cnMatrix self-signed certificate or an external certificate given by the user. The external certificate has to be obtained from a certificate request generated on the cnMatrix switch.

The SSL/TLS server interoperates with SSL clients found in the following HTTP browsers:

- IE5 on Win98 and Win2000.
- IE6 on WinXP.
- Netscape7.0 on Win98.
- Netscape6.0 on RedHat-Linux 7.1.
- Google chrome version 70 on Win10.
- Mozilla Firefox version 52.7.2 on CentOS Linux release 7.4.

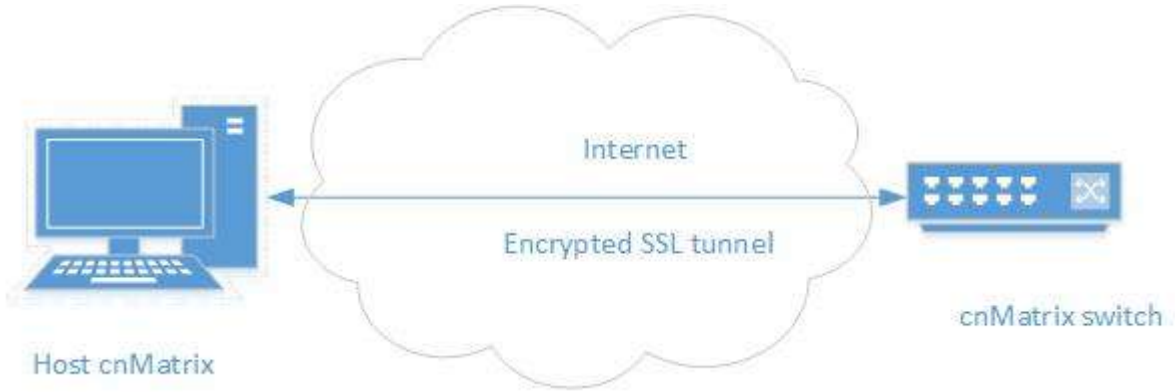
The TLS server supports the following:

- Algorithms :
  - Encryption Algorithms DES/3DES
  - Hash MD5/SHA
  - Key Negotiation can be done using RSA or Diffie-Hellman.
- Cipher suites:
  - TLS_RSA_WITH_NULL_MD5
  - TLS_RSA_WITH_NULL_SHA
  - TLS_RSA_WITH_DES_CBC_SHA
  - TLS_RSA_WITH_3DES_EDE_CBC_SHA
  - TLS_DHE_RSA_WITH_DES_CBC_SHA
  - TLS_DHE_RSA_WITH_3DES_EDE_CBC_SHA
  - TLS_RSA_EXPORT1024_WITH_DES_CBC_SHA
  - TLS_RSA_WITH_AES_128_CBC_SHA
  - TLS_RSA_WITH_AES_256_CBC_SHA
  - TLS_DHE_RSA_WITH_AES_128_CBC_SHA
  - TLS_DHE_RSA_WITH_AES_256_CBC_SHA
- Port – the standard port used is 443.
- Fragmentation of information blocks into records carrying data in chunks of 2^14 or less.

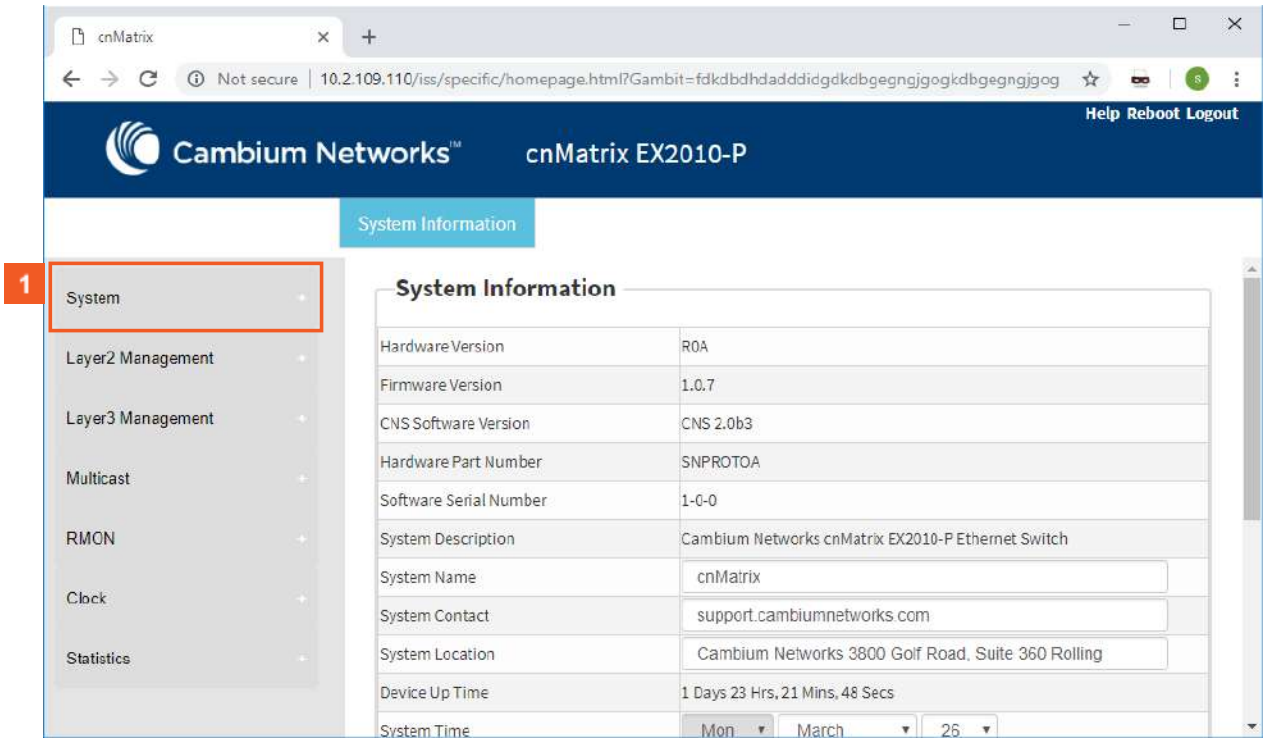
The TLS server implementation does not support the following configuration:

- The optional compression capability of TLS Record Protocol is not supported because the primary application of TLS for cnMatrix is for securing web based configuration in which the data transferred is relatively less.

