Configuring for Network Management Applications

Contents

Using SNMP Tools To Manage the Switch

Overview

You can manage the switch via SNMP from a network management station running an application such as ProCurve Manager (PCM) or ProCurve Manager Plus (PCM+). For more on PCM and PCM+, visit the ProCurve web site at:

http://www.procurve.com

Click on **products index** in the sidebar, then click on the appropriate link appearing under the **Network Management** heading.

This section includes:

- An overview of SNMP management for the switch
- Configuring the switches for:
  - SNMP Communities (page 13-12)
  - Trap Receivers and Authentication Traps (page 13-18)
- Information on advanced management through RMON Support (page 13-24)

To implement SNMP management, the switch must have an IP address, configured either manually or dynamically (using DHCP or Bootp). If multiple VLANs are configured, each VLAN interface should have its own IP address. For DHCP use with multiple VLANs, see the chapter on VLANs in the *Advanced Traffic Management Guide*.

Note

If you use the switch's Authorized IP Managers and Management VLAN features, ensure that the SNMP management station and/or the choice of switch port used for SNMP access to the switch are compatible with the access controls enforced by these features. Otherwise, SNMP access to the switch will be blocked. For more on Authorized IP Managers, refer to the *Access Security Guide* on the Documentation CD-ROM shipped with your switch. (For the latest version of this guide, visit the ProCurve web site.) For information on the Management VLAN feature, see the chapter on VLANs in the *Advanced Traffic Management Guide*.

SNMP Management Features

SNMP management features on the switch include:

- SNMP version 1, version 2c or version 3 over IP
- Security via configuration of SNMP communities (page 13-4)
- Security via authentication and privacy for SNMP Version 3 access
- Event reporting via SNMP
  - Version 1 traps
  - RMON
- ProCurve Manager/Plus support
- Flow sampling using either EASE or sFlow
- Standard MIBs, such as the Bridge MIB (RFC 1493), Ethernet MAU MIB (RFC 1515), and others

The switch SNMP agent also uses certain variables that are included in a Hewlett-Packard proprietary MIB (Management Information Base) file. To ensure that you have the latest version in the database of your SNMP network management tool, you can copy the MIB file from the ProCurve Networking web site at:

http://www.procurve.com

Click on **software**, then **MIBs**.

Configuring for SNMP Access to the Switch

SNMP access requires an IP address and subnet mask configured on the switch. For managed switches, ProCurve recommends permanent IP addressing. (Refer to "IP Configuration" on page 8-3.)

Once an IP address has been configured, the main steps for configuring SNMP version 1 and version 2c access management features are:

1. Configure the appropriate SNMP communities. (Refer to "SNMP Communities" on page 13-12.)
2. Configure the appropriate trap receivers. (Refer to "SNMP Notification and Traps" on page 13-18.)

In some networks, authorized IP manager addresses are not used. In this case, all management stations using the correct community name may access the switch with the View and Access levels that have been set for that community.

If you want to restrict access to one or more specific nodes, you can use the switch's IP Authorized Manager feature. (Refer to the *Access Security Guide* for your switch.)

Caution The "public" community exists by default and is used by ProCurve's network management applications. Deleting the "public" community disables many network management functions (such as auto-discovery, traffic monitoring, SNMP trap generation, and threshold setting). If security for network management is a concern, it is recommended that you change the write access for the "public" community to "Restricted".

Configuring for SNMP Version 3 Access to the Switch

SNMP version 3 (SNMPv3) access requires an IP address and subnet mask configured on the switch. (See "IP Configuration" on page 8-3.) If you are using DHCP/Bootp to configure the switch, ensure that the DHCP/Bootp process provides the IP address. (See "DHCP/Bootp Operation" on page 8-12.)

Once an IP address has been configured, the main steps for configuring SNMP version 3 access management features are:

1. Enable SNMPv3 for operation on the switch (Refer to "SNMP Version 3 Commands" on page 13-6).
2. Configure the appropriate SNMP users. (Refer to "SNMP Version 3 Users" on page 13-8).
3. Configure the appropriate SNMP communities. (Refer to "SNMP Communities" on page 13-12.)
4. Configure the appropriate trap receivers. (Refer to "SNMP Notification and Traps" on page 13-18.)

In some networks, authorized IP manager addresses are not used. In this case, all management stations using the correct User and community name may access the switch with the View and Access levels that have been set for that community. If you want to restrict access to one or more specific nodes, you can use the switch's IP Authorized Manager feature. (Refer to the *Access Security Guide* for your switch.)

SNMP Version 3 Commands

SNMP version 3 (SNMPv3) adds new commands to the CLI for configuring SNMPv3 functions. You can:

- Enable SNMPv3 with the **snmpv3 enable** command. An initial user entry will be generated with MD5 authentication and DES privacy.
- Restrict access to only SNMPv3 agents with the **snmpv3 only** command.
- Restrict write access to only SNMPv3 agents with the **snmpv3 restricted-access** command

Caution

Restricting access to only version 3 messages will make the community named "public" inaccessible to network management applications (such as auto-discovery, traffic monitoring, SNMP trap generation, and threshold setting).

Syntax: [no] snmpv3 enable

Enable and disable the switch for access from SNMPv3 agents. This includes the creation of the initial user record.

[no] snmpv3 only

Enables or disables restrictions to access from only SNMPv3 agents. When enabled, the switch rejects all non-SNMPv3 messages.

[no] snmpv3 restricted-access

Enables or disables restrictions from all non- SNMPv3 agents to read only access.

show snmpv3 enable

Displays the operating status of SNMPv3.

show snmpv3 only

Displays the status of message reception of non-SNMPv3 messages.

show snmpv3 restricted-access

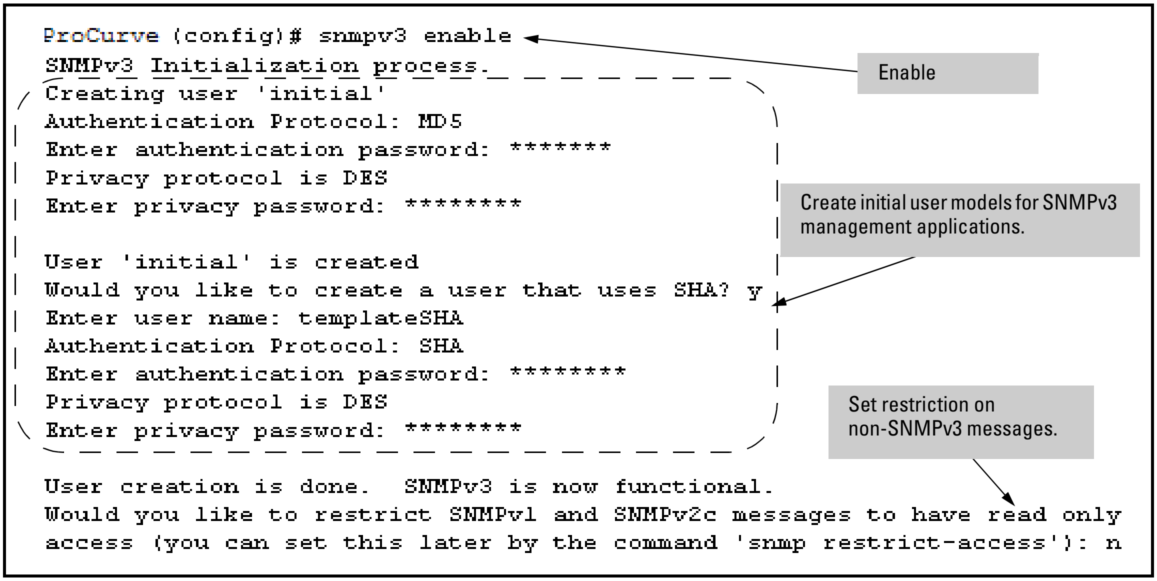
Displays the status of write messages of non-SNMPv3 messages.

SNMPv3 Enable

The **snmpv3 enable** command starts a dialog that performs three functions: enabling the switch to receive SNMPv3 messages, configuring the initial users, and, optionally, to restrict non version-3 messages to “read only”. Figure 13-1 shows and example of this dialog.

Note: SNMP Version 3 Initial Users

For most SNMPv3 management software to be able to create new users, they must have an initial user record clone. These records can be downgraded, (given fewer features), but not upgraded with new features added. For this reason ProCurve recommends that you create a second user with SHA and DES at when you enable SNMPv3



```
ProCurve (config)# snmpv3 enable
SNMPv3 Initialization process.
Creating user 'initial'
Authentication Protocol: MD5
Enter authentication password: *******
Privacy protocol is DES
Enter privacy password: ********

User 'initial' is created
Would you like to create a user that uses SHA? y
Enter user name: templateSHA
Authentication Protocol: SHA
Enter authentication password: ********
Privacy protocol is DES
Enter privacy password: ********

User creation is done.  SNMPv3 is now functional.
Would you like to restrict SNMPv1 and SNMPv2c messages to have read only
access (you can set this later by the command 'snmp restrict-access'): n
```

Enable

Create initial user models for SNMPv3 management applications.

Set restriction on non-SNMPv3 messages.

Figure 13-1. Example of SNMP version 3 Enable Command

SNMP Version 3 Users

The second step to using SNMPv3 on the switch is to configure the users that you assign to different groups. To establish users on the switch:

a. Add the users to the User table. This is done with the **snmpv3 user** command. To view the users in the list you use the **show snmpv3 user** command.

b. Assign users to Security Groups based on their security model.

Caution

When stacking is enabled, SNMPv3 provides security only between an SNMPv3 management station and the stack manager. Communications between the stack commander and stack members is not secure.

Syntax: [no] snmpv3 user user_name [auth <md5 | sha><auth_pass>] [priv priv_pass]

Add or Deletes an user entry for snmpv3. Authorization and Privacy are optional, but to use privacy you must use authorization. When deleting a user only the user_name is required

[auth <md5 | sha> <auth_pass>]

With authorization you can select either md5 authentication or sha authentication. The auth_pass must be 6-32 characters in length and must be included when authentication is included. (**Default:** None)

[priv priv_pass]

With privacy the switch only supports DES (56-bit) encryption. The privacy password priv_pass must be 6-32 characters in length and must be included when priv is included. (**Default:** None)

[no] snmpv3 group group_name user user_name sec-model <ver1| ver2c | ver3>

This command assigns or removes a user to a security group for access right to the with. To delete a entry all fields must be used.

group group_name

This is the group privileges that will be assigned to the user. For more details see "Group Access Levels" on page 13-11.

[no] snmpv3 group group_name user user_name sec-model <ver1| ver2c | ver3> *(— Continued —)*

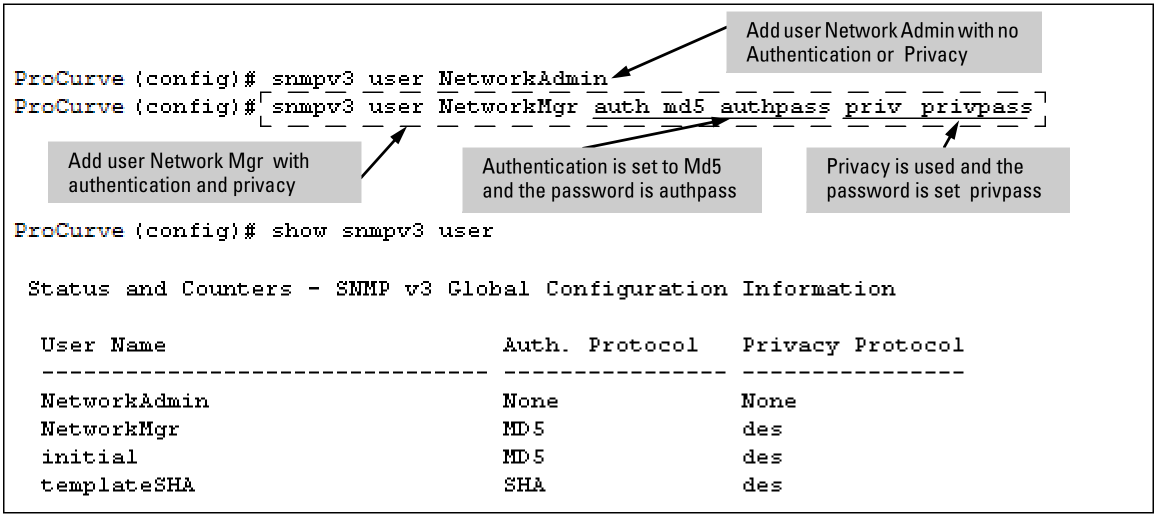
user user_name

This is the user to be added to the access group. This must match the user name added with the **snmpv3 user** *command.*

sec-model <ver1 | ver2c | ver3>

This defines which security model to use for the added user. A SNMPv3 access Group should only use the ver3 security model.

