Part No. 314725-C Rev 00
June 2004

600 Technology Park Drive
Billerica, MA 01821-4130

Configuring VLANs, Spanning Tree, and Link Aggregation

Passport 8000 Series Software Release 3.7

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Contents

Figures

Tables

Preface

This guide describes how to configure VLANs, spanning tree, and link aggregation on the Passport 8000 Series switch.

Before you begin

This guide is intended for network administrators with the following background:

- Basic knowledge of networks, Ethernet bridging, and IP routing
- Familiarity with networking concepts and terminology
- Experience with graphical user interfaces (GUIs)
- Basic knowledge of network topologies

Before using this guide, you must complete the following procedures. For a new switch:

- Install the switch (see the *Installation Guide* that came with your switch).
- Connect the switch to the network (see the publication, *Getting Started with the Management Software* for more information).

Make sure that you are running the latest version of Nortel Networks* 8000 Series switch and Device Manager software. For information about upgrading the 8000 Series switch and Device Manager, see the upgrading guide for your version of the 8000 Series switch.

Text conventions

This guide uses the following text conventions:

angle brackets (< >)	Indicate that you choose the text to enter based on the description inside the brackets. Do not type the brackets when entering the command. Example: If the command syntax is `ping <ip_address>`, you enter `ping 192.32.10.12`
italic text	Indicates new terms, book titles, and variables in command syntax descriptions. Where a variable is two or more words, the words are connected by an underscore. Example: If the command syntax is `show at <valid_route>`, *`valid_route`* is one variable and you substitute one value for it.
`plain Courier text`	Indicates command syntax and system output, for example, prompts and system messages. Example: `Set Trap Monitor Filters`

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Chapter 1
Layer 2 operational concepts

This chapter describes layer 2 operational concepts and features supported on your Passport 8600 switch.

Note: See Chapter 12, “Configuration examples,” on page 327, for configuration examples, including CLI commands, for concepts described in this chapter.

This chapter includes the following topics:

VLANs

A virtual LAN (VLAN) lets you divide your LAN into smaller groups without interfering with the physical network. VLAN practical applications include:

- You can create VLANs, or workgroups, for common interest groups.
- You can create VLANs, or workgroups, for specific types of network traffic.
- You can add, move, or delete members from these workgroups without making any physical changes to the network.

By dividing the network into separate VLANs, you can create separate broadcast domains. This arrangement conserves bandwidth, especially in networks supporting broadcast and multicast applications that flood the network with traffic. A VLAN workgroup may include members from a number of dispersed physical segments on the network, improving traffic flow between them.

The Passport 8000 Series switch performs the layer 2 switching functions necessary to transmit information within VLANs as well as the layer 3 routing functions necessary for VLANs to communicate with one another. A VLAN can be defined for a single switch or it can span multiple switches. A port can be a member of multiple VLANs.

This section includes the following topics:

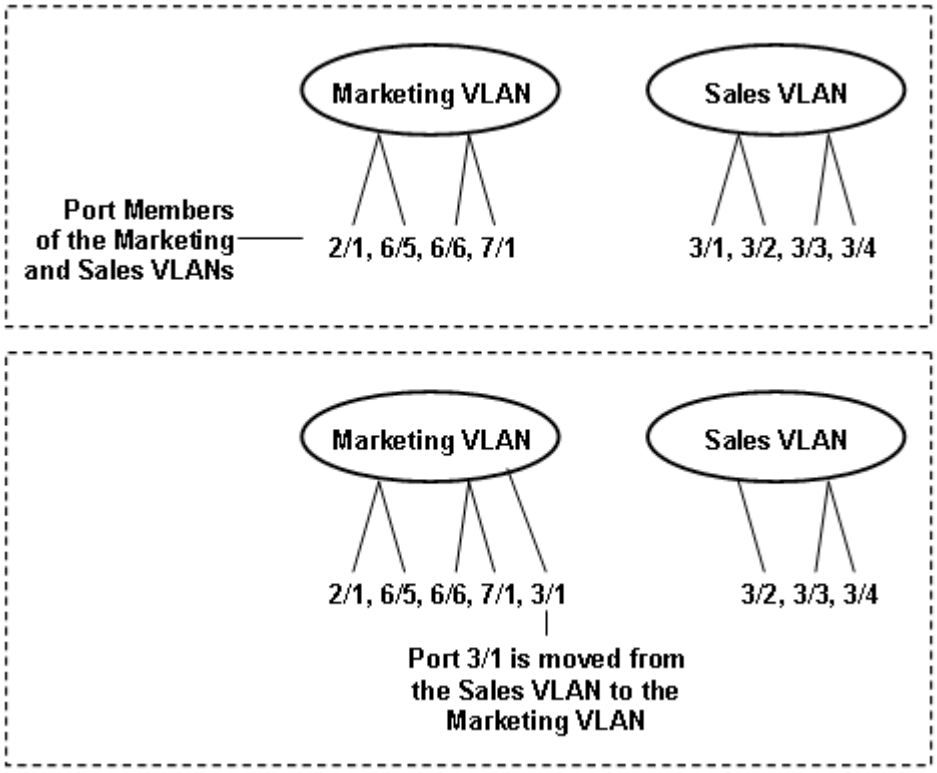
Port-based VLANs

A port-based VLAN is a VLAN in which the ports are explicitly configured to be in the VLAN. When creating a port-based VLAN on a switch, you assign a VLAN identification number (VLAN ID) and specify the ports that belong to the VLAN. The VLAN ID is used to coordinate VLANs across multiple switches.

Note: Port-based VLANs created on a Passport 8100 have the MAC address 00:00:00:00:00:00.

The example in Figure 1 shows two port-based VLANs: one for the marketing department, and one for the sales department. Ports are assigned to each port-based VLAN. A change in the sales area can move the sales representative at port 3/1 (the first port in the I/O module in chassis slot 3) to the marketing department without moving cables. With a port-based VLAN, you only need to indicate in Device Manager or CLI that port 3/1 in the sales VLAN now is a member of the marketing VLAN.

Figure 1 Port-based VLAN



Policy-based VLANs

A policy-based VLAN consists of ports that are dynamically added to the VLAN on the basis of the traffic coming into the port.

This section includes the following topics:

Port membership types

In a policy-based VLAN, a port can be designated as always a member or never a member of the VLAN describing the port membership types.

Table 1 Port membership types for policy-based VLANs

Membership type	Description
Static (always a member)	Static members are always active members of the VLAN once configured as belonging to that VLAN. This membership type is used in policy-based and port-based VLANs. • In policy-based VLANs, the tagged ports are usually configured as static members. • In port-based VLANs, all ports are always static members.
Not allowed to join (never a member)	Ports of this type are not allowed to join the VLAN.

In addition, you can designate a port as a potential member of the VLAN on the Passport 8000 Series switch. When a port is designated as a potential member of the VLAN, and the incoming traffic matches the policy, the port is dynamically added to the VLAN. Potential member ports that join the VLAN are removed ("timed out") from the VLAN when that VLAN's timeout (aging time) period expires.

A port's membership in a VLAN is determined by the traffic coming into the port. Nortel Networks recommends that at least some ports be designated as always a member of the VLAN. One situation in which a port should be designated always a member of a VLAN is if a server or router connects to the port. If a server is connected to a port that is only a potential member and the server sends out very little traffic, a client will fail to reach the server if the server port has timed out of the VLAN.

Note: A port can belong to one port-based VLAN and many policy-based VLANs.

Table 2 lists supported policy-based VLANs by module type:

Table 2 Policy-based VLAN types

VLAN type	8600	8100
Protocol-based	supported	supported
User-defined protocol-based	supported	unsupported
MAC address-based	supported	unsupported
IP subnet-based	supported	unsupported
Stacked VLANs	supported	unsupported

Protocol-based VLANs

Protocol-based VLANs are an effective way to segment your network into broadcast domains according to the network protocols in use. Traffic generated by any network protocol—IPX, Appletalk, PPPoE—can be automatically confined to its own VLAN.

All ports within a protocol-based VLAN must be in the same port-based VLAN. However, the same port within a port-based VLAN can belong to multiple protocol-based VLANs. Port tagging is not required for a port to be a member of multiple protocol-based VLANs.