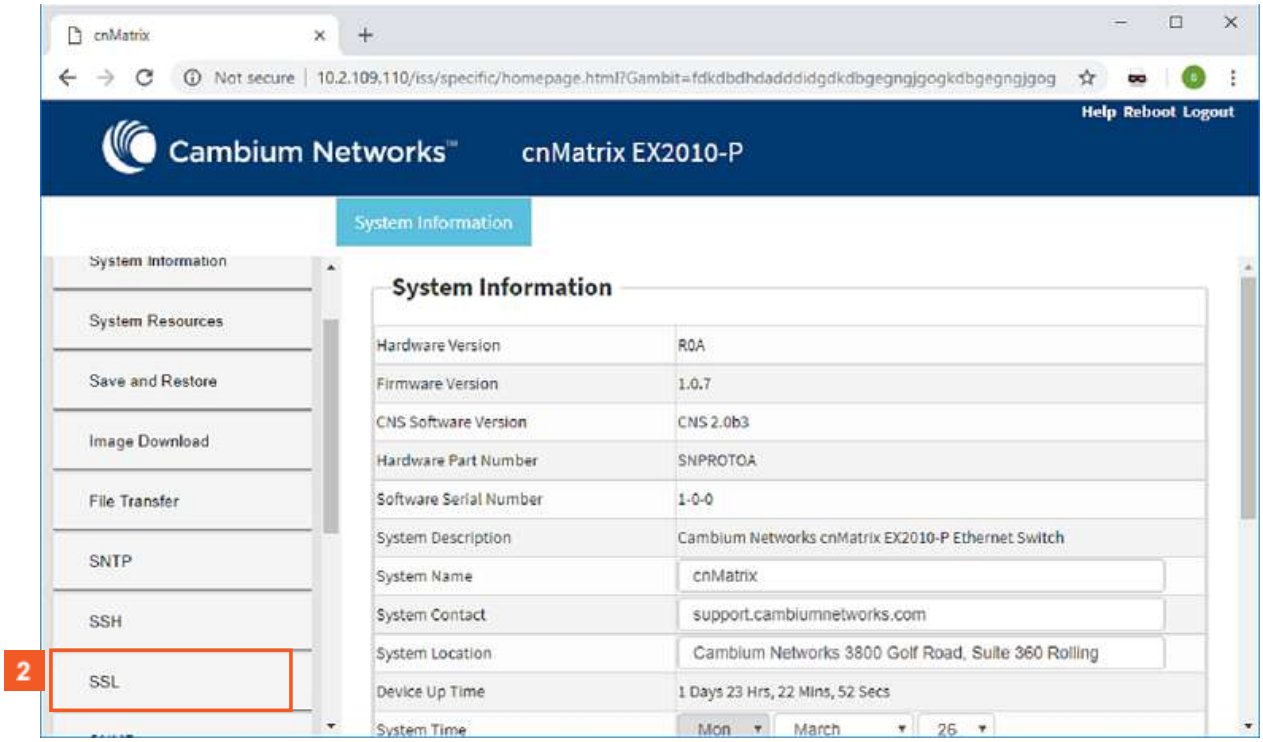
5.9.1.2 Network Diagram



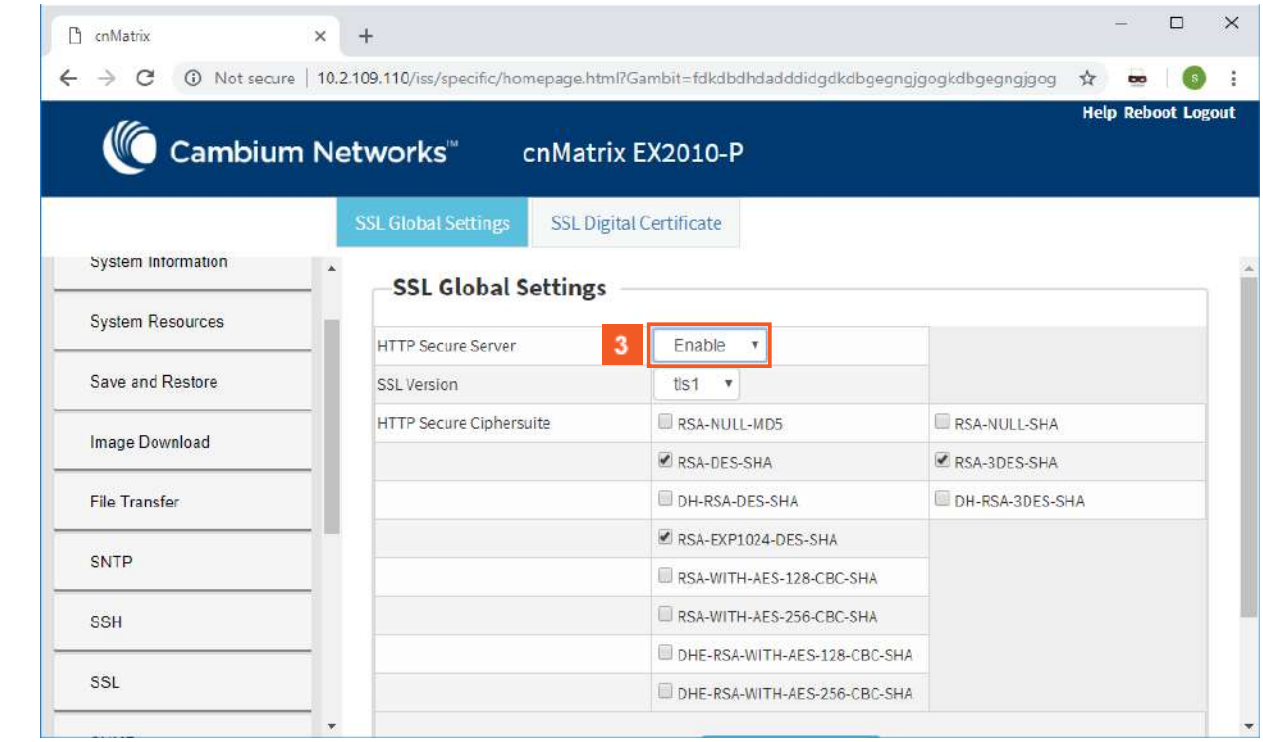
5.9.2 Configuring HTTPS WEB



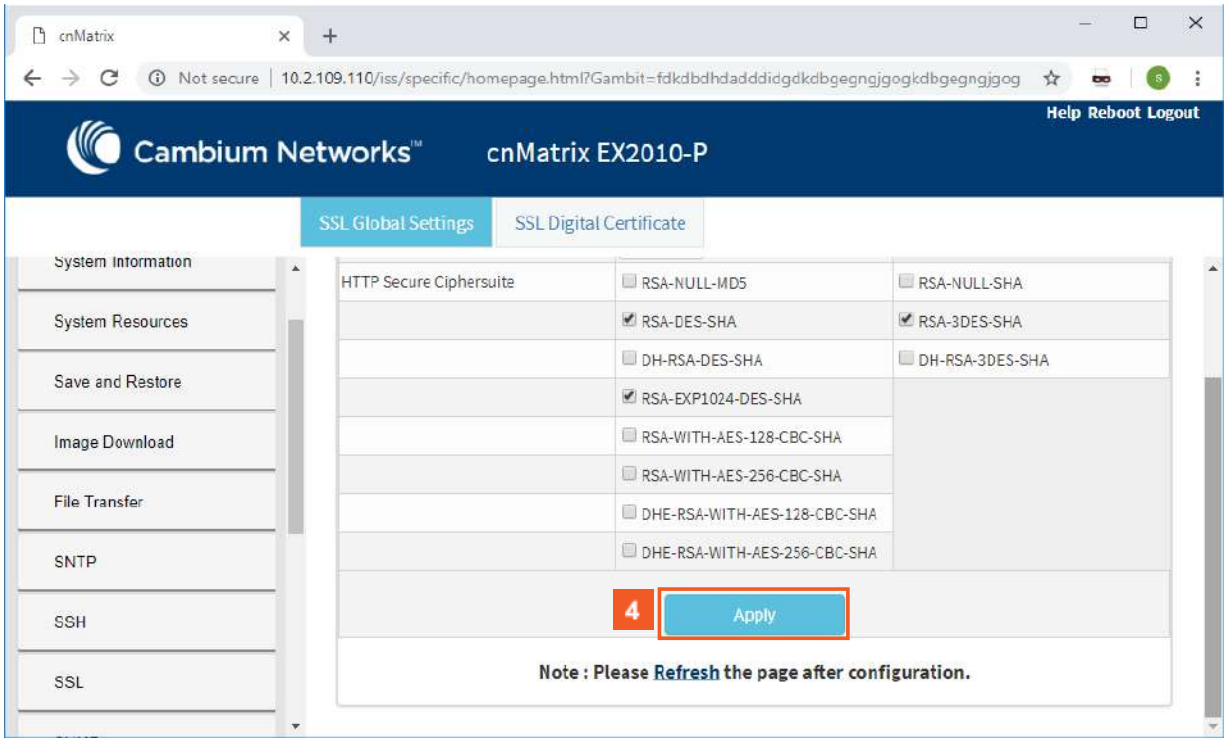
1 Click the **System** menu item.



2 Click the **SSL** menu item.



3 Click the **HTTP Secure Server** drop-down button and select the **Enabled** list item (the status of the HTTP secure server).



4 Click the **Apply** button.

5.10 HTTP

5.10.1 Managing HTTP

5.10.1.1 FeatureDescription

The **Hypertext Transfer Protocol** (HTTP) is an application protocol used in the implementation of the cnMatrix WEB user interface.