To establish a user you must first add the user names to the list of known users. Add user names with the **snmpv3 user** CLI command.



```
ProCurve (config)# snmpv3 user NetworkAdmin
ProCurve (config)# snmpv3 user NetworkMgr auth md5 authpass priv privpass

ProCurve (config)# show snmpv3 user

 Status and Counters - SNMP v3 Global Configuration Information

  User Name                        Auth. Protocol   Privacy Protocol
  -------------------------------- ---------------- ----------------
  NetworkAdmin                     None             None
  NetworkMgr                       MD5              des
  initial                          MD5              des
  templateSHA                      SHA              des
```

Add user Network Admin with no Authentication or Privacy

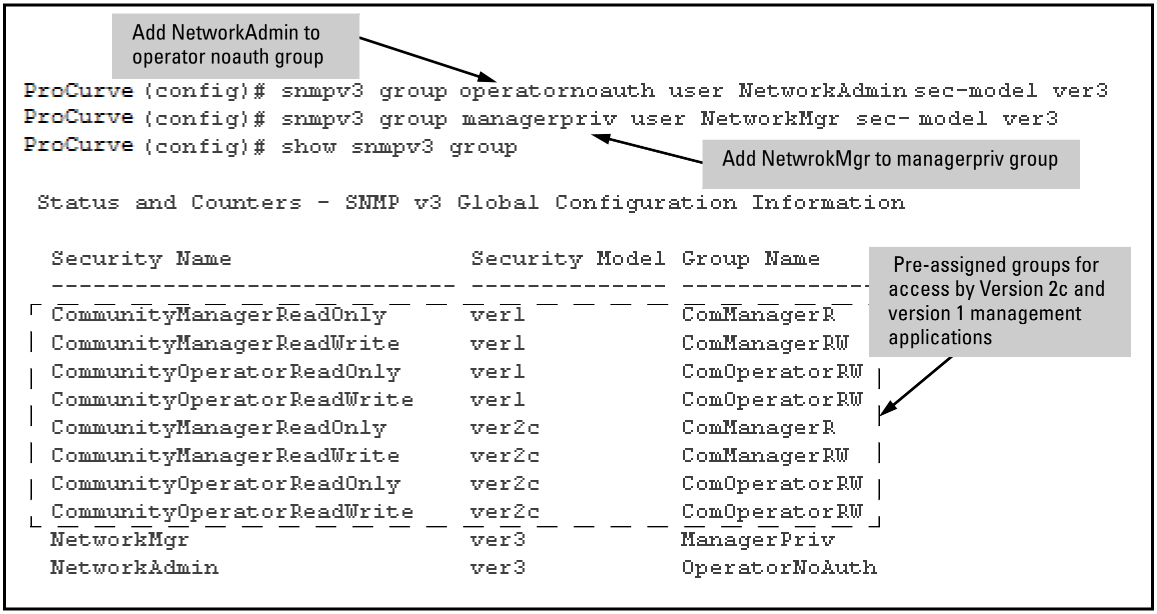
Add user Network Mgr with authentication and privacy

Authentication is set to Md5 and the password is authpass

Privacy is used and the password is set privpass

Figure 13-2. Adding and showing Users for SNMPv3

Then you must set the group access level to the user. This is done with the **snmpv3 group** command. For more details on the MIBs access for a give group see "Group Access Levels" on page 13-11.



Add NetworkAdmin to operator noauth group

Add NetwrokMgr to managerpriv group

Pre-assigned groups for access by Version 2c and version 1 management applications

```
ProCurve (config)# snmpv3 group operatornoauth user NetworkAdmin sec-model ver3
ProCurve (config)# snmpv3 group managerpriv user NetworkMgr sec- model ver3
ProCurve (config)# show snmpv3 group

 Status and Counters - SNMP v3 Global Configuration Information

  Security Name                 Security Model Group Name
  ----------------------------- -------------- --------------
  CommunityManagerReadOnly      ver1           ComManagerR
  CommunityManagerReadWrite     ver1           ComManagerRW
  CommunityOperatorReadOnly     ver1           ComOperatorRW
  CommunityOperatorReadWrite    ver1           ComOperatorRW
  CommunityManagerReadOnly      ver2c          ComManagerR
  CommunityManagerReadWrite     ver2c          ComManagerRW
  CommunityOperatorReadOnly     ver2c          ComOperatorRW
  CommunityOperatorReadWrite    ver2c          ComOperatorRW
  NetworkMgr                    ver3           ManagerPriv
  NetworkAdmin                  ver3           OperatorNoAuth
```

Figure 13-3. Assign Users to group for SNMPv3

Caution

Adding a user without authentication and/or privacy to a group that requires it will cause the user to not be able to access the switch. You should only add users to the group that is appropriate for their security parameters

Group Access Levels

The switch supports eight predefined group access levels. There are four levels for use with version 3 users and four are used for access by version 2c or version 1 management applications.

Group Name	Group Access Type	Group Read View	Group Write View
managerpriv	Ver3 Must have Authentication and Privacy	ManagerReadView	ManagerWriteView
managerauth	Ver3 Must have Authentication	ManagerReadView	ManagerWriteView
operatorauth	Ver3 Must have Authentication	OperatorReadView	DiscoveryView
operatornoauth	Ver3 No Authentication	OperatorReadView	DiscoveryView
commanagerrw	Ver2c or Ver1	ManagerReadView	ManagerWriteView
commanagerr	Ver2c or Ver1	ManagerReadView	DiscoveryView
comoperatorrw	Ver2c or Ver1	OperatorReadView	OperatorReadView
comoperatorr	Ver2c or Ver1	OperatorReadView	DiscoveryView

Each view allows you to view or modify a different set of MIBs.

- **Manager Read View** – access to all managed objects
- **Manager Write View** – access to all managed objects *except* the following: vacmContextTable, vacmAccessTable, vacmViewTreeFamilyTable
- **OperatorReadView** – no access to icfSecurityMIB, ProCurveIpTftpMode, vacmContextTable, vacmAccessTable, vacmViewTreeFamilyTable, usmUserTable, snmpCommunityTable
- **Discovery View** – Access limited to samplingProbe MIB.

Note

All access groups and views are predefined on the switch. There is no method to modify or add groups or views to those that are pre-defined on the switch.

SNMP Communities

SNMP commuities are supported by the switch to allow management application that use version 2c or version 1 to access the switch. The communities are mapped to Group Access Levels that are used for version 2c or version 1 support. For more information see “Group Access Levels” on page 13-11. This mapping will happen automatically based on the communities access privileges, but special mappings can be added with the **snmpv3 community** command.

Syntax: [no] snmpv3 community

This command maps or removes a mapping of a community name to a group access level. To remove a mapping you only need the index_name.

< index < index-name >>

This is an index number or title for the mapping. The values of 1-5 are reserved and can not be mapped.

< name < com-name >>

This is the community name that is being mapped to a group access level

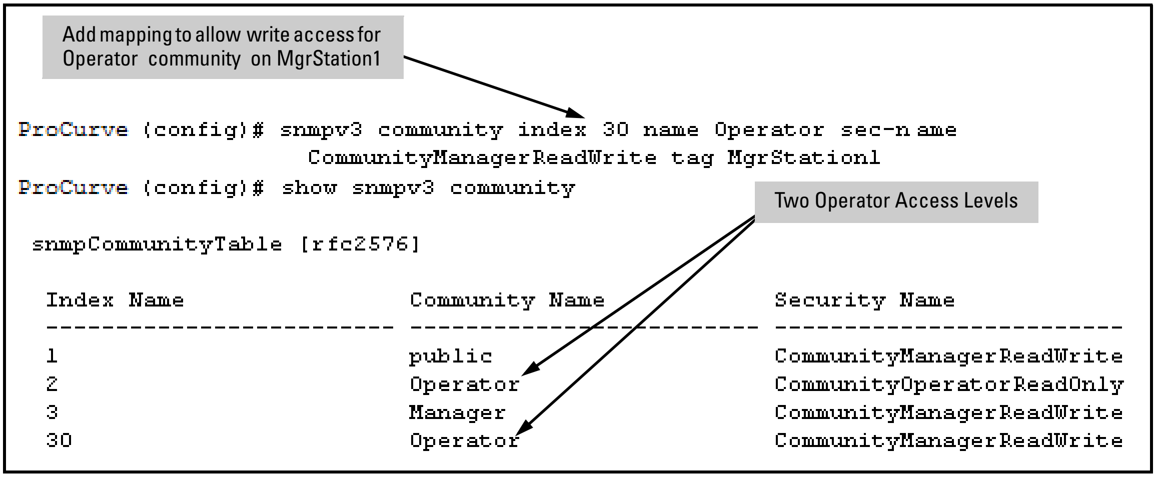
< sec-name < security-name >>

This is the group level that the community is being mapped. For more information see “Group Access Levels” on page 13-11.

< tag < tag-value >>

This is used to specify which target address may have access via this index reference.

Figure 13-4 shows the assigning of the Operator community on MgrStation1 to the **CommunityOperatorReadWrite** group. Any other Operator only has an access level of **CommunityOperatorReadOnly.**



Add mapping to allow write access for Operator community on MgrStation1

Two Operator Access Levels

```
ProCurve (config)# snmpv3 community index 30 name Operator sec-name
                   CommunityManagerReadWrite tag MgrStation1
ProCurve (config)# show snmpv3 community

 snmpCommunityTable [rfc2576]

  Index Name                Community Name              Security Name
  ------------------------- -------------------------   -------------------------
  1                         public                      CommunityManagerReadWrite
  2                         Operator                    CommunityOperatorReadOnly
  3                         Manager                     CommunityManagerReadWrite
  30                        Operator                    CommunityManagerReadWrite
```

Figure 13-4. Assigning a Community to a Group Access Level

Table 13-1. SNMP Community Features

Feature	Default	Menu	CLI	Web
show SNMP communities	n/a	page 13-14	page 13-16	—
configure identity information	none	—	page 13-17	
configure community names	public	page 13-14	page 13-17	—
MIB view for a community name (operator, manager)	manager	“	“	
write access for default community name	unrestricted	“ “	“ “	

Use SNMP communities to restrict access to the switch by SNMP management stations by adding, editing, or deleting SNMP communities. You can configure up to five SNMP communities, each with either an operator-level or a manager-level view, and either restricted or unrestricted write access.

Using SNMP requires that the switch have an IP address and subnet mask compatible with your network.

Caution

Deleting or changing the community named "public" prevents network management applications (such as auto-discovery, traffic monitoring, SNMP trap generation, and threshold setting) from operating in the switch. (Changing or deleting the "public" name also generates an Event Log message.) If security for network management is a concern, it is recommended that you change the write access for the "public" community to "Restricted".

Menu: Viewing and Configuring non-SNMP version 3 Communities

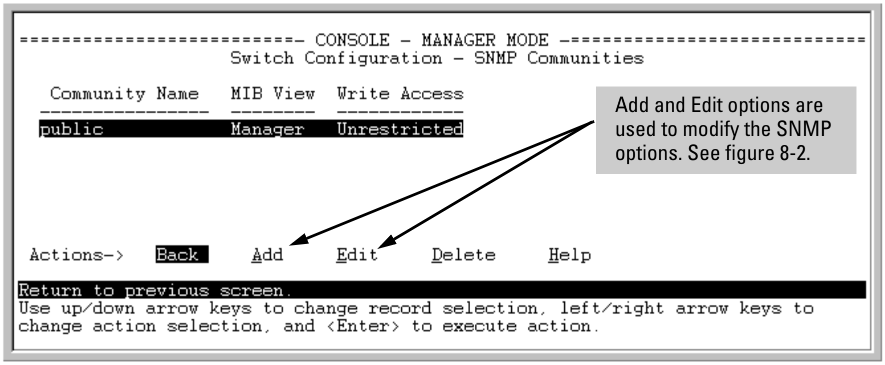
To View, Edit, or Add SNMP Communities:

1. From the Main Menu, Select:

   2. Switch Configuration...

   6. SNMP Community Names

Note: This screen gives an overview of the SNMP communities that are currently configured. All fields in this screen are read-only.



```
========================- CONSOLE - MANAGER MODE -===========================
                    Switch Configuration - SNMP Communities

  Community Name   MIB View   Write Access
 ---------------- --------   ------------
 public            Manager    Unrestricted




 Actions->   Back     Add     Edit     Delete     Help

Return to previous screen.
Use up/down arrow keys to change record selection, left/right arrow keys to
change action selection, and <Enter> to execute action.
```

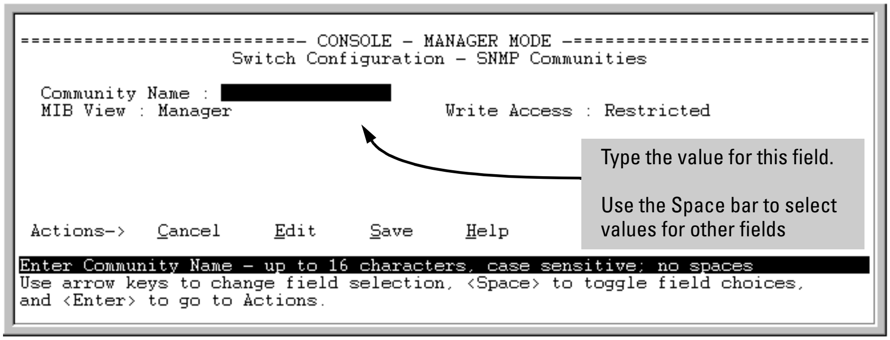
Add and Edit options are used to modify the SNMP options. See figure 8-2.