The Passport 8000 Series switch supports the following protocol-based VLANs:

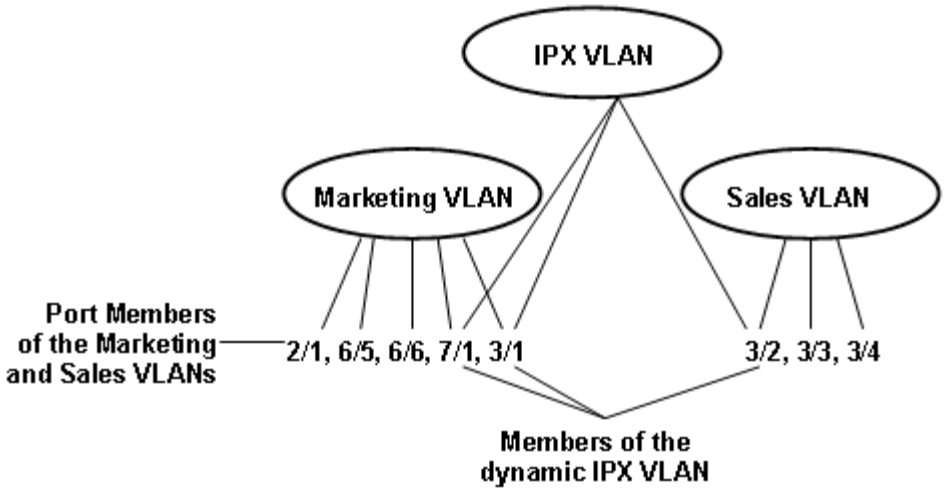
- IP version 4 (ip)
- Novell IPX on Ethernet 802.3 frames (ipx802dot3)

- Novell IPX on IEEE 802.2 frames (ipx802dot2)
- Novell IPX on Ethernet SNAP frames (ipxSnap)
- Novell IPX on Ethernet Type 2 frames (ipxEthernet2)
- AppleTalk on Ethernet Type 2 and Ethernet SNAP frames (AppleTalk)
- DEC LAT Protocol (decLat)
- Other DEC protocols (decOther)
- IBM SNA on IEEE 802.2 frames (sna802dot2)
- IBM SNA on Ethernet Type 2 frames (snaEthernet2)
- NetBIOS Protocol (netBIOS)
- Xerox XNS (xns)
- Banyan VINES (vines)
- IP version 6 (ipv6)
- Reverse Address Resolution Protocol (RARP)
- Point-to-point protocol over Ethernet (PPPoE)
- User-defined protocols

Example: IPX protocol-based VLAN

You can create a VLAN for the IPX protocol and place ports carrying substantial IPX traffic into this new VLAN. In Figure 2, the network manager has placed ports 7/1, 3/1, and 3/2 in an IPX VLAN. These ports still belong to their respective marketing and sales VLANs, but they are also new members of the IPX VLAN. This arrangement localizes traffic and ensures that only three ports are flooded with IPX broadcast packets.

Figure 2 Dynamic protocol-based VLAN



Example: PPPoE protocol-based VLAN

Note: This information applies to 8600 modules only.

Point-to-point protocol over Ethernet (PPPoE) lets you connect multiple computers on an Ethernet to a remote site through a device such as a modem so that multiple users can share a common line connection to the Internet. PPPoE combines the Point-to-Point protocol, commonly used in dial-up connections, with the Ethernet protocol, which supports multiple users in a local area network by encapsulating the PPPoE protocol within an Ethernet frame.