The cnMatrix switch includes an implementation of the HTTP server that implements the HTTP protocol version 1.1. This implementation is a subset of the HTTP 1.1 specification optimized for embedded systems, and is not a complete implementation of the full HTTP 1.1 specification.

The HTTP server in the software maintains persistent connections with clients over both Ipv4 and Ipv6 addresses, over TCP and over SSL. After the server processes a request from the client, the server immediately closes the socket connection unless the client had sent a KEEP_ALIVE header or indicated the content-type as MULTIPART in its request, if the version of the client is less than 1.1. If the version of the client is 1.1 or greater the server does not close the socket connection immediately. This allows the same socket connection to be reused for serving all the requests from the client. Thus, resulting in better WebUI management performance. The connection is closed if the server receives a close connection token in the request, or if there is no activity on the connection for more than 5 minutes, or if any network or client failure is suspected. In the last case, the server also sends a message with the connection header containing a close connection token.

The HTTP server allows further requests to come from the same client, while processing one request from the client.

The server buffers the requests and dispatches the requests to other internal managed modules in the same order in which the requests arrived.

The server collects the status of the requests and sends responses to the client in the same order in which the requests arrived.

A browser that supports pipelining can take advantage of this capability to reduce the latency associated with multiple requests. The server implements the expiration model and the validation model to allow clients to cache web pages.

All the WebUI management pages implemented for managing features in the cnMatrix, are statically compiled into the cnMatrix image. This allows the client to specify an absolute URL (for example, GET http://www.host.com/path.file.html). The server accepts this and looks for such a file on the file system in the switch. If present, the file is then returned.

The server parses the requests from the clients to find out the character set used in the requests. If the server does not support the requested character set, the server returns an error message to the client. The server also parses the Transfer Encoding header field in the requests from the clients. If the Transfer Encoding is chunked, the server extracts data from the request message depending upon the size of the chunk. A 501 (Unimplemented) error code is returned and the connection is closed, if it receives an entity body with the Transfer Encoding that it does not understand. The response headers are composed of the following:

- HTTP version – 1.1;
- Date header including current time in the form of Greenwich Mean Time;
- Delta seconds (the number of seconds elapsed after receiving the request message from the client);
- Character sets supported – Accept-charset:iso-8859-1;
- Content coding – Used to support compression.
- Connection field – Indicates whether a connection is persistent or will be closed.
- Content length
- Entity tag – Provided for all separate entities send in the response messages.
- Internet Media Types in the Content-Type and Accept header fields.
- Language tags
- Access Authentication field
- Authorization field

The server provides the following response codes:100 (Continue); 200 (OK) ; 202(Accepted);304(Not Modified) ;405(Method Not Allowed); 406(Not Acceptable); 414 (Request-URI Too Long);413(Request Entity Too Large) ;411 (Length Required); 415(Unsupported Media Type; 505(HTTP Version Not Supported).

The HTTP server implementation supports an Authentication Framework that provides three authentication mechanisms:

- DEFAULT - This is a Form-Based proprietary authentication scheme used by the software to authenticate the HTTP clients. In it the client trying to access the Web UI will be presented a Login Page where the user has to enter the Credentials and Submit. The user is allowed access to the Web UI upon successful authentication of the credentials. This is the default authentication scheme used by the software.
- BASIC - This is an HTTP Authentication scheme where the client must authenticate itself with a user-ID and a password for a realm. The HTTP server provides a single protection space called the cnMatrix protection space and a single realm namely “cnMatrix” which corresponds to the software’s protection space. The protection space contains all the web pages of the cnMatrix server. The HTTP server will service the request only if it can validate the user-ID and password for the cnMatrix protection space.
- DIGESTS - This is an HTTP Authentication scheme where the HTTP server challenges the HTTP client using a WWWAuthenticate header containing a nonce value. A valid Authorization request from the client contains a checksum (the MD5 checksum) of the username, the password, the given nonce value, the HTTP method and the requested URI. In response to the Authorization request, the server sends an Authentication-Info header to communicate the status of the authentication attempt. The Authentication framework of the software provides two parameters:

- Operational Authentication Scheme - governs the scheme to be used to authenticate all the HTTP sessions. This is a READ-ONLY parameter which is initialized at software startup time.
- Configurable Authentication scheme contains the scheme which can be modified at run-time through the CLI or the Web UI. The modified value is applied only after the restart of the software.

Standards

- The HTTP server is RFC 1945 RFC 2068 (HTTP 1.1 – partial), and 2617 compliable.

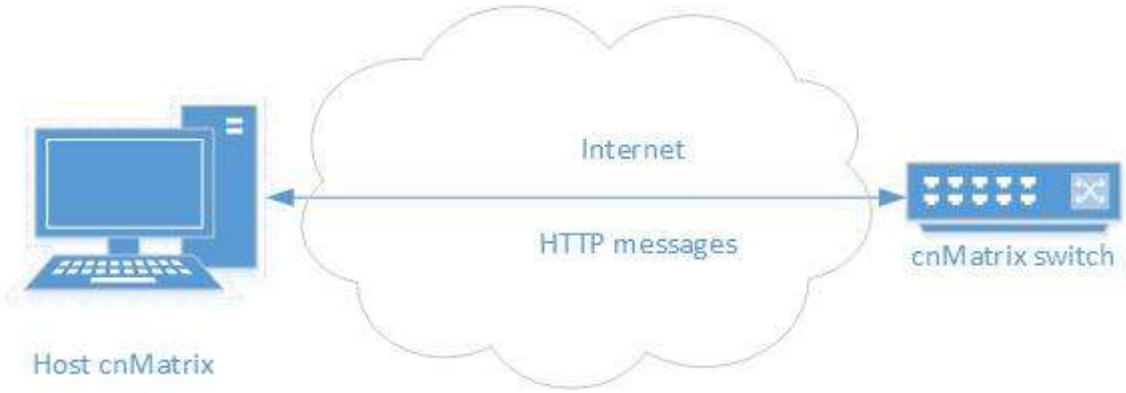
Scaling Numbers

- The HTTP server supports maximum 4 HTTP WEB UI sessions opened simultaneously.