Figure 13-5. The SNMP Communities Screen (Default Values)

2. Press **[A]** (for **Add**) to display the following screen:

If you are adding a community, the fields in this screen are blank.

If you are editing an existing community, the values for the currently selected Community appear in the fields.



```
=========================- CONSOLE - MANAGER MODE -============================
                    Switch Configuration - SNMP Communities

  Community Name :
  MIB View : Manager                          Write Access : Restricted




 Actions->   Cancel     Edit     Save     Help

Enter Community Name - up to 16 characters, case sensitive; no spaces
Use arrow keys to change field selection, <Space> to toggle field choices,
and <Enter> to go to Actions.
```

Type the value for this field.

Use the Space bar to select values for other fields

Figure 13-6. The SNMP Add or Edit Screen

Need Help? If you need information on the options in each field, press **[Enter]** to move the cursor to the Actions line, then select the **Help** option on the Actions line. When you are finished with Help, press **[E]** (for Edit) to return the cursor to the parameter fields.

3. Enter the name you want in the Community Name field, and use the Space bar to select the appropriate value in each of the other fields. (Use the **[Tab]** key to move from one field to the next.)

4. Press **[Enter]**, then **[S]** (for **Save**).

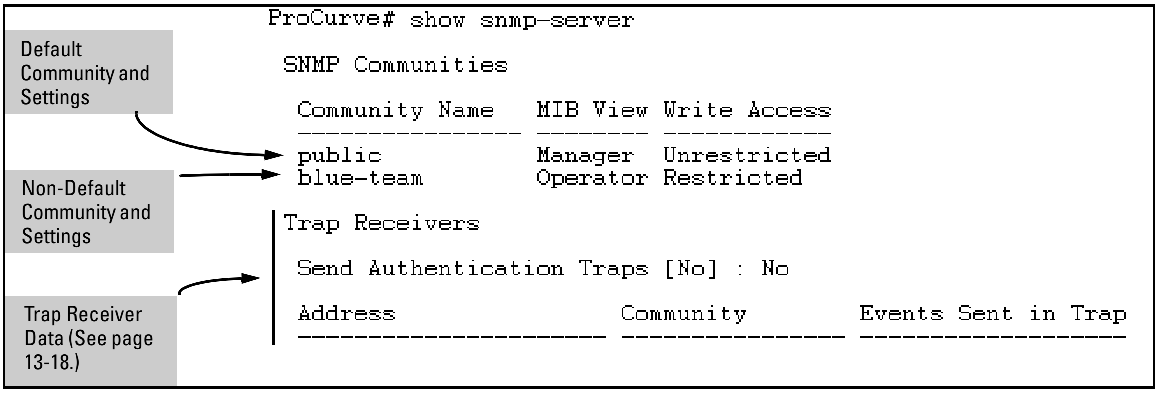
CLI: Viewing and Configuring SNMP Community Names

Community Name Commands	Page
show snmp-server [<community-string>]	13-16
[no] snmp-server	13-17
[community <community-str>]	13-17
[host <community-str> <ip-addr>] [<none | debug | all | not-info | critical>]	13-22
[enable traps <authentication>	13-23

Listing Community Names and Values. This command lists the data for currently configured SNMP community names (along with trap receivers and the setting for authentication traps — see “SNMP Notification and Traps” on page 13-18).

Syntax: show snmp-server [<community-string>]

This example lists the data for all communities in a switch; that is, both the default ProCurve "public" community name and another community named "blue-team".



```
ProCurve# show snmp-server

 SNMP Communities

  Community Name   MIB View Write Access
  ---------------- -------- ------------
  public           Manager  Unrestricted
  blue-team        Operator Restricted

 Trap Receivers

  Send Authentication Traps [No] : No

  Address                Community        Events Sent in Trap
  ---------------------- ---------------- -------------------
```

Default Community and Settings

Non-Default Community and Settings

Trap Receiver Data (See page 13-18.)

Figure 13-7. Example of the SNMP Community Listing with Two Communities

To list the data for only one community, such as the "public" community, use the above command with the community name included. For example:

```
ProCurve# show snmp-server public
```

Configuring Community Names and Values. The **snmp-server** command enables you to add SNMP communities with either default or specific access attributes, and to delete specific communities.

Syntax: [no] snmp-server community < community-name >

Configures a new community name. If you do not also specify **operator** *or* **manager**, *the switch automatically assigns the community to the* **operator** *MIB view. If you do not specify* **restricted** *or* **unrestricted**, *the switch automatically assigns the community to* **restricted** *(read-only) access. The* **no** *form uses only the* ***<community-name >*** *variable and deletes the named community from the switch.*

[operator | manager]

Optionally assigns an access level. At the **operator** *level the community can access all MIB objects except the CONFIG MIB. At the* **manager** *level the community can access all MIB objects.*

[restricted | unrestricted]

Optionally assigns MIB access type. Assigning the **restricted** *type allows the community to read MIB variables, but not to set them. Assigning the* **unrestricted** *type allows the community to read and set MIB variables.*

For example, to add the following communities:

Community	Access Level	Type of Access
red-team	manager (Access to all MIB objects.)	unrestricted (read/write)
blue-team	operator (Access to all MIB objects except the CONFIG MIB.)	restricted (read-only)

```
ProCurve(config)# snmp-server community red-team
      manager unrestricted
ProCurve(config)# snmp-server community blue-team
      operator restricted
```

To eliminate a previously configured community named "gold-team":

```
ProCurve(config) # no snmp-server community gold-team
```

SNMP Notification and Traps

The switches covered in this guide support the SNMPv3 notification process. They also support version 1or version 2c traps. For more information on version 1 or version 2c traps, see "Trap Features" on page 13-20. The SNMPv3 notification process allows for the messages passed to be authenticated and encrypted if you choose. To set up a SNMPv3 notification there are three steps:

1. Establish a Notification with the **snmpv3 notify** command.
2. Point the notification to a Address with the **snmpv3 targetaddress** command.
3. Establish a parameter record for the target address with the **snmpv3 params** command.

Syntax: [no] snmpv3 notify < notify-name > [tagvalue < tag-name >]

This adds or deletes a notification request. To remove a mapping you only need the notify-name.

[no] snmpv3 targetaddress < addr-name > params < parms-name> < IP-Addr >

Add or delete an address where notification messages are sent.

filter < none | debug | all | not-info | critical >

This filter messages to restrict type of messages transmitted to address. (Default: none)

udp-port < port >

This specifies the UDP port to use. (Default: 162)

port-mask < mask >

Used to specific a range of UDP ports. (Default: 0)

addr-mask < mask >

Used to specify a range of address to transit notify messages. (Default: 0)

retries < value >

Number times to retransmit a message when no response is reviewed. (Default: 3)

timeout < value >

How long to wait for a response for the target. (Default: 1500)

[no] snmpv3 targetaddress < addr-name > params < parms-name>
< IP-Addr > *(— Continued —)*

max-msg-size<size>

The maximum number of bytes of length a message to this target can be. (Default:1472)

taglist < tag-params >

Set list of values used to select this entry from **snmpNotifyTable**.

[no] snmpv3 params < params-name > user < user-name >

Add or delete a user parameter for use with target address. The params-name must match the parms-name *in the* **targetaddress** *command. The* user-name *should be a User from the user table. For more information on users see "SNMP Version 3 Users" on page 13-8*

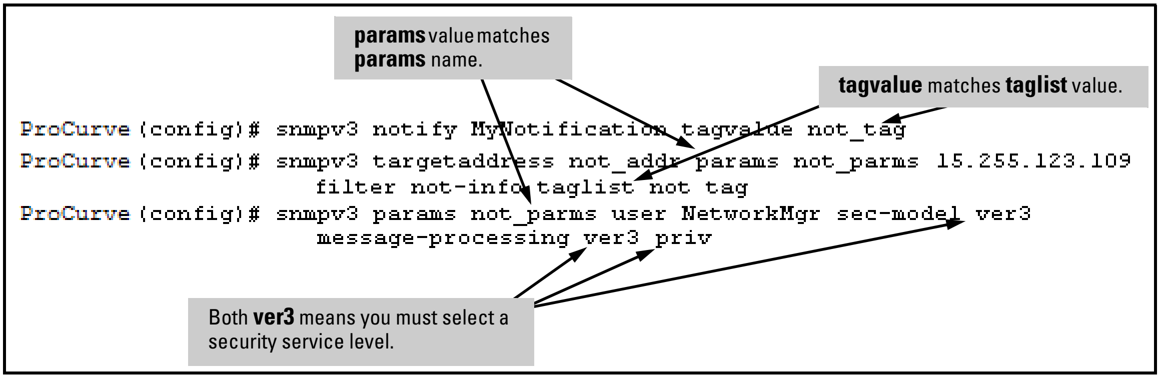
A complete **params** *command must also have a sec-model and msg-processing entry.*

< sec-model < ver1 | ver2c | ver3 >>

This established the security model to use for messages passed to the targetaddress. IF ver3 is used then the msg-processing must also be ver3.

< msg-processing < ver1 | ver2c | ver3> [noaut | auth | priv >

Establish the msg-processing for algorithm for messages passed to the target address. If **ver3** *is used and* **sec-model** *is* **ver3** *then you must select a security services level* (**< noauth | auth | priv >**)



params value matches **params** name.

tagvalue matches **taglist** value.

```
ProCurve(config)# snmpv3 notify MyNotification tagvalue not_tag
ProCurve(config)# snmpv3 targetaddress not_addr params not_parms 15.255.123.109
                    filter not-info taglist not tag
ProCurve(config)# snmpv3 params not_parms user NetworkMgr sec-model ver3
                    message-processing ver3 priv
```

Both **ver3** means you must select a security service level.

Figure 13-8. Example of SNMPv3 Configuration Session

Trap Features

Feature	Default	Menu	CLI	Web
snmp-server host (trap receiver)	public	—	page 13-22	—
snmp-server enable (authentication trap)	none	—	page 13-23	—

A *trap receiver* is a management station designated by the switch to receive SNMP traps sent from the switch. An *authentication trap* is a specialized SNMP trap sent to trap receivers when an unauthorized management station tries to access the switch.

Note

Fixed or "Well-Known" Traps: The switch automatically sends fixed traps (such as "coldStart", "warmStart", "linkDown", and "linkUp") to trap receivers using the **public** community name. These traps cannot be redirected to other communities. Thus, if you change or delete the default **public** community name, these traps will be lost.

Thresholds: The switch automatically sends all messages resulting from thresholds to the network management station(s) that set the thresholds, regardless of the trap receiver configuration.

In the default configuration, there are no trap receivers configured, and the authentication trap feature is disabled. From the CLI you can configure up to ten SNMP trap receivers to receive SNMP traps from the switch. As an option, you can also configure the switch to send Event Log messages as traps. CLI: Configuring and Displaying Trap Receivers

Trap Receiver Commands	Page
show snmp-server	13-21
snmp-server host <ip-addr> <community-name> [none | all | non-info| critical | debug]	13-22
snmp-server enable traps authentication	13-22

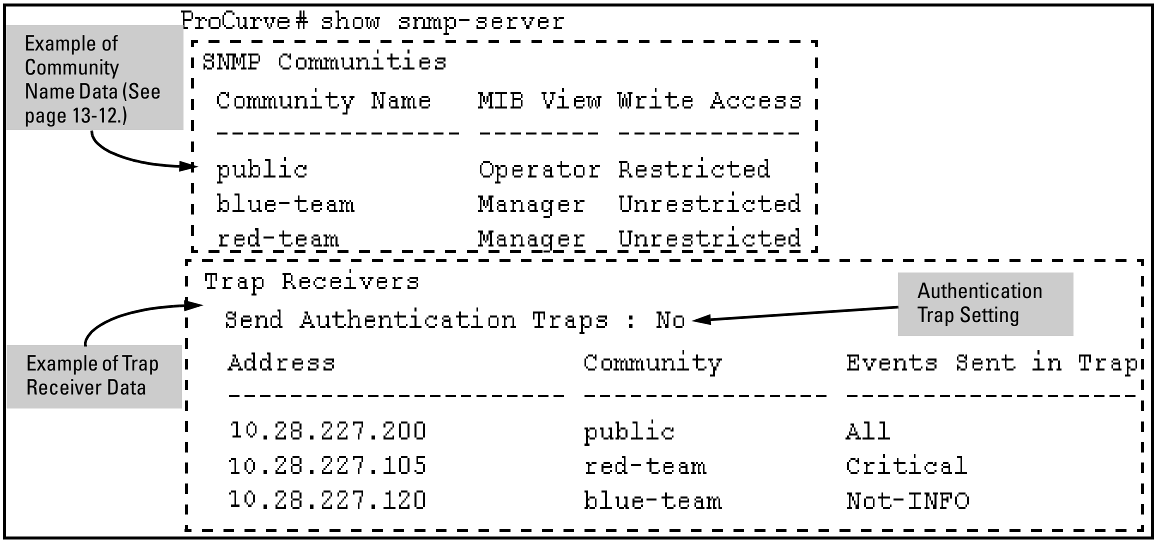
Using the CLI To List Current SNMP Trap Receivers.

This command lists the currently configured trap receivers and the setting for authentication traps (along with the current SNMP community name data — see “SNMP Communities” on page 13-12).

Syntax: show snmp-server

Displays current community and trap receiver data.

In the next example, the **show snmp-server** command shows that the switch has been previously configured to send SNMP traps to management stations belonging to the “public”, “red-team”, and “blue-team” communities.



```
ProCurve# show snmp-server
 SNMP Communities

  Community Name   MIB View Write Access
  ---------------- -------- ------------
  public           Operator Restricted
  blue-team        Manager  Unrestricted
  red-team         Manager  Unrestricted

 Trap Receivers

  Send Authentication Traps : No

  Address                Community        Events Sent in Trap
  ---------------------- ---------------- -------------------
  10.28.227.200          public           All
  10.28.227.105          red-team         Critical
  10.28.227.120          blue-team        Not-INFO
```

Example of Community Name Data (See page 13-12.)

Example of Trap Receiver Data

Authentication Trap Setting

Figure 13-9. Example of Show SNMP-Server Listing

Configuring Trap Receivers. This command specifies trap receivers by community membership, management station IP address, and the type of Event Log messages to send to the trap receiver.

Note

If you specify a community name that does not exist—that is, has not yet been configured on the switch—the switch still accepts the trap receiver assignment. However, no traps will be sent to that trap receiver until the community to which it belongs has been configured on the switch.

Syntax: snmp-server host < community-string > < ip-address >

Using community name and destination IP address, this command designates a destination network-management station for receiving SNMP event log messages from the switch. If you do not specify the event level, then the switch does not send event log messages as traps. You can specify up to ten trap receivers (network management stations).

Note: *In all cases, the switch sends any threshold trap(s) to the network management station(s) that explicitly set the threshold(s).*

[<none | all | non-info | critical | debug>]

Options for sending switch Event Log messages to a trap receiver. Refer toTable 13-2, "Options for Sending Event Log Messages as Traps," on page 13-22. The levels specified with these options apply only to Event Log messages, and not to threshold traps.

Table 13-2. Options for Sending Event Log Messages as Traps

Event Level	Description
None (default)	Send no log messages.
All	Send all log messages.
Not INFO	Send the log messages that are not information-only.
Critical	Send critical-level log messages.
Debug	Reserved for HP-internal use.

For example, to configure a trap receiver in a community named "red-team" with an IP address of 10.28.227.130 to receive only "critical" log messages:

```
ProCurve(config)# snmp-server trap-receiver red-team 10.28.227.130
                  critical
```

Notes

To replace one community name with another for the same IP address, you must use **no snmp-server host < community-name> < ip-address >** to delete the unwanted community name. Otherwise, adding a new community name with an IP address already in use with another community name simply creates two allowable community name entries for the same management station.

If you do not specify the event level ([<none | all | non-info | critical | debug>]) then the switch does not send event log messages as traps. "Well-Known" traps and threshold traps (if configured) will still be sent.

Using the CLI To Enable Authentication Traps

Note

For this feature to operate, one or more trap receivers must be configured on the switch. See “Configuring Trap Receivers” on page 13-22.

Using the CLI To Enable Authentication Traps.

Syntax: [no] snmp-server enable traps authentication

Enables or disables sending an authentication trap to the configured trap receiver(s) if an unauthorized management station attempts to access the switch.

For example:

```
ProCurve(config)# snmp-server enable traps authentication
```

Check the Event Log in the console interface to help determine why the authentication trap was sent. (Refer to “Using Logging To Identify Problem Sources” on page C-23.)

Advanced Management: RMON

The switches covered in this guide support RMON (Remote Monitoring) on all connected network segments. This allows for troubleshooting and optimizing your network. The following RMON groups are supported:

- Ethernet Statistics (except the numbers of packets of different frame sizes)
- Alarm
- History (of the supported Ethernet statistics)
- Event

The RMON agent automatically runs in the switch. Use the RMON management station on your network to enable or disable specific RMON traps and events.

LLDP (Link-Layer Discovery Protocol)

To standardize device discovery on all ProCurve switches, LLDP has been implemented while offering limited read-only support for CDP as documented in this manual. For current information on your switch model, consult the latest Release Notes (available on the ProCurve Networking web site). If LLDP has not yet been implemented (or if you are running an older version of software), consult a previous version of the Management and Configuration Guide for device discovery details.

Introduction

LLDP Features

Feature	Default	Menu	CLI	Web
View the switch's LLDP configuration	n/a	—	page 13-32	—
Enable or disable LLDP on the switch	Enabled	—	page 13-34	—
Change the transmit interval (refresh-interval) for LLDP packets	30 seconds	—	page 13-35	—
Change the holdtime multiplier for LLDP Packets (holdtime-multiplier x refresh-interval = time-to-live)	4 seconds	—	page 13-35	—
Change the delay interval between advertisements	2 seconds	—	page 13-36	—
Changing the reinitialization delay interval	2 seconds	—	page 13-37	—
Configuring SNMP notification support	Disabled	—	page 13-37	—
Configuring transmit and receive modes	tx_rx	—	page 13-39	—
Configuring per-port advertisement content	Enabled	—	page 13-39	—
Displaying Advertisement Data and Statistics	n/a	—	page 13-41	—

The Link Layer Discovery Protocol (LLDP) provides a standards-based method for enabling switches to advertise themselves to adjacent devices and to learn about adjacent LLDP devices.

An SNMP utility can progressively discover LLDP devices in a network by:

1. Reading a given device's Neighbors table (in the Management Information Base, or MIB) to learn about other, neighboring LLDP devices.
2. Using the information learned in step 1 to find and read the neighbor devices' Neighbors tables to learn about additional devices, and so on.

Also, by using **show** commands to access the switch's neighbor database for information collected by an individual switch, system administrators can learn about other devices connected to the switch, including device type (capability) and some configuration information.

LLDP Terminology

Adjacent Device: Refer to "Neighbor or Neighbor Device".

Advertisement: See LLDPDU.

Active Port: A port linked to another active device (regardless of whether STP is blocking the link).

LLDP: Link Layer Discovery Protocol. ProCurve switches are compatible with IEEE 802.1AB-2005.

LLDP-Aware: A device that has LLDP in its operating code, regardless of whether LLDP is enabled or disabled.

LLDP Device: A switch, server, router, or other device running LLDP.

LLDP Neighbor: An LLDP device that is either directly connected to another LLDP device or connected to that device by another, non-LLDP Layer 2 device (such as a hub) Note that an 802.1D-compliant switch does not forward LLDP data packets even if it is not LLDP-aware.

LLDPDU (LLDP Data Unit): LLDP data packets are transmitted on active links and include multiple TLVs containing global and per-port switch information. In this guide, LLDPDUs are termed "advertisements" or "packets".

MIB (Management Information Base): An internal database the switch maintains for configuration and performance information.

Neighbor: See "LLDP Neighbor".

Non_LLDP Device: A device that is not capable of LLDP operation.

TLV (Type-Length-Value): A data unit that includes a data type field, a data unit length field (in bytes), and a field containing the actual data the unit is designed to carry (as an alphanumeric string, a bitmap, or a subgroup of information). Some TLVs include subelements that occur as separate data points in displays of information maintained by the switch for LLDP advertisements. (That is, some TLVs include multiple data points or subelements.)

General LLDP Operation

An LLDP packet contains data about the transmitting switch and port. The switch advertises itself to adjacent (neighbor) devices by transmitting LLDP data packets out all ports on which outbound LLDP is enabled, and reading LLDP advertisements from neighbor devices on ports that are inbound LLDP-enabled. (LLDP is a one-way protocol and does not include any acknowledgement mechanism.) An LLDP-enabled port receiving LLDP packets inbound from neighbor devices stores the packet data in a Neighbor database (MIB).

Note

Ports can also be enabled for reading CDP packets and storing the CDP data in an LLDP-compatible version. See “LLDP and CDP Data Management” on page 13-50 for details.

Packet Boundaries in a Network Topology

- Where multiple LLDP devices are directly connected, an outbound LLDP packet travels only to the next LLDP device. An LLDP-capable device does not forward LLDP packets to any other devices, regardless of whether they are LLDP-capable.
- An intervening hub or repeater forwards the LLDP packets it receives in the same manner as any other multicast packets it receives. Thus, two LLDP switches joined by a hub or repeater handle LLDP traffic in the same way that they would if directly connected.
- Any intervening 802.1D device, or Layer-3 device that is either LLDP-unaware or has disabled LLDP operation, drops the packet.

LLDP Configuration Options

Enable or Disable LLDP on the Switch. In the default configuration, LLDP is globally enabled on the switch. To prevent transmission or receipt of LLDP traffic, you can disable LLDP operation (page 13-34).

Change the Frequency of LLDP Packet Transmission to Neighbor Devices. On a global basis, you can increase or decrease the frequency of outbound LLDP advertisements (page 13-35).

Change the Time-To-Live for LLDP Packets Sent to Neighbors. On a global basis, you can increase or decrease the time that the information in an LLDP packet outbound from the switch will be maintained in a neighbor LLDP device (page 13-35).

Transmit and Receive Mode. With LLDP enabled, the switch periodically transmits an LLDP advertisement (packet) out each active port enabled for outbound LLDP transmissions, and receives LLDP advertisements on each active port enabled to receive LLDP traffic (page 13-39). Per-Port configuration options include four modes:

- Transmit and Receive (**tx_rx**): This is the default setting on all ports. It enables a given port to both transmit and receive LLDP packets, and to store the data from received (inbound) LLDP packets in the switch's MIB.
- Transmit only (**txonly**): This setting enables a port to transmit LLDP packets that can be read by LLDP neighbors. However, the port drops inbound LLDP packets from LLDP neighbors without reading them. This prevents the switch from learning about LLDP neighbors on that port.
- Receive only (**rxonly**): This setting enables a port to receive and read LLDP packets from LLDP neighbors, and to store the packet data in the switch's MIB. However, the port does not transmit outbound LLDP packets. This prevents LLDP neighbors from learning about the switch through that port.
- Disable (**disable**): This setting disables LLDP packet transmissions and reception on a port. In this state, the switch does not use the port for either learning about LLDP neighbors or informing LLDP neighbors of its presence.

SNMP Notification. You can enable the the switch to send a notification to any configured SNMP trap receiver(s) when the switch detects a remote LLDP data change on an LLDP-enabled port (page 13-37).

Per-Port (Outbound) Data Options. The following table lists the information the switch can include in the per-port, outbound LLDP packets it generates. In the default configuration, all outbound LLDP packets include this information in the TLVs transmitted to neighbor devices. However, you can configure LLDP advertisements on a per-port basis to omit some of this information (page 13-40).

Table 13-10. Viewable[1] Data Available for LLDP Advertisements

Data Type	Configuration Options	Default	Description
ChassisType[2, 6]	N/A	Always Enabled	Indicates the the type of identifier used for Chassis ID.
Chassis ID[6]	N/A	Always Enabled	Uses base MAC address of the switch.
Port Type[3, 6]	N/A	Always Enabled	Uses “Local”, meaning assigned locally by LLDP.
Port Id[6]	N/A	Always Enabled	Uses port number of the physical port.

Data Type	Configuration Options	Default	Description
Remote Management Address			
Type[4, 6]	N/A	Always Enabled	Shows the network address type.
Address[4]	Default or Configured	Uses a default address selection method unless an optional address is configured. See “Remote Management Address”, below.	
System Name[6]	Enable/Disable	Enabled	Uses the switch’s assigned name.
System Description[6]	Enable/Disable	Enabled	Includes switch model name and running software version, and ROM version.
Port Description[6]	Enable/Disable	Enabled	Uses the physical port identifier.
System capabilities supported[5, 6]	Enable/Disable	Enabled	Identifies the switch’s primary capabilities (bridge, router).
System capabilities enabled[5, 6]	Enable/Disable	Enabled	Identifies the primary switch functions that are enabled, such as routing.

[1] The Packet Time-to-Live value is not viewable, but is included in LLDP data packets. (Refer to “Changing the Time-to-Live for Transmitted Advertisements” on page 13-35.)

[2] Subelement of the Chassis ID TLV.

[3] Subelement of the Port ID TLV.

[4] Subelement of the Remote-Management-Address TLV.

[5] Subelement of the System Capability TLV.

[6] Populated with data captured internally by the switch. For more on these data types, refer to the IEEE 802.1AB-2005 Standard.