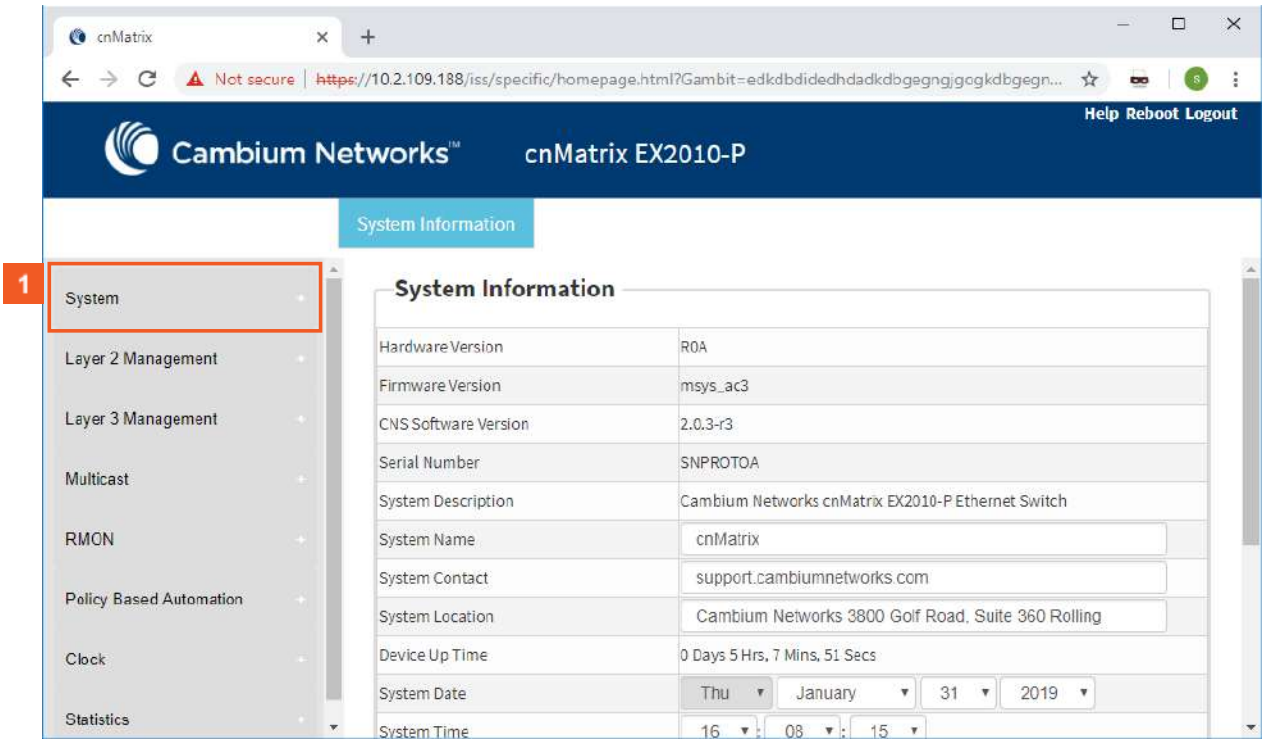
Default Values

- The default authentication scheme: default.
- The HTTP redirection option is disabled by default.
- The default HTTP port: 80.
- HTTP is disabled by default in the switch.