Remote Management Address. The switch always includes an IP address in its LLDP advertisements. This can be either an address selected by a default process, or an address configured for inclusion in advertisements. Refer to “IP Address Advertisements” on page 13-31.

Debug Logging. You can enable LLDP debug logging to a configured debug destination (Syslog server and/or a terminal device) by executing the **debug lldp** command. (For more on Debug and Syslog, see “Debug and Syslog Operation” on page C-27.) Note that the switch’s Event Log does not record usual LLDP update messages.

Options for Reading LLDP Information Collected by the Switch

You can extract LLDP information from the switch to identify adjacent LLDP devices. Options include:

- Using the switch's **show lldp info** command options to display data collected on adjacent LLDP devices—as well as the local data the switch is transmitting to adjacent LLDP devices (page 13-32).
- Using an SNMP application that is designed to query the Neighbors MIB for LLDP data to use in device discovery and topology mapping. (This includes CDP data the switch has read and mapped to the LLDP counterpart.)
- Using the **walkmib** command to display a listing of the LLDP MIB objects

LLDP Standards Compatibility

The features covered by this guide for the Series 2600 switches are compatible with the following LLDP-related standards:

- IEEE 802.1AB-2005
- RFC 2922 (PTOPO, or Physical Topology MIB)
- RFC 2737 (Entity MIB)
- RFC 2863 (Interfaces MIB)

LLDP Operating Rules

Port Trunking. LLDP manages trunked ports individually. That is, trunked ports are configured individually for LLDP operation, in the same manner as non-trunked ports. Also, LLDP sends separate advertisements on each port in a trunk, and not on a per-trunk basis. Similarly, LLDP data received through trunked ports is stored individually, per-port.

IP Address Advertisements. In the default operation, if a port belongs to only one static VLAN, then the port advertises the lowest-order IP address configured on that VLAN. If a port belongs to multiple VLANs, then the port advertises the lowest-order IP address configured on the VLAN with the lowest VID. If the qualifying VLAN does not have an IP address, the port advertises 127.0.0.1 as its IP address. For example, if the port is a member of the default VLAN (VID = 1), and there is an IP address configured for the default VLAN, then the port advertises this IP address. In the default operation, the IP address that LLDP uses can be an address acquired by DHCP or Bootp.

You can override the default operation by configuring the port to advertise any IP address that is manually configured on the switch, even if the port does not belong to the VLAN configured with the selected IP address (page 13-39). (Note that LLDP cannot be configured through the CLI to advertise an addresses acquired through DHCP or Bootp. However, as mentioned above, in the default LLDP configuration, if the lowest-order IP address on the VLAN with the lowest VID for a given port is a DHCP or Bootp address, then the switch includes this address in its LLDP advertisements unless another address is configured for advertisements on that port.) Also, although LLDP allows configuring multiple remote management addresses on a port, only the lowest-order address configured on the port will be included in outbound advertisements. Attempting to use the CLI to configure LLDP with an IP address that is either not configured on a VLAN, or has been acquired by DHCP or Bootp results in the following error message.

```
xxx.xxx.xxx.xxx: This IP address is not configured or is
a DHCP address.
```

Spanning-Tree Blocking. Spanning tree does not prevent LLDP packet transmission or receipt on STP-blocked links.

802.1x Blocking. Ports blocked by 802.1x operation do not allow transmission or receipt of LLDP packets.

LLDP Operation and Commands

In the default configuration, LLDP is enabled and in both transmit and receive mode on all active ports. The LLDP configuration includes global settings that apply to all active ports on the switch, and per-port settings that affect only the operation of the specified ports.

Command	Page
show lldp config	13-32
[no] lldp run	13-34
lldp refresh-interval	13-35
lldp holdtime-multiplier	13-35
lldpTxDelay	13-36
lldpReinitDelay	13-37
lldp enable-notification	13-37
lldpnotificationinterval	13-38
lldp admin-status < txonly | rxonly | tx_rx | disable >	13-39
lldp config < *port-list* > IpAddrEnable	13-39
lldp config < *port-list* > basicTlvEnable	13-40

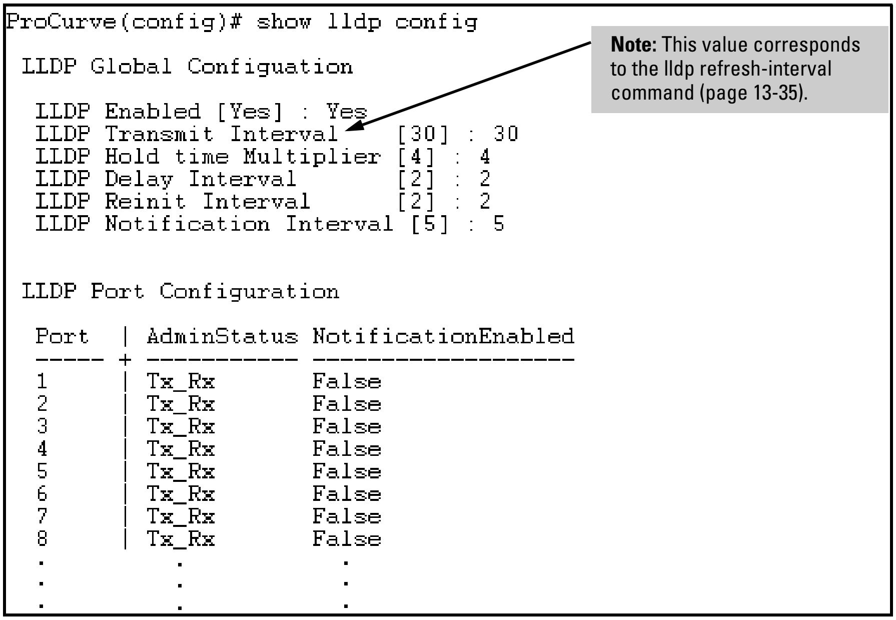
Viewing the Current LLDP Configuration

Displaying the Global LLDP, Port Admin, and SNMP Notification Status. This command displays the switch's general LLDP configuration status, including some per-port information affecting advertisement traffic and trap notifications.

Syntax show lldp config

Displays the LLDP global configuration, LLDP port status, and SNMP notification status. For information on port admin status, refer to "Configuring Per-Port LLDP Transmit and Receive Modes" on page 13-39.

For example, **show lldp config** produces the following display when the switch is in the default LLDP configuration:



```
ProCurve(config)# show lldp config

 LLDP Global Configuation

  LLDP Enabled [Yes] : Yes
  LLDP Transmit Interval    [30] : 30
  LLDP Hold time Multiplier [4] : 4
  LLDP Delay Interval       [2] : 2
  LLDP Reinit Interval      [2] : 2
  LLDP Notification Interval [5] : 5


 LLDP Port Configuration

  Port  | AdminStatus NotificationEnabled
  ----- + ----------- -------------------
  1     | Tx_Rx       False
  2     | Tx_Rx       False
  3     | Tx_Rx       False
  4     | Tx_Rx       False
  5     | Tx_Rx       False
  6     | Tx_Rx       False
  7     | Tx_Rx       False
  8     | Tx_Rx       False
  .         .           .
  .         .           .
  .         .           .
```

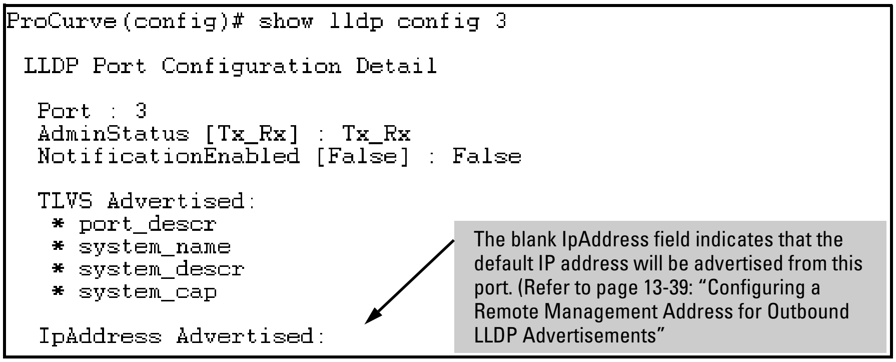
Note: This value corresponds to the lldp refresh-interval command (page 13-35).

Figure 13-1. Example of Viewing the General LLDP Configuration

Displaying Port Configuration Details. This command displays the port-specific configuration, including .

Syntax show lldp config < *port-list* >

Displays the LLDP port-specific configuration for all ports in < port-list>*, including which optional TLVs and any non-default IP address that are included in the port's outbound advertisements. For information on the notification setting, refer to "Configuring SNMP Notification Support" on page 13-37. For information on the other configurable settings displayed by this command, refer to "Configuring Per-Port LLDP Transmit and Receive Modes" on page 13-39.*



```
ProCurve(config)# show lldp config 3

 LLDP Port Configuration Detail

  Port : 3
  AdminStatus [Tx_Rx] : Tx_Rx
  NotificationEnabled [False] : False

  TLVS Advertised:
   * port_descr
   * system_name
   * system_descr
   * system_cap

  IpAddress Advertised:
```

The blank IpAddress field indicates that the default IP address will be advertised from this port. (Refer to page 13-39: "Configuring a Remote Management Address for Outbound LLDP Advertisements"

Figure 13-2. Example of Per-Port Configuration Display

Configuring Global LLDP Packet Controls

The commands in this section configure the aspects of LLDP operation that apply the same to all ports in the switch.

Enabling or Disabling LLDP Operation on the Switch. Enabling LLDP operation (the default) causes the switch to:

- Use active, LLDP-enabled ports to transmit LLDP packets describing itself to neighbor devices.
- Add entries to its neighbors table based on data read from incoming LLDP advertisements.

Syntax [no] lldp run

Enables or disables LLDP operation on the switch. The **no** *form of the command, regardless of individual LLDP port configurations, prevents the switch from transmitting outbound LLDP advertisements, and causes the switch to drop all LLDP advertisements received from other devices. The switch preserves the current LLDP configuration when LLDP is disabled. After LLDP is disabled, the information in the LLDP neighbors database remains until it times-out. (Default: Enabled)*

For example, to disable LLDP on the switch:

```
ProCurve(config)# no lldp run
```

Changing the Transmission Interval for LLDP Packets. This interval controls how often active ports retransmit advertisements to their neighbors.

Syntax lldp refresh-interval < 5 - 32768 >

Changes the interval between consecutive transmissions of LLDP advertisements on any given port. (Default: 30 seconds)

Note:** The* **refresh-interval** *must be greater than or equal to (4* x **delay-interval). (The default* **delay-interval** *is 2). For example, with the default* **delay-interval**, *the lowest* **refresh-interval** *you can use is 8 seconds (4* x *2 = 8). Thus, if you want a* **refresh-interval** *of 5 seconds, you must first change the delay interval to 1 (that is, 4 x 1 < 5). If you want to change the* **delay-interval**, *use the setmib command. (Refer to page 13-36.)*

Changing the Time-to-Live for Transmitted Advertisements. The Time-to-Live value (in seconds) for all LLDP advertisements transmitted from a switch is controlled by the switch that generates the advertisement, and determines how long an LLDP neighbor retains the advertised data before discarding it. The Time-to-Live value is the result of multiplying the **refresh-interval** by the **holdtime-multiplier** described below.

Syntax lldp holdtime-multiplier < 2 - 10 >

Changes the multiplier an LLDP switch uses to calculate the Time-to-Live for the LLDP advertisements it generates and transmits to LLDP neighbors. When the Time-to-Live for a given advertisement expires the advertised data is deleted from the neighbor switch's MIB. (Default: 4; Range: 2 - 10)

For example, if the refresh-interval on the switch is 15 seconds and the **holdtime-multiplier** is at the default, the Time-to-Live for advertisements transmitted from the switch is 60 seconds (4 x 15). To reduce the Time-to-Live, you could lower the **holdtime-interval** to 2, which would result in a Time-to-Live of 30 seconds.

```
ProCurve(config)# lldp holdtime-multiplier 2
```

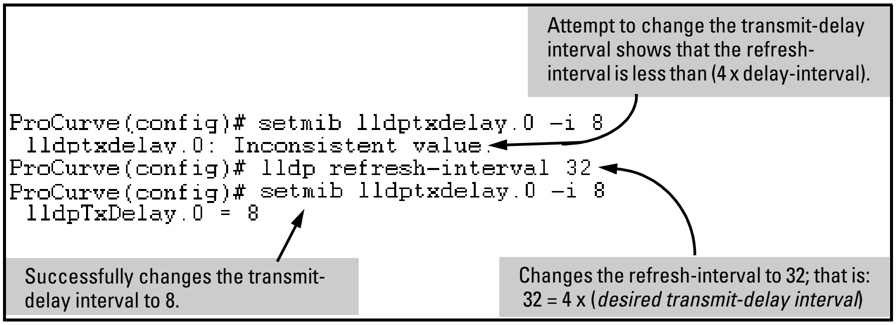
Changing the Delay Interval Between Advertisements Generated by Value or Status Changes to the LLDP MIB. The switch uses a *delay-interval* setting to delay transmitting successive advertisements resulting from these LLDP MIB changes. If a switch is subject to frequent changes to its LLDP MIB, lengthening this interval can reduce the frequency of successive advertisements. The delay-interval can be changed using either an SNMP network management application or the CLI **setmib** command.

Syntax setmib lldpTxDelay.0 -i < 1 - 8192 >

Uses **setmib** *to change the minimum time (delay-interval) any LLDP port will delay advertising successive LLDP advertisements due to a change in LLDP MIB content. (Default: 2; Range: 1 - 8192)*

Note: *The LLDP refresh-interval (transmit interval) must be greater than or equal to (4* x *delay-interval). The switch does not allow increasing the delay interval to a value that conflicts with this relationship. That is, the switch displays* **Inconsistent value** *if (4* x *delay-interval) exceeds the current transmit interval, and the command fails. Depending on the current refresh-interval setting, it may be necessary to increase the refresh-interval before using this command to increase the delay-interval.*

For example, to change the delay-interval from 2 seconds to 8 seconds when the refresh-interval is at the default 30 seconds, you must first set the refresh-interval to a minimum of 32 seconds (32 = 4 x 8).



Attempt to change the transmit-delay interval shows that the refresh-interval is less than (4 x delay-interval).

```
ProCurve(config)# setmib lldptxdelay.0 -i 8
 lldptxdelay.0: Inconsistent value.
ProCurve(config)# lldp refresh-interval 32
ProCurve(config)# setmib lldptxdelay.0 -i 8
 lldpTxDelay.0 = 8
```

Successfully changes the transmit-delay interval to 8.

Changes the refresh-interval to 32; that is: 32 = 4 x (*desired transmit-delay interval*)

Figure 13-3. Example of Changing the Transmit-Delay Interval

Changing the Reinitialization Delay Interval. In the default configuration, a port receiving a **disable** command followed immediately by a **txonly**, **rxonly**, or **tx_rx** command delays reinitializing for two seconds, during which time LLDP operation remains disabled. If an active port is subjected to frequent toggling between the LLDP disabled and enabled states, LLDP advertisements are more frequently transmitted to the neighbor device. Also, the neighbor table in the adjacent device will change more frequently, as it deletes, then replaces LLDP data for the affected port which, in turn, generates SNMP traps (if trap receivers and SNMP notification are configured). All of this can unnecessarily increase network traffic. Extending the reinitialization-delay interval delays the port's ability to reinitialize and generate LLDP traffic following an LLDP disable/enable cycle.

Syntax setmib lldpReinitDelay.0 -i < 1 - 10 >

Uses **setmib** *to change the minimum time (reinitialization delay interval) an LLDP port will wait before reinitializing after receiving an LLDP disable command followed closely by a txonly or tx_rx command. The delay interval commences with execution of the* **lldp admin-status <** ***port-list*** **> disable** *command. (Default: 2 seconds; Range: 1 - 10 seconds)*

For example, the following command changes the reinitialization delay interval to five seconds:

```
ProCurve(config)# setmib lldpreinitdelay.0 -i 5
```

Configuring SNMP Notification Support

You can enable SNMP trap notification of LLDP data changes detected on advertisements received from neighbor devices, and control the interval between successive notifications of data changes on the same neighbor.

Enabling LLDP Data Change Notification for SNMP Trap Receivers.

Syntax [no] lldp enable-notification < *port-list* >

Enables or disables each port in < port-list > *for sending notification to configured SNMP trap receiver(s) if an LLDP data change is detected in an advertisement received on the port from an LLDP neighbor. (Default: Disabled)*

For information on configuring trap receivers in the switch, refer to the chapter titled "Configuring for Network Management Applications" in the Management and Configuration Guide for your switch.

For example, this command enables SNMP notification on ports 1 - 5:

```
ProCurve(config)# lldp enable-notification 1-5
```

Changing the Minimum Interval for Successive LLDP Data Change Notifications for the Same Neighbor.

If LLDP trap notification is enabled on a port, a rapid succession of changes in LLDP information received in advertisements from one or more neighbors can generate a high number of traps. To reduce this effect, you can globally change the interval between successive notifications of neighbor data change.

Syntax setmib lldpnotificationinterval.0 -i < 1 - 3600 >

Globally changes the interval between successive traps generated by the switch. If multiple traps are generated in the specified interval, only the first trap will be sent. The remaining traps will be suppressed. (A network management application can periodically check the switch MIB to detect any missed change notification traps. Refer to IEEE 802.1AB-2005 or later for more information.) (Default: 5 seconds)

For example, the following command limits change notification traps from a particular switch to one per minute.

```
ProCurve(config)# setmib lldpnotificationinterval.0 -i 60
lldpNotificationInterval.0 = 60
```

Configuring Per-Port LLDP Transmit and Receive Modes

These commands control LLDP advertisement traffic inbound and outbound on active ports.

Syntax lldp admin-status < *port-list* > < txonly | rxonly | tx_rx | disable >

With LLDP enabled on the switch in the default LLDP configuration, each port is configured to transmit and receive LLDP packets. These options enable you to control which ports participate in LLDP traffic and whether the participating ports allow LLDP traffic in only one direction or in both directions.

txonly: *Configures the specified port(s) to transmit LLDP packets, but block inbound LLDP packets from neighbor devices.*

rxonly: *Configures the specified port(s) to receive LLDP packets from neighbors, but block outbound packets to neighbors.*

tx_rx: *Configures the specified port(s) to both transmit and receive LLDP packets. (This is the default setting.)*

disable: *Disables LLDP packet transmit and receive on the specified port(s).*

Configuring LLDP Per-Port Advertisement Content

In the default LLDP configuration, outbound advertisements from each port on the switch include both the mandatory and the optional data listed in the next two subsections.

Mandatory Data. An active LLDP port on the switch always includes the mandatory data in its outbound advertisements. LLDP collects the mandatory data, and, except for the Remote Management Address, you cannot use LLDP commands to configure the actual data.

- Chassis Type (TLV subelement)
- Chassis ID (TLV)
- Port Type (TLV subelement)
- Port ID (TLV)
- Remote Management Address (TLV; actual IP address is a subelement that can be a default address or a configured address)

Configuring a Remote Management Address for Outbound LLDP Advertisements. This is an optional command you can use to include a specific IP address in the outbound LLDP advertisements for specific ports.

Syntax [no] lldp config < *port-list* > ipAddrEnable < *ip-address* >

Replaces the default IP address for the port with an IP address you specify. This can be any IP address configured in a static VLAN on the switch, even if the port does not belong to the VLAN configured with the selected IP address. The **no** *form of the command deletes the specified IP address. If there are no IP addresses configured as management addresses, then the IP address selection method returns to the default operation. (Default: The port advertises the primary IP address of the lowest-numbered VLAN (VID) to which it belongs. If there is no IP address configured on the VLAN(s) to which the port belongs, and the port is not configured to advertise an IP address from any other (static) VLAN on the switch, then the port advertises an address of 127.0.0.1.)*

Note: *This command does not accept either IP addresses acquired through DHCP or Bootp, or IP addresses that are not configured in a static VLAN on the switch*

For example, if port 3 belongs to a subnetted VLAN that includes a secondary IP address of 10.10.10.100 and you wanted port 3 to use this secondary address in LLDP advertisements, you would need to execute the following command:

```
ProCurve(config)# lldp config 3 ipAddrEnable 10.10.10.100
```

Optional Data. You can configure an individual port or group of ports to exclude one or more of these data types from outbound LLDP advertisements. Note that optional data types, when enabled, are populated with data internal to the switch; that is, you cannot use LLDP commands to configure their actual content.

- Port Description (TLV)
- System Name (TLV)
- System Description (TLV)
- System Capabilities (TLV)
  - System Capabilities Supported (TLV subelement)
  - System Capabilities Enabled (TLV subelement)

Syntax [no] lldp config < *port-list* > basicTlvEnable < *TLV-Type* >

port_descr

For outbound LLDP advertisements, includes an alphanumeric string describing the port.

system_name

For outbound LLDP advertisements, includes the system's assigned name.

system_descr

For outbound LLDP advertisements, includes an alphanumeric string describing the full name and version identification for the system's hardware type, software version, and networking application.

system_cap

For outbound advertisements, includes a bitmask of system capabilities (device functions) that are supported. Also includes information on whether the capabilities are enabled.

For example, if you wanted to exclude the system name from the outbound LLDP advertisements for all ports on a 2626 switch, you would use this command:

```
ProCurve(config)# no lldp config 1-26 basicTlvEnable
system_name
```

If you later decided to reinstate the system name on ports 1-5, you would use this command:

```
ProCurve(config)# lldp config 1-5 basicTlvEnable
system_name
```

Displaying Advertisement Data

Command	**Page**
show lldp info local-device	below
show lldp info remote-device	13-43
show lldp info stats	13-46

Displaying Switch Information Available for Outbound Advertisements

These commands display the current switch information that will be used to populate outbound LLDP advertisements.

Syntax show lldp info local-device [*port-list*]

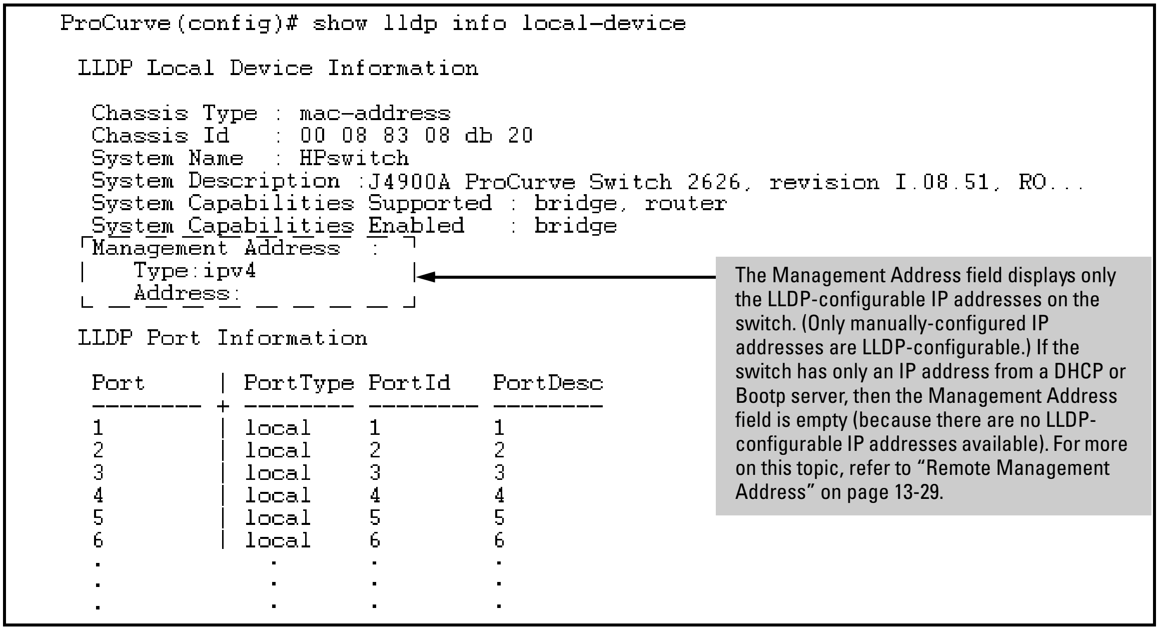
Without the [*port-list*] *option, this command displays the global switch information and the per-port information currently available for populating outbound LLDP advertisements.*

With the [*port-list*] *option, this command displays only the following port-specific information that is currently available for outbound LLDP advertisements on the specified ports:*

- **PortType**
- **PortId**
- **PortDesc**

Note: *This command displays the information available on the switch. Use the* **lldp config <** ***port-list*** **>** *command to change the selection of information that is included in actual outbound advertisements. In the default LLDP configuration, all information displayed by this command is transmitted in outbound advertisements.*

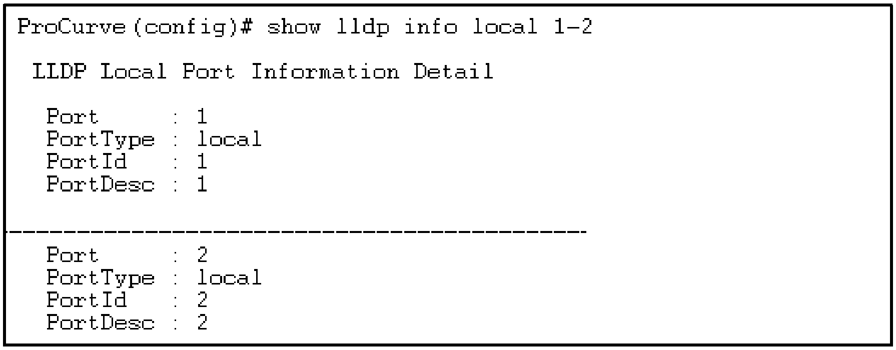
For example, in the default configuration, the switch information currently available for outbound LLDP advertisements appears similar to the display in figure 13-4 on page page 13-43.



```
ProCurve(config)# show lldp info local-device

 LLDP Local Device Information

  Chassis Type : mac-address
  Chassis Id   : 00 08 83 08 db 20
  System Name  : HPswitch
  System Description :J4900A ProCurve Switch 2626, revision I.08.51, RO...
  System Capabilities Supported : bridge, router
  System Capabilities Enabled   : bridge
  Management Address  :
     Type:ipv4
     Address:

 LLDP Port Information

  Port     | PortType PortId   PortDesc
  -------- + -------- -------- --------
  1        | local    1        1
  2        | local    2        2
  3        | local    3        3
  4        | local    4        4
  5        | local    5        5
  6        | local    6        6
  .           .       .        .
  .           .       .        .
  .           .       .        .
```

The Management Address field displays only the LLDP-configurable IP addresses on the switch. (Only manually-configured IP addresses are LLDP-configurable.) If the switch has only an IP address from a DHCP or Bootp server, then the Management Address field is empty (because there are no LLDP-configurable IP addresses available). For more on this topic, refer to “Remote Management Address” on page 13-29.