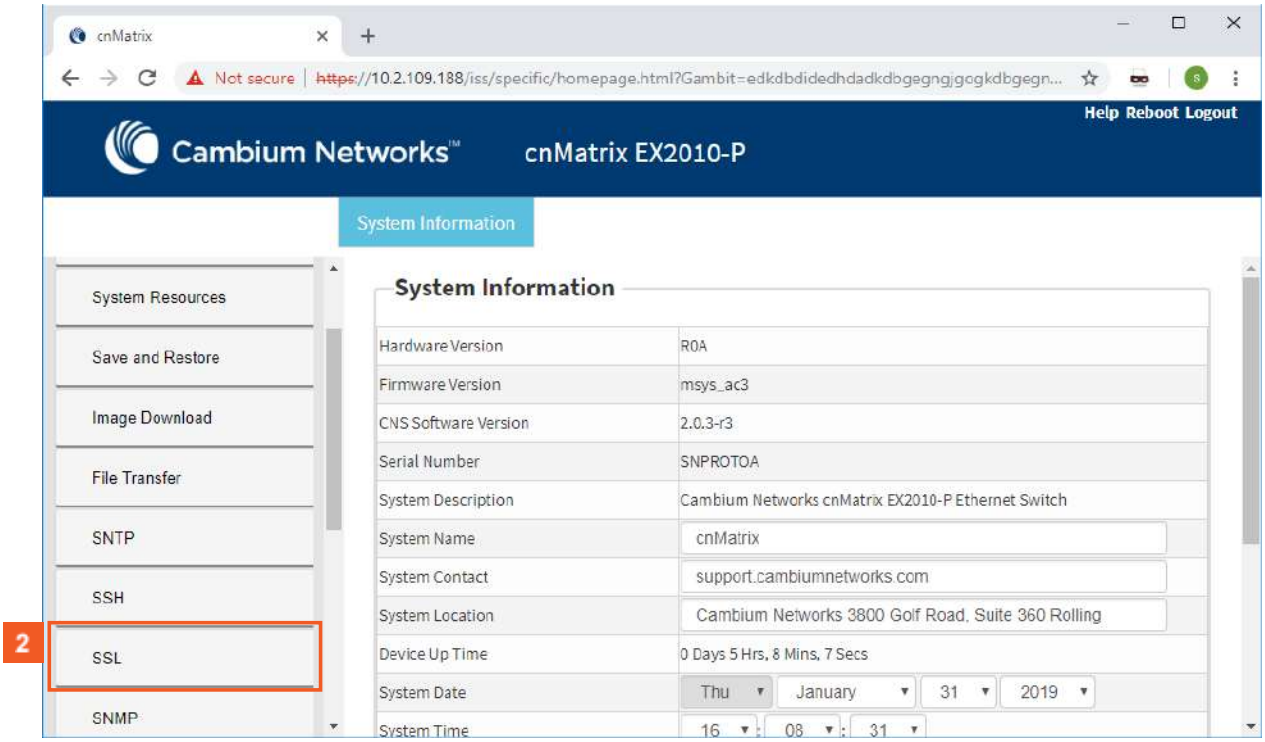
5.10.1.2 Network Diagram



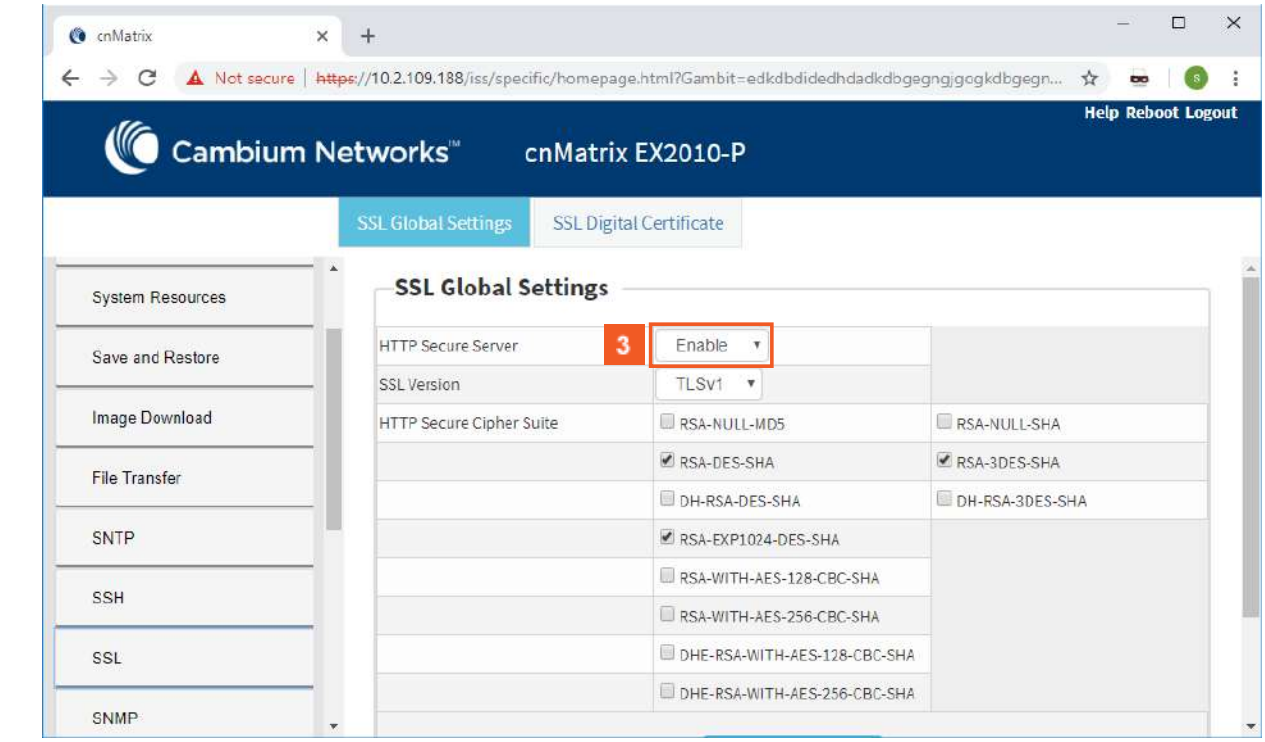
5.10.2 WEB HTTP Configuration



1 Click the **System** menu item.

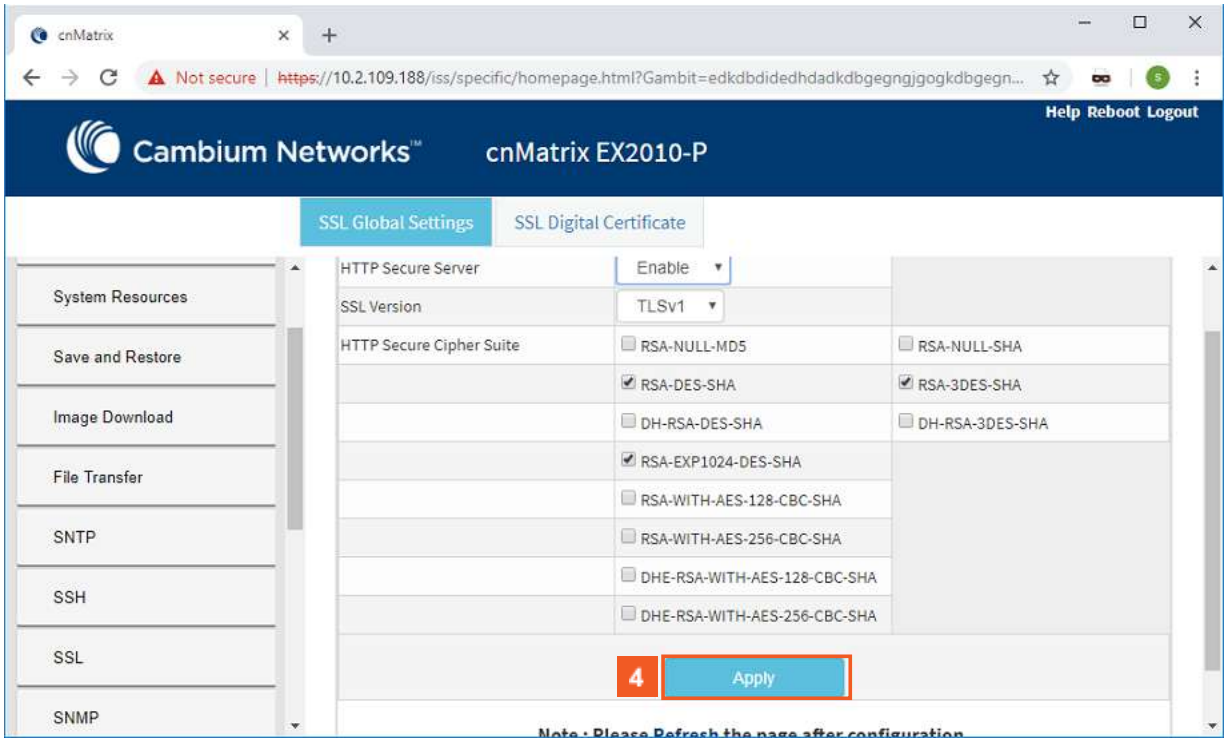


2 Click the **SSL** menu item. The **SSL Global Settings** window is displayed.

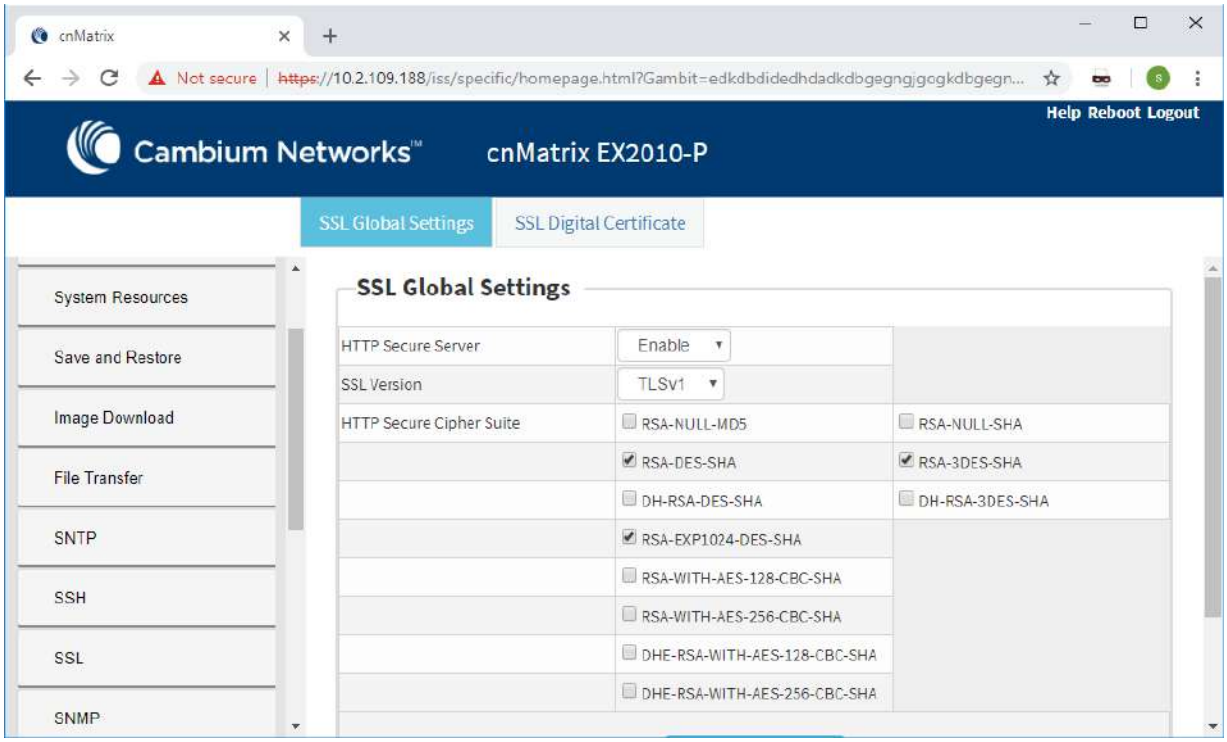


3 Click the **HTTP Secure Server** drop-down button and select the **Disabled** option.

The **Disabled** option represents the status of the HTTP secure server.



4 Click the **Apply** button.



5.11802.1x Authentication

5.11.1Managing 802.1x Authentication

The **802.1X** feature enables network devices authentication on the switch and prevents unauthorized devices from accessing the services provided by the Switch and LAN.

The cnMatrix switch controls physical access to the network based on the authorization status of Client devices. It requests the credentials (Identity and Password) of the Client and submits it to the

Authentication Server (RADIUS). In addition, the cnMatrix switch acts as a RADIUS client and is responsible for encapsulating and decapsulating the EAP frames to interact with the RADIUS server.

The following host modes are available:

- single-host
- multi-host

The switch has a local authentication server in order to support local authentication without the RADIUS server.

Standards

- IEEE 802.1X
- RFC 2865

Scaling Numbers

- N/A

Limitations

- N/A

Default Values

- 802.1X is disabled by default.
- 802.1X per port Authentication Mode is set to Multi-Host by default.

Prerequisites

- N/A

5.11.2 Configuring 802.1x Authentication WEB

The 802.1x Authentication feature is not available in WEB Interface.

6 Regulatory and Compliance

6.1 Legal and Regulatory Information

6.1.1 Legal and Reference Information

6.1.1.1 Introduction

This chapter provides legal notices including software license agreements.

Attention

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The following topics are described in this chapter:

Cambium Networks End User License Agreement

- Open Source Components incorporated in the Hardware and associated notices
- Hardware Warranty
- Limitation of Liability
- Compliance with Safety Standards

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6.1.2.1 Introduction

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Intended Use: The Cambium Networks cnMatrix next-generation switching platform offers a cloud-managed, high-performance, feature-rich enterprise-grade ethernet switching solution. This equipment is intended for professional applications for fixed indoor installations only.

Installation and Operation: Installation and operation of this product are complex and Cambium Networks therefore recommends professional installation and management of the system. Please follow the instructions in this leaflet. Further guidance on cnMatrix installation and operation is available in the accompanying *Quick Start Guide*, which can also be found online at the link below

The installer must have sufficient skills, knowledge, and experience to perform the installation task and is responsible for:

- Familiarity with current applicable national regulations, including electrical installation and surge protection
- Installation in accordance with Cambium Networks' instructions

Product Safety Information:

The following general safety guidelines are provided to help ensure your own personal safety and protect your product from potential damage. Remember to consult the product *User Guide, web link below,* for more details. Please observe the following safety rules:

- Static electricity can be harmful to electronic components. Discharge static electricity from your body (i.e., touch grounded bare metal) before touching the product. Ensure that the product is properly grounded.