Figure 13-4. Example of Displaying the Global and Per-Port Information Available for Outbound Advertisements



```
ProCurve(config)# show lldp info local 1-2

 LLDP Local Port Information Detail

  Port     : 1
  PortType : local
  PortId   : 1
  PortDesc : 1

-------------------------------------------
  Port     : 2
  PortType : local
  PortId   : 2
  PortDesc : 2
```

Figure 13-5. Example of the Default Per-Port Information Content for Ports 1 and 2

Displaying Advertisements Currently in the Neighbors MIB. These commands display the content of the inbound LLDP advertisements received from other LLDP devices. These commands can also display the content of inbound CDP advertisements. (For more on how the switches handle data received in CDP advertisements, refer to “LLDP and CDP Data Management” on page 13-50).

Syntax show lldp info remote-device [*port-list*]

Without the [port-list] *option, this command provides a global list of the individual devices it has detected by reading LLDP advertisements (and also CDP advertisements). Discovered devices are listed by the inbound port on which they were discovered.*

Multiple devices listed for a single port indicates either or both of the following:

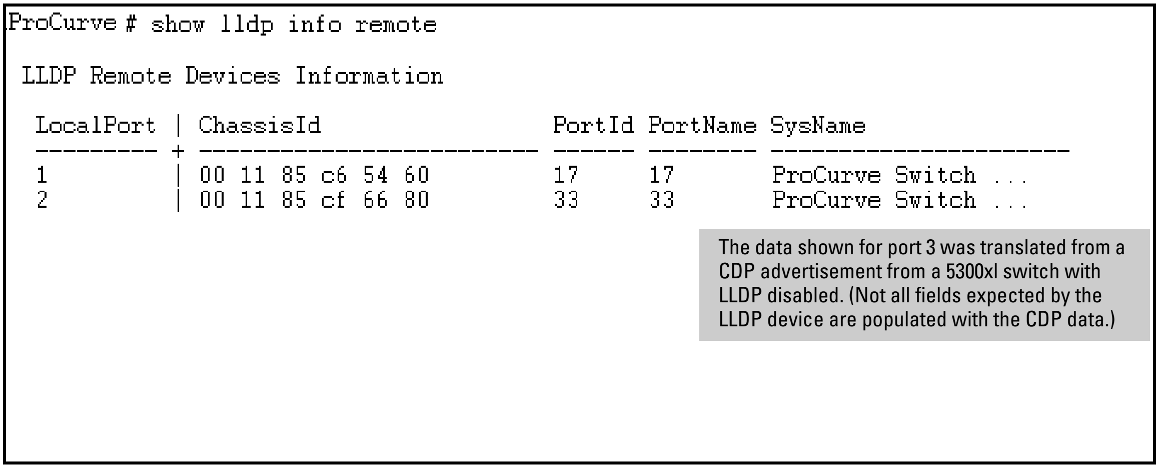
- *A discovered device is transmitting both LLDP and CDP packets with different chassis and port ID information.*
- *Multiple devices are connected to the switch through a hub.*

Discovering the same device on multiple ports indicates that the remote device may be connected to the switch in one of the following ways:

- *Through different VLANS using separate links. (This applies to switches that use the same MAC address for all configured VLANs.)*
- *Through different links in the same trunk.*
- *Through different links using the same VLAN. (In this case, spanning-tree should be invoked to prevent a network topology loop. Note that LLDP packets travel on links that spanning-tree blocks for other traffic types.)*

With the [port-list] *option, this command provides a listing of the LLDP data that the switch has detected in advertisements received on the specified ports. If neighbor data is read from CDP advertisements, the switch remaps this information into the switch's LLDP neighbors MIB in addition to the CDP Neighbors MIB.*

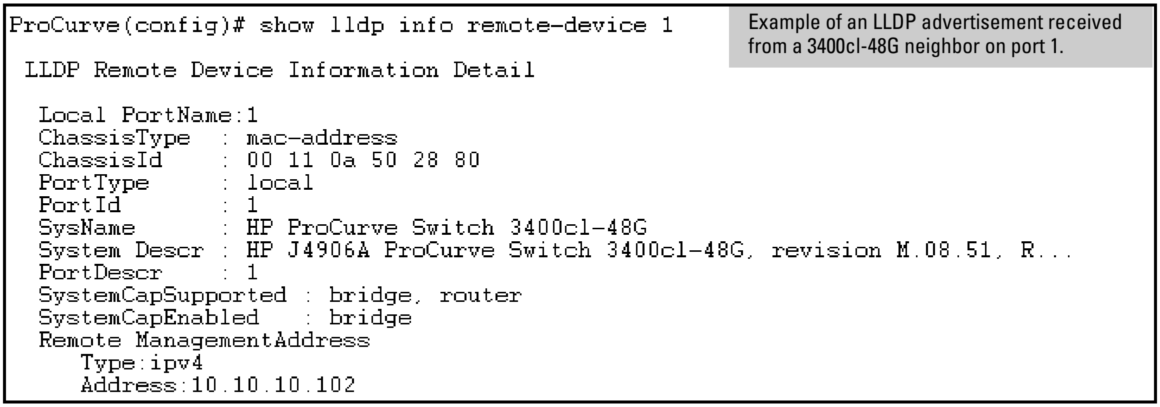
For descriptions of the various types of information displayed by these commands, refer to Table 13-10 on page 13-28.



```
ProCurve # show lldp info remote

 LLDP Remote Devices Information

  LocalPort | ChassisId                 PortId PortName SysName
  --------- + ------------------------- ------ -------- ----------------------
  1         | 00 11 85 c6 54 60         17     17       ProCurve Switch ...
  2         | 00 11 85 cf 66 80         33     33       ProCurve Switch ...
```

The data shown for port 3 was translated from a CDP advertisement from a 5300xl switch with LLDP disabled. (Not all fields expected by the LLDP device are populated with the CDP data.)

Figure 13-6. Example of a Global Listing of Discovered Devices



```
ProCurve(config)# show lldp info remote-device 1

 LLDP Remote Device Information Detail

  Local PortName:1
  ChassisType   : mac-address
  ChassisId     : 00 11 0a 50 28 80
  PortType      : local
  PortId        : 1
  SysName       : HP ProCurve Switch 3400cl-48G
  System Descr  : HP J4906A ProCurve Switch 3400cl-48G, revision M.08.51, R...
  PortDescr     : 1
  SystemCapSupported  : bridge, router
  SystemCapEnabled    : bridge
  Remote ManagementAddress
     Type:ipv4
     Address:10.10.10.102
```

Example of an LLDP advertisement received from a 3400cl-48G neighbor on port 1.

Figure 13-7. Example of a Per-Port Listing of Advertisements Received from an LLDP Device

Note

With both LLDP and (read-only) CDP enabled on a switch port, the port can read both LLDP and CDP advertisements, and stores both types of data in its neighbor database. (When reading CDP advertisements, the switch only stores data that has a corresponding field in the LLDP neighbor database.)

Displaying LLDP Statistics

LLDP statistics are available on both a global and a per-port levels. Rebooting the switch resets the LLDP statistics counters to zero. Disabling the transmit and/or receive capability on a port "freezes" the related port counters at their current values.

Syntax show lldp info stats [*port-list*]

The global LLDP statistics command displays an overview of neighbor detection activity on the switch, plus data on the number of frames sent, received, and discarded per-port. The per-port LLDP statistics command enhances the list of per-port statistics provided by the global statistics command with some additional per-port LLDP statistics.

Global LLDP Counters:

Neighbor Entries List Last Updated: *Shows the elapsed time since a neighbor was last added or deleted.*

New Neighbor Entries Count: *Shows the total of new LLDP neighbors detected since the last switch reboot. Disconnecting, then reconnecting a neighbor increments this counter.*

Neighbor Entries Deleted Count: *Shows the number of neighbor deletions from the MIB for AgeOut Count and forced drops for all ports. For example, if the admin status for port on a neighbor device changes from* **tx_rx** *or* **txonly** *to* **disabled** *or* **rxonly**, *then the neighbor device sends a "shutdown" packet out the port and ceases transmitting LLDP frames out that port. The device receiving the shutdown packet deletes all information about the neighbor received on the applicable inbound port and increments the counter .*

Neighbor Entries Dropped Count: *Shows the number of valid LLDP neighbors the switch detected, but could not add. This can occur, for example, when a new neighbor is detected when the switch is already supporting the maximum number of neighbors. Refer to "Neighbor Maximum" on page 13-49.*

Neighbor Entries AgeOut Count: *Shows the number of LLDP neighbors dropped on all ports due to Time-to-Live expiring.*

— Continued on the next page. —

— Continued from the preceding page. —

Per-Port LLDP Counters:

NumFramesRecvd: *Shows the total number of valid, inbound LLDP advertisements received from any neighbor(s) on <* port-list*>. Where multiple neighbors are connected to a port through a hub, this value is the total number of LLDP advertisements received from all sources.*

NumFramesSent: *Shows the total number of LLDP advertisements sent from <* port-list*>.*

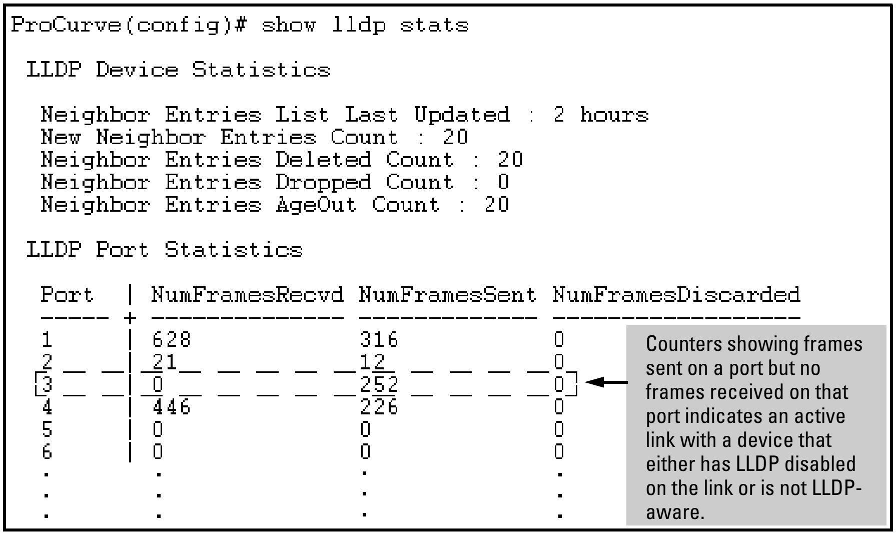
NumFramesDiscarded: *Shows the total number of inbound LLDP advertisements discarded by <* port-list*>. This can occur, for example, when a new neighbor is detected on the port, but the switch is already supporting the maximum number of neighbors. Refer to "Neighbor Maximum" on page 13-49. This can also be an indication of advertisement formatting problems in the neighbor device.*

Frames Invalid: *Shows the total number of invalid LLDP advertisements received on the port. An invalid advertisement can be caused by header formatting problems in the neighbor device.*

TLVs Unrecognized: *Shows the total number of LLDP TLVs received on a port with a type value in the reserved range. This could be caused by a basic management TLV from a later LLDP version than the one currently running on the switch.*

TLVs Discarded: *Shows the total number of LLDP TLVs discarded for any reason. In this case, the advertisement carrying the TLV may be accepted, but the individual TLV was not usable.*

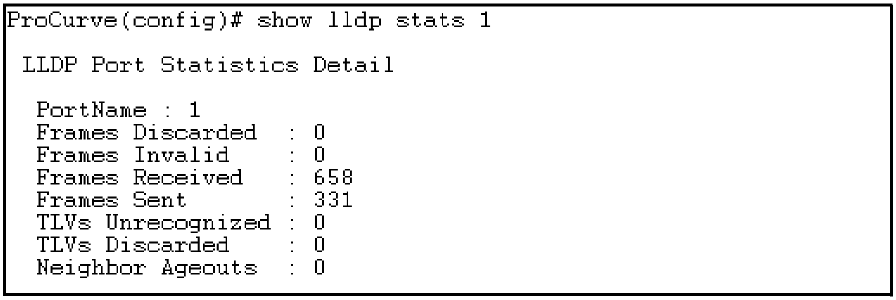
Neighbor Ageouts: *Shows the number of LLDP neighbors dropped on the port due to Time-to-Live expiring.*



```
ProCurve(config)# show lldp stats

 LLDP Device Statistics

  Neighbor Entries List Last Updated : 2 hours
  New Neighbor Entries Count : 20
  Neighbor Entries Deleted Count : 20
  Neighbor Entries Dropped Count : 0
  Neighbor Entries AgeOut Count : 20

 LLDP Port Statistics

  Port  | NumFramesRecvd NumFramesSent NumFramesDiscarded
  ----- + -------------- ------------- ------------------
  1     | 628            316           0
  2     | 21             12            0
  3     | 0              252           0
  4     | 446            226           0
  5     | 0              0             0
  6     | 0              0             0
  .       .              .             .
  .       .              .             .
  .       .              .             .
```

Counters showing frames sent on a port but no frames received on that port indicates an active link with a device that either has LLDP disabled on the link or is not LLDP-aware.