Ensure that the equipment is not powered during installation. Always disconnect equipment from its power source before servicing.

Always use a qualified electrician to install cabling.

Use outdoor-rated cables for connections that will be exposed to the outdoor environment.

Operation in the EU – Restrictions:

- This equipment is for indoor use only.
- CE EMI Class A Warning: This equipment is compliant with Class A of CISPR32. In a residential environment, this equipment may cause radio interference.

Waste Electrical and Electronic Equipment (WEEE) Directive:

Please do not dispose of electronic and electric equipment or electronic and electric accessories with your household waste. In some countries or regions, collection systems have been set up to handle waste of electrical and electronic equipment. If you reside in European Union countries, please contact your local equipment supplier representative or the Cambium Networks Support Center for information about the waste collection system in your country

Useful Web Links:

- User Guide: https://www.cambiumnetworks.com/guides
- Technical Training: https://learning.cambiumnetworks.com

- Cambium Support Center: https://support.cambiumnetworks.com/
- EU Declaration of Conformity: http://www.cambiumnetworks.com/eu_dofc

Equipment Manufacturer:

Cambium Networks Ltd, Unit B2 Linhay Business Park, Eastern Road, Ashburton, Devon, TQ13 7UP, United Kingdom

7 Appendix: Parameters and Commands

7.1 Appendix: Parameters and Commands

7.1.1 LLDP-MED Parameters and Commands

7.1.1.1 LLDP-MED

Commands	Description	CLI Mode
lldp med-tlv-select { med-capability | net-workpolicy | inventory-management | location-id | expower-via-mdi } [mac-address] **Available options:** med-capability ■ Configures the Med Capability TLVtransmission for the LLDP module. network-policy - Configures the Network-policy ■ TLVrelated transmission for the LLDP module. inventory-management - Configures the Inventorymanagement ■ TLV related transmission for the LLDPmodule. location-id ■ Configures the Location identificationTLV related transmission for the LLDP module. ex-power-via-mdi ■ Configures the Extended power viaMDI TLV related transmission for the LLDP module. mac-address ■ Configures the basic TLVtransmission to use the MAC address as destination MACaddress by the LLDP agent on the specified switch port.	Enables thetransmission of aspecific LLDP-MEDTLV on a given port.	Interface Configuration
lldp med-location elin-location location-id	Configures theEmergency LocationInformation Number(ELIN) location subtypeinformation advertisedby	Interface Configuration

Available options: `location-id` ■ Configures the location identification	the endpoint	

lldp med-app-type {voice | voiceSignaling |guestVoice | guestVoiceSignaling | softPhoneVoice| videoconferencing | streamingVideo |videoSignaling} {vlan {untagged | vlan-id priority } dscp | none}
 	
Available options:
`voice`
■ Sets the Network-policy TLV as Voice-Application for indicating that the media type defining aprimary function of the application for the policy advertisedon the local port is voice.
`voiceSignaling`
■ Sets the Network-policy TLV asVoiceSignaling Application for indicating that the mediatype defining a primary function of the application for thepolicy advertised on the local port is VoiceSignaling.
`guestVoice`
■ Sets the Network-policy TLV asguestVoice Application for indicating that the media typedefining a primary function of the application for the policyadvertised on the local port is guestVoice.
`guestVoiceSignaling`
■ Sets the Network-policy TLVas guestVoiceSignaling Application for indicating that themedia type defining a primary function of the applicationfor the policy advertised on the local port isguestVoiceSignaling
`softPhoneVoice`
■ Sets the Network-policy TLV assoftPhoneVoice Application for indicating that the mediatype defining a primary function of the application for thepolicy advertised on the local port is softPhoneVoice.
`videoconferencing`
■ Sets the Network-policy TLV asvideoconferencing Application for indicating that the mediatype defining a primary function of the application for thepolicy advertised on the local port is videoconferencing
`streamingVideo`
■ Configures the location identificationEnables the propertiesof Network-
	Enables the propertiesof Network-policy TLV	Interface Configuration

policy TLVInterfaceConfigurationLLDP-MED Parameters and Commands2
 	
`videoSignaling`
 	
■ Sets the Network-policy TLV asvideoSignaling Application for indicating that the mediatype defining a primary function of the application for thepolicy advertised on the local port is videoSignaling.
 	
`vlan`
 	
■ Configures the advertised VLAN properties.Options are:
■ untagged - Configures the ports that should beused for the VLAN to transmit egress packets asuntagged packets
■ priority - Configures the priority value forthe VLAN
■ vlan-id - VLAN ID is a unique value thatrepresents the specific VLAN
 	
`dscp`
 	
■ Sets the DSCP value
 	
`none`
 	
■ Sets the MED policy unknown flag, causing theswitch not to advertise this policy		

7.1.2 Save Restore Erase Download Configurations Parameters and Commands in CLI

7.1.2.1 Introduction

Commands	Description	CLI Mode

`write { flash:filename | startup-config |tftp://server/filename | sftp://<user-name>:<pass-word>@server/filename}`
 	
Available options:
 	
`flash:filename`
 	
■ Configures the name of the file to whichthe configuration is to be saved. This file is present in theflash.
 	
`startup-config`
 	
■ Starts the switch with the savedconfiguration on reboot.
 	
`tftp`
 	
■ Configures the TFTP related details for writing theconfiguration to a file in TFTP server.
 	
`server`
	This command writes the running-config to a flash file, startup configuration file or to a remote site.	Privileged EXEC Mode

■ The IP address or host name of the server inwhich configuration should be maintained.
`filename`
■ The name of the file in which theconfiguration should be written.
`sftp`
■ Configures the SFTP related details for writing theconfiguration to a file in SFTP server.
`user-name`
■ The user name of remote host or server.
`pass-word`
■ The password for the corresponding username of remote host or server.
`server`
■ The IP address or host name of the server inwhich configuration should be maintained.
`filename`
■ The name of the file in which theconfiguration should be written.		

`copy { tftp://server/filename startup-config | sftp://<user-name>:<pass-word>@server/filename startup-config | flash: filename} startup-config`
 	
Available options:
`tftp://server/filename startup-config`
■ Configures the address from which the file is to be copied and the file name from which configuration is to be copied. This option configures the TFTP server details.
`sftp://<user-name>:<pass-word>@server/filename`
■ Configures the name of the file in remote location to be copied (downloaded) into configuration file. This option configures the SFTP server details.
`flash: filename startup-config`
■ Configures the name of the file in flash. The configuration in the flash file are used.
	This command copies the configuration from a remote site to flash.	Privileged EXEC Mode

`copy running-config startup-config`	This command copies the running configuration to the startup configuration file in NVRAM, where the running-	Privileged EXEC Mode

	config is the current configuration in the switch and the startup config is the configuration that is loaded when the router boots up.	

copy startup-config {flash: filename | tftp://server/filename | sftp://<user-name>:<password>@ server/filename}
 	
Available options:
 	
`flash: filename`
■ Configures the name of the file in which the initial configuration should be stored. This file is available in the Flash.
 	
`tftp://server/filename`
■ Configures the TFTP details for taking back up of initial configuration in TFTP server.
 	
`server`
■ The IP address or host name of the server.
 	
`filename`
■ The name of the file in which the initial configuration should be stored.
 	
`sftp://<user-name>:<password>@ server/filename`
■ Configures the SFTP details for taking back up of initial configuration in SFTP server.
 	
`user-name`
■ The user name of remote host or server.
 	
`pass-word`
■ The password for the corresponding user name of remote host or server.
 	
`server`
■ The IP address or host name of the server.
 	
`filename`
■ The name of the file in which the initial configuration should be stored.
	This command takes a back-up of the initial configuration in flash to a remote location.	Privileged EXEC Mode

`incremental-save { enable | disable }`
 	
Available options:
 	
`enable`
■ Enables the incremental save feature.
	Enables/Disables the auto save trigger function feature.	GlobalConfiguration

disable ■ Disables the incremental save feature.		
auto-save trigger { enable | disable } **Available options:** enable ■ Enables the auto save trigger function. disable ■ Disables the auto save trigger function.	Enables/Disables the auto save trigger function feature.	GlobalConfiguration
config-restore {flash | norestore} **Available options:** flash ■ Enables configuration restore from flash start-up configuration file. norestore ■ Specifies that the switch configurations need not be restored when the system is restarted.	Configures the startup configuration restore option.	Privileged EXEC Mode
erase startup-config	Clears the startup configuration file.	Privileged EXEC Mode
show nvram	Displays the current information stored in the NVRAM.	Privileged EXEC Mode
show system information	Displays the system information.	Privileged EXEC Mode
clear config[default-config-restore <filename>]	All configurations will be cleared and default configurations will berestored.	Privileged EXEC Mode

7.1.3 Auto Attach Parameters and Commands

7.1.3.1 Auto Attach Parameters and Commands

Commands	Description	CLI Mode
debug auto-attach [trace { error | warning | info | debug }] [dump { rule | action | policy | prec | ifc }]	Enables debug options for the Auto-Attach module.	Privileged EXEC
no debug auto-attach	Disable trace option for the Auto-Attach module.	Privileged EXEC
no debug auto-attach	Displays Auto-Attach global configuration details.	Privileged EXEC
show auto-attach interface [<iftype>	Displays Auto-Attach per-interface	Privileged EXEC

<ifnum>]	configuration details.	
show auto-attach action [name <string(20)>]	Displays Auto-Attach per-interface configuration details.	Privileged EXEC
show auto-attach rule [name <string(20)>]	Displays Auto-Attach per-interface configuration details.	Privileged EXEC
show auto-attach policy [name <string(20)>] [{detail | interface | statistics}]	Displays Auto-Attach per-interface configuration details.	Privileged EXEC
show auto-attach script [{cnPilot}]	Displays Auto-Attach per-interface configuration details.	Privileged EXEC

Commands	Description	CLI Mode
auto-attach	Enables Auto-Attach on the system.	Global Configuration
no auto-attach	Disables Auto-Attach on the system.	Global Configuration
auto-attach default	Resets all Auto-Attach settings to default values.	Global Configuration
auto-attach string-comparison { casesensitive | ignore-case } **Available options:** case-sensitive ■ Perform case-sensitive device data comparisons. ignore-case ■ Ignore case for device data comparisons.	Configures the device data string comparison mode.	Global Configuration
auto-attach action <action-name(20)> ([vlan <vlan-list(99)>] [pvid <vlan(1-4094)>] [switch-port-mode hybrid]) **Available options:** <action-name(20)> ■ Unique action set name. vlan ■ Specify list of VLANs. <vlan-list(99)> ■ List of 1..20 commaseparated	Configures Auto-Attach action entries.	Global Configuration

VLANs. pvid ■ Specify default port VLAN. <vlan> ■ Default VLAN from VLAN list. switch-port-mode ■ Update switch port mode for the interface. hybrid ■ Update switch port mode to Hybrid.		
no auto-attach action <string(20)>	Deletes Auto-Attach action entries	Global Configuration
auto-attach rule <string(20)> { LLDP-ANY | LLDP-CAP | LLDP-SYS-NAME | LLDP-SYS-DESC | LLDP-CHASSIS | LLDP-PORT | LLDP-PORT-DESC } <string(60)> **Available options:** <rule-name(20)> ■ Unique rule name. LLDP-ANY ■ Search multiple LLDP TLVs for device ID data. LLDP-CAP ■ Match LLDP Capabilities TLV data (comma-separated combination of 'bridge', 'wlan', 'router', 'phone', 'station', 'repeat-er', 'docsis', 'other'). LLDP-SYS-NAME ■ Search LLDP System Name TLV for de-vice ID data. LLDP-SYS-DESC ■ Search LLDP System Description TLV for device ID data. LLDP-CHASSIS ■ Search LLDP Chassis ID TLV for device ID data. LLDP-PORT ■ Search LLDP Port ID TLV for device ID data.	Configures Auto-Attach rule entries.	Global Configuration

LLDP-PORT-DESC ■ Search LLDP Port Description TLV for device ID data. <device-desc(60)> ■ Target device identification data.		
no auto-attach rule <rule-name(20)>	Deletes Auto-Attach rule entries.	Global Configuration
auto-attach policy <string(20)> match { rule <string(20)> | { LLDP-ANY | LLDP-CAP | LLDP-SYS-NAME | LLDP-SYS-DESC | LLDP-CHASSIS | LLDP-PORT | LLDP-PORT-DESC } <string(60)> } set { action <string(20)> | vlan <string(99)> [pvid <integer(1-4094)>] [switch-port-mode hybrid] | switch-port-mode hybrid } [precedence <integer(1-100)>] [{ enable | disable }] **Available options:** policy ■ Configure Auto-Attach policy data. <policy-name(20)> ■ Unique policy name. match ■ Specify device match criteria. rule ■ Specify rule table entry. <rule-name(20)> ■ Unique rule name. LLDP-ANY ■ Search multiple LLDP TLVs for device ID data. LLDP-CAP ■ Match LLDP Capabilities TLV data (comma-separated combination of 'bridge', 'wlan', 'router', 'phone', 'station', 'repeat-er', 'docsis', 'other'). LLDP-SYS-NAME ■ Search LLDP System Name TLV for de-vice ID data.	Configures Auto-Attach poli-cy entries.	Global Configuration

LLDP-SYS-DESC ■ Search LLDP System Description TLV for device ID data. LLDP-CHASSIS ■ Search LLDP Chassis ID TLV for device ID data. LLDP-PORT ■ Search LLDP Port ID TLV for device ID data. LLDP-PORT-DESC ■ Search LLDP Port Description TLV for device ID data. <device-desc(60)> ■ Target device identification data. set ■ Specify action criteria. action ■ Specify action table entry. <action-name(20)> ■ Unique action name vlan ■ Specify list of VLANs. <vlan-list(99)> ■ List of 1..20 commaseparated VLANs. pvid ■ Specify default port VLAN. <vlan> ■ Default VLAN from VLAN list. switch-port-mode ■ Update switch port mode for the interface. switch-port-mode ■ Update switch port mode for the interface. hybrid ■ Update switch port mode to Hybrid. precedence ■ Policy precedence value. <value(1-100)> ■ Precedence.		

enable ■ Enable policy. disable ■ Disable policy		
auto-attach policy <string(20)> ([precedence <integer(1-100)>] [{ enable | disable }]) **Available options:** <policy-name(20)> ■ Unique policy name. precedence ■ Policy precedence value. <value(1-100)> ■ Precedence. enable ■ Enable policy. disable ■ Disable policy.	Updates Auto-Attach policy information.	Global Configuration
no auto-attach policy <string(20)>	Deletes Auto-Attach policy entries.	Global Configuration
clear auto-attach policy statistics [<string(20)>] **Available options:** <policy-name(20)> ■ Unique policy name	Clears Auto-Attach policy-related statistics.	Global Configuration
auto-attach script {cnPilot} vlan <vlan-list(99)> [pvid <vlan(1-4094)>] **Available options:** cnPilot ■ Configure cnPilot device detection. vlan ■ Specify list of VLANs. <vlan-list(99)> ■ List of 1..20 commaseparated VLANs.	Creates Auto-Attach device script configuration.	Global Configuration

pvid ■ Specify default port VLAN. <vlan> ■ Default VLAN from VLAN list.		
no auto-attach script {cnPilot}	Deletes Auto-Attach script configuration data.	Global Configuration