Figure 13-8. Example of a Global LLDP Statistics Display



```
ProCurve(config)# show lldp stats 1

 LLDP Port Statistics Detail

  PortName : 1
  Frames Discarded   : 0
  Frames Invalid     : 0
  Frames Received    : 658
  Frames Sent        : 331
  TLVs Unrecognized  : 0
  TLVs Discarded     : 0
  Neighbor Ageouts   : 0
```

Figure 13-9. Example of a Per-Port LLDP Statistics Display

LLDP Operating Notes

Neighbor Maximum. The neighbors table in the switch supports as many neighbors as there are ports on the switch. The switch can support multiple neighbors connected through a hub on a given port, but if the switch neighbor maximum is reached, advertisements from additional neighbors on the same or other ports will not be stored in the neighbors table unless some existing neighbors time-out or are removed.

LLDP Packet Forwarding: If CDP is globally disabled on a switch, the switch forwards CDP packets received from a neighbor CDP device instead of reading and dropping them. However, an 802.1D-compliant switch does not forward LLDP packets, regardless of whether LLDP is globally enabled or disabled on the switch.

One IP Address Advertisement Per-Port: LLDP advertises only one IP address per-port, even if multiple IP addresses are configured by **lldp config <** ***port-list*** **> ipAddrEnable** on a given port.

802.1Q VLAN Information. LLDP packets do not include 802.1Q header information, and are always handled as untagged packets.

Effect of 802.1X Operation. If 802.1X port security is enabled on a port and a connected device is not authorized, LLDP packets are not transmitted or received on that port. Any neighbor data stored in the neighbor MIB for that port prior to the unauthorized device connection remains in the MIB until it ages out. If an unauthorized device later becomes authorized, LLDP transmit and receive operation resumes.

Neighbor Data Can Remain in the Neighbor Database After the Neighbor Is Disconnected. After disconnecting a neighbor LLDP device from the switch, the neighbor can continue to appear in the switch's neighbor database for an extended period if the neighbor's **holdtime-multiplier** is high; especially if the **refresh-interval** is large. Refer to "Changing the Time-to-Live for Transmitted Advertisements" on page 13-35.

LLDP and CDP Data Management

This section describes points to note regarding LLDP (Link-Layer Discovery Protocol) and CDP (Cisco Discovery Protocol) data received by the switch from other devices. LLDP operation includes both transmitting LLDP packets to neighbor devices and reading LLDP packets received from neighbor devices. CDP operation is limited to reading incoming CDP packets from neighbor devices. (ProCurve switches do not generate CDP packets.)

LLDP and CDP Neighbor Data

With both LLDP and (read-only) CDP enabled on a switch port, the port can read both LLDP and CDP advertisements, and stores the data from both types of advertisements in its neighbor database. (The switch only *stores* CDP data that has a corresponding field in the LLDP neighbor database.) The neighbor database itself can be read by either LLDP or CDP methods or by using the **show lldp** commands. Take note of the following rules and conditions:

- If the switch receives both LLDP and CDP advertisements on the same port from the same neighbor the switch stores this information as two separate entries if the advertisements have differences chassis ID and port ID information.
- If the chassis and port ID information are the same, the switch stores this information as a single entry. That is, LLDP data overwrites the corresponding CDP data in the neighbor database if the chassis and port ID information in the LLDP and CDP advertisements received from the same device is the same.
- Data read from a CDP packet does not support some LLDP fields, such as "System Descr", "SystemCapSupported", and "ChassisType". For such fields, LLDP assigns relevant default values. Also:
  - The LLDP "System Descr" field maps to CDP's "Version" and "Platform" fields.
  - The switch assigns "ChassisType" and "PortType" fields as "local" for both the LLDP and the CDP advertisements it receives.
  - Both LLDP and CDP support the "System Capability" TLV. However, LLDP differentiates between what a device is capable of supporting and what it is actually supporting, and separates the two types of information into subelements of the System Capability TLV. CDP has only a single field for this data. Thus, when CDP System Capability data is mapped to LLDP, the same value appears in both LLDP System Capability fields.
  - System Name and Port Descr are not communicated by CDP, and thus are not included in the switch's Neighbors database.

Note

Because ProCurve switches do not generate CDP packets, they are not represented in the CDP data collected by any neighbor devices running CDP.

A switch with CDP disabled forwards the CDP packets it receives from other devices, but does not store the CDP information from these packets in its own MIB.

LLDP data transmission/collection and CDP data collection are both enabled in the switch's default configuration. In this state, an SNMP network management application designed to discover devices running either CDP or LLDP can retrieve neighbor information from the switch regardless of whether LLDP or CDP is used to collect the device-specific information.

Protocol State	Packet Generation	Inbound Data Management	Inbound Packet Forwarding
CDP Enabled[1]	n/a	Store inbound CDP data.	No forwarding of inbound CDP packets.
CDP Disabled	n/a	No storage of CDP data from neighbor devices.	Floods inbound CDP packets from connected devices to outbound ports.
LLDP Enabled[1]	Generates and transmits LLDP packets out all ports on the switch.	Store inbound LLDP data.	No forwarding of inbound LLDP packets.
LLDP Disabled	No packet generation.	No storage of LLDP data from neighbor devices.	No forwarding of inbound LLDP packets.

[1] Both CDP data collection and LLDP transmit/receive are enabled in the default configuration. If a switch receives CDP packets and LLDP packets from the same neighbor device on the same port, it stores and displays the two types of information separately if the chassis and port ID information in the two types of advertisements is different. In this case, if you want to use only one type of data from a neighbor sending both types, disable the unwanted protocol on either the neighbor device or on the switch. However, if the chassis and port ID information in the two types of advertisements is the same, the LLDP information overwrites the CDP data for the same neighbor device on the same port.

CDP Operation and Commands

By default the switches covered by this guide have CDP enabled on each port. This is a read-only capability, meaning that the switch can receive and store information about adjacent CDP devices but does not generate CDP packets.

When a CDP-enabled switch receives a CDP packet from another CDP device, it enters that device's data in the CDP Neighbors table, along with the port number where the data was received (and does not forward the packet). The switch also periodically purges the table of any entries that have expired. (The hold time for any data entry in the switch's CDP Neighbors table is configured in the device transmitting the CDP packet, and cannot be controlled in the switch receiving the packet.) A switch reviews the list of CDP neighbor entries every three seconds, and purges any expired entries.

Command	**Page**
show cdp	13-52
show cdp neighbors [< *port-list* > detail] [detail < *port-list* >]	13-53
[no] cdp run	13-54
[no] cdp enable < *port-list* >	13-54

Note

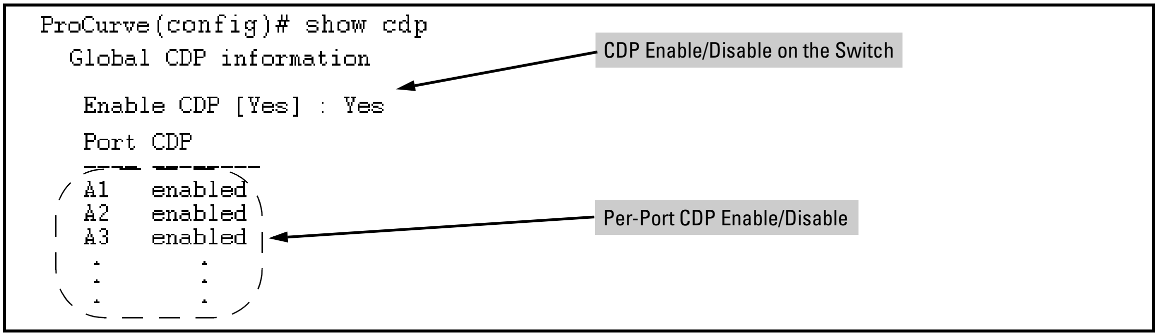
For details on how to use an SNMP utility to retrieve information from the switch's CDP Neighbors table maintained in the switch's MIB (Management Information Base), refer to the documentation provided with the particular SNMP utility.

Viewing the Switch's Current CDP Configuration. CDP is shown as enabled/disabled both globally on the switch and on a per-port basis.

Syntax: show cdp

Lists the switch's global and per-port CDP configuration.

The following example shows the default CDP configuration.



```
ProCurve(config)# show cdp
  Global CDP information

   Enable CDP [Yes] : Yes

   Port CDP
   ---- --------
   A1   enabled
   A2   enabled
   A3   enabled
    .       .
    .       .
    .       .
```

CDP Enable/Disable on the Switch

Per-Port CDP Enable/Disable

Figure 13-11. Example of Show CDP with the Default CDP Configuration

Viewing the Switch's Current CDP Neighbors Table. Devices are listed by the port on which they were detected.

Syntax: show cdp neighbors

Lists the neighboring CDP devices the switch detects, with a subset of the information collected from the device's CDP packet.

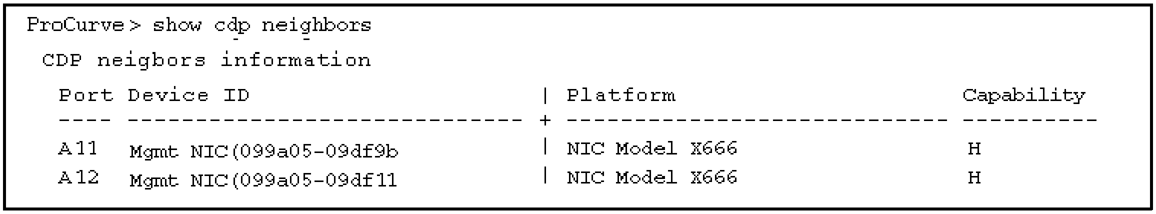
[[e] port-numb [detail]]

Lists the CDP device connected to the specified port. (Allows only one port at a time.) Using **detail** *provides a longer list of details on the CDP device the switch detects on the specified port.*

[detail [[e] port-num]]

Provides a list of the details for all of the CDP devices the switch detects. Using port-num *produces a list of details for the selected port.*

Figure 13-12 lists two CDP devices that the switch has detected by receiving their CDP packets.



```
ProCurve> show cdp neighbors
 CDP neigbors information
  Port Device ID                      | Platform                     Capability
  ---- ------------------------------ + ---------------------------- ----------
  A11  Mgmt NIC(099a05-09df9b         | NIC Model X666               H
  A12  Mgmt NIC(099a05-09df11         | NIC Model X666               H
```

Figure 13-12. Example of CDP Neighbors Table Listing

Enabling CDP Operation. Enabling CDP operation (the default) on the switch causes the switch to add entries to its CDP Neighbors table for any CDP packets it receives from other neighboring CDP devices.

Disabling CDP Operation. Disabling CDP operation clears the switch's CDP Neighbors table and causes the switch to drop inbound CDP packets from other devices without entering the data in the CDP Neighbors table.

Syntax: [no] cdp run

Enables or disables read-only CDP operation on the switch. (Default: Enabled)

For example, to disable CDP read-only operation on the switch:

```
ProCurve(config)# no cdp run
```

When CDP is disabled:

- **show cdp neighbors** displays an empty CDP Neighbors table
- **show cdp** displays

```
Global CDP information
 Enable CDP [Yes]: No
```

Enabling or Disabling CDP Operation on Individual Ports. In the factory-default configuration, the switch has all ports enabled to receive CDP packets. Disabling CDP on a port causes it to drop inbound CDP packets without recording their data in the CDP Neighbors table.

Syntax: [no] cdp enable < [e] port-list >

For example, to disable CDP on port A1:

```
ProCurve(config)# no cdp enable a1
```