Commands	Description	CLI Mode
auto-attach	Enables Auto-Attach on the target interface.	Interface Configuration
no auto-attach	Disables Auto-Attach on the target interface.	Interface Configuration
clear auto-attach statistics	Clears Auto-Attach interface-related statistics.	Interface Configuration

7.1.4 VLAN Parameters and Commands

7.1.4.1 VLAN Parameters and Commands

Command	Description	CLI Mode
vlan <vlan-id>	Creates a VLAN and enters into the config - VLAN mode in which VLAN specific configurations are done and sets the VLAN in active mode.	Global Configuration
protocol-vlan	Enables protocol-VLAN based membership classification on all ports of the switch.	Global Configuration
map protocol {ip | novell | netbios | appletalk | other <aa:aa or aa:aa:aa:aa:aa>} {enet-v2 | snap | llcOther | snap8021H | snapOther} protocols-group <Group id integer(0-2147483647)> TBD	Creates a protocol group with a specific protocol and encapsulation frame type combination.	Global Configuration
clear mac-address-table dynamic [interface {port-channel <port-channel-id (1-65535)> | <interface-type> <interface-id>}] [vlan <vlan_>] Available options:	Clears the dynamically learnt MAC Addresses.	Global Configuration

port-channel <port-channel-id (1-65535)> ■ Clears the FDB entries for the specified port channel interface. <interface-type> ■ Clears the FDB entries for the specified type of interface. gigabitethernet <vlan -id> ■ VLAN ID is a unique value that represents the specific VLAN.		

Command	Description	CLI Mode
name <vlan name string>	Configures name for the VLAN.	Config-VLAN
ports [add] [(gigabitethernet/extremeethernet/ port-channel)]	Configures a VLAN entry with the required member ports, untagged ports and/or forbidden ports, and activates the VLAN.	Config-VLAN
ports [add] ([<interface-type> <0/ab, 0/c,...>] [<interface-type> <0/ab, 0/c,...>] [port-channel <a,b,c-d>]) [untagged <interface-type> <0/a-b,0/c,...> [<interface-type> <0/a-b,0/c,...>] [portchannel <a,b,c-d>][all])] [forbidden <interface-type> <0/a-b,0/c,...> [<interface-type> <0/a-b,0/c,...>] [portchannel <a,b,c-d>] <interface-type> parameter can have the following values: ■ gigabitethernet ■ extreme-ethernet ■ port-channel	Configures a VLAN entry with the required member ports, untagged ports and/or forbidden ports, and activates the VLAN. The VLAN can also be activated using the vlan active command.	Config-VLAN
vlan active	Activates a VLAN in the switch.	Config-VLAN

Command	Description	CLI Mode
switchport access vlan <vlanid (1-4094)>	Configures the PVID (Port VLAN Identifier) on a port.	Interface Configuration
switchport acceptable-frame-type {all | tagged | untaggedAndPrioritytagged }	Configures the type of VLAN dependent BPDU frames such as GMRP BPDU that the	Interface Configuration

Available options:
`all`
■ configures the acceptable frame type as all.
`tagged`
■ configures the acceptable frame type as tagged.
`untaggedAndPrioritytagged`
■ configures the acceptable frame type as untagged and priority tagged.
	port should accept during the VLAN membership configuration.	

`switchport ingress-filter`	Enables ingress filtering feature on the port.	Interface Configuration
`port protocol-vlan`	Enables protocol-VLAN based membership classification in a port.	Interface Configuration

`switchport map protocols-group <Group id integer(0-2147483647)> vlan <vlan-id>`
Available options:
`<Group id integer(0-2147483647)>`
■ configures a unique group ID that is already created with the specified protocol type and encapsulation frame type.
	Maps the configured protocol group to a particular VLAN ID for an interface.	Interface Configuration

`switchport mode { access | trunk | hybrid | {private-vlan {promiscuous | host }} |{dynamic {auto | desirable}} }`
Available options:
`access`
■ configures the port as access port that accepts and sends only untagged.
`trunk`
■ configures the port as trunk port that accepts and sends only tagged frames.
`hybrid`
■ configures the port as hybrid port that accepts and sends both tagged and untagged frames.
	Configures the mode of operation for a switch port.	Interface Configuration

Command	Description	CLI Mode
`debug vlan { [{fwd | priority |`	Enables the tracing of the VLAN sub module as per the	Privileged Exec

redundancy}([initshut] [mgmt] [data] [ctpl][dump] [os] [failall] [buffer] [all])][switch <context_name>] }[{ <short (0-7)> | alerts | critical | debugging | emergencies | errors | informational | notification | warnings }] **Available options:** fwd ■ sets the submodule as VLAN forward module, for which the tracing is to be done as per the configured debug levels. priority ■ sets the submodule as VLAN priority module, for which the tracing is to be done as per the configured debug levels. redundancy ■ sets the submodule as VLAN redundancy module, for which the tracing is to be done as per the configured debug levels. initshut ■ generates debug statements for init and shutdown traces. switch <context_name> ■ configures the tracing of the VLAN submodule for the specified context. mgmt ■ generates debug statements for management traces. dump ■ Generates debug statements for packet dump traces. failall ■ generates debug statements for all kind of failure traces. buffer ■ generates debug statements for VLAN buffer related traces. ctpl ■ generates debug statements for control path traces. os ■ generates debug statements for OS re-	configured debug levels.	

source related traces. data ■ generates debug statements for data path traces.		
show vlan [brief | id <vlan-range> | summary | ascending]	Displays VLAN entry related information of all active VLANs and VLANs (that are not active) for which the port details are configured.	Privileged Exec
show vlan device info	Displays the VLAN global information that is applicable to all VLANs created in the switch / all contexts.	Privileged Exec
show vlan protocols-group	Displays all entries in the protocol group table.	Privileged Exec
show protocol-vlan	Displays all entries in the port protocol table.	Privileged Exec
show mac-address-table [vlan <vlan-range>]	Displays all static / dynamic unicast and multicast MAC entries created in the MAC address table for the specified VLANs alone.	Privileged Exec
how mac-address-table static unicast [vlan <vlan-range>] [address <aa:aa:aa:aa:aa:aa>] [{interface <interface-type> <interface-id> **Available options:** vlan <vlan-range> ■ displays all static unicast MAC address entries created in the FDB table for the specified VLANs alone. address <aa:aa:aa:aa:aa:aa> ■ displays all static unicast MAC address entries created in the FDB table for the specified unicast MAC address. interface ■ displays all static unicast MAC address entries for the specified interface.	Displays all static unicast MAC address entries created in the FDB table.	Privileged Exec
show mac-address-table dynamic unicast [vlan <vlan-range>] [address <aa:aa:aa:aa:aa:aa>] [{interface <interface-type> <interface-id> **Available options:**	Displays all dynamically learnt unicast entries from the MAC address table.	Privileged Exec

`vlan <vlan-range>`
■ displays all dynamically learnt unicast entries from the MAC address table for the specified VLANs alone.
`address <aa:aa:aa:aa:aa:aa>`
■ displays all dynamically learnt unicast entries from the MAC address table for the specified unicast MAC address.
`interface`
■ displays all dynamically learnt unicast entries from the MAC address table for the specified interface.		

show mac-address-table dynamic multicast [vlan <vlan-range>] [address <aa:aa:aa:aa:aa:aa>] [{interface <interface-type> <interface-id>}]
 	
Available options:
`vlan <vlan-range>`
■ displays all dynamically learnt multicast entries from the MAC address table for the specified VLANs alone.
`address <aa:aa:aa:aa:aa:aa>`
■ displays all dynamically learnt multicast entries from the MAC address table for the specified unicast MAC address.
`interface`
■ displays all dynamically learnt multicast entries from the MAC address table for the specified interface.
	Displays all dynamically learnt multicast entries from the MAC address table.	Privileged Exec

`show mac-address-table aging-time`	Displays the ageing time configured for the MAC address table.	Privileged Exec
`debug vlan global`	Enables tracing in VLAN sub module and generates debug statements for global traces for the specified severity levels.	Privileged Exec