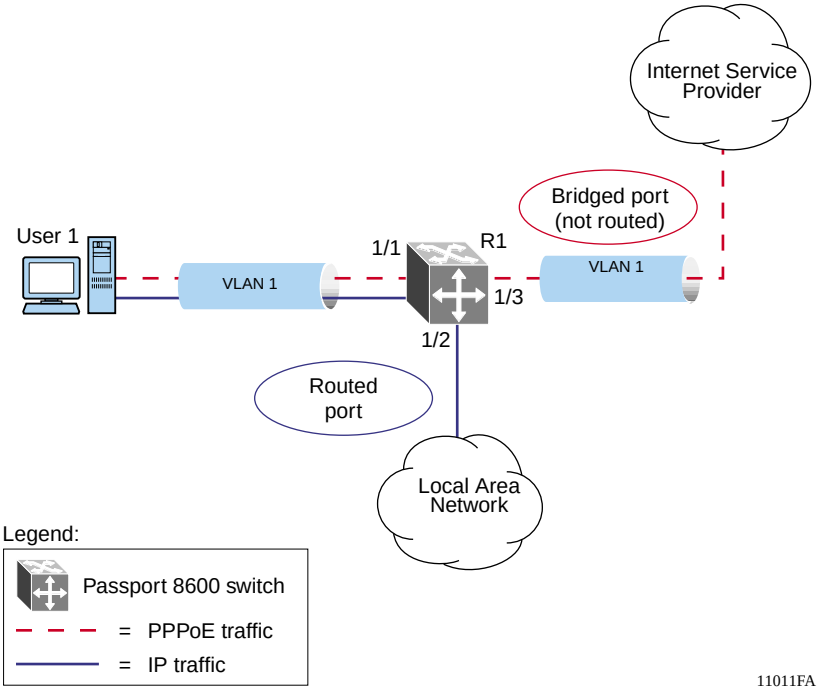
PPPoE occurs in two stages—a discovery stage and a PPP session stage. The Ether_Type field in the Ethernet frame identifies the stage:

- The discovery stage uses 0x8863 Ether_Type
- The session stage uses 0x8864 Ether_Type

In Figure 3 on page 34, VLAN 1 is a protocol-based VLAN that transports PPPoE traffic to the Internet Service Provider (ISP) network. The traffic to the ISP is bridged.

IP traffic can also be routed to the Local Area Network (LAN) using port-based VLANs, IP protocol-based VLANs, or IP subnet-based VLANs.

Figure 3 PPPoE and IP configuration



User-defined protocol-based VLANs

You can create user-defined protocol-based VLANs to support networks with non-standard protocols. For user-defined protocol-based VLANs, you can specify the Protocol Identifier (PID) for the VLAN. Frames that match the specified PID for the following are assigned to that user-defined VLAN:

- The ethertype for Ethernet type 2 frames
- The PID in Ethernet SNAP frames
- The DSAP or SSAP value in Ethernet 802.2 frames

Table 3 lists reserved, pre-defined policy-based PIDs which cannot be used as user-defined PIDs.

Table 3 PIDs which cannot be used for user-defined protocol-based VLANs

PID (hex)	Description
04xx, xx04	sna802dot2
F0xx, xxF0	netBIOS
0000-05DC	Overlaps with 802.3 frame length
0600, 0807	xns
0BAD	VINES
4242	IEEE 802.1D BPDUs
6000-6003, 6005-6009	decOther
6004	decLat
0800, 0806	ip
8035	RARP
809B, 80F3	AppleTalk
8100	Reserved by IEEE 802.1Q for tagged frames
8137, 8138	ipxEthernet2 and ipxSnap
80D5	snaEthernet2
86DD	ipv6
8808	IEEE 802.3x pause frames
9000	Used by diagnostic loopback frames
8863, 8864	PPPoE

MAC address-based VLANs

As with all policy-based VLANs, using source MAC address VLANs allows 8600 modules to associate frames with a VLAN based on the frame content. With source MAC-based VLANs, a frame is associated with a VLAN if the source MAC address is one of the MAC addresses explicitly associated with the VLAN. To create a source MAC-based VLAN, you add the MAC address to a list of MAC addresses that constitutes the VLAN. However, because it is necessary to explicitly associate MAC addresses with a source MAC-based VLAN, the administrative overhead can be quite high.

Use source MAC-based VLANs when you want to enforce a MAC level security scheme to differentiate groups of users. For example, in a university environment, the students will be part of a student VLAN with certain services and access privileges, and the faculty will be part of a source MAC-based VLAN with faculty services and access privileges. Therefore, a student and a faculty member could plug into the same port but have access to a different range of services. In order to provide the correct services throughout the campus, the source MAC-based VLAN would need to be defined on Passport 8000 Series switches throughout the campus, which entails administrative overhead.

Note: When a source MAC VLAN is created, not all of the port members of the STG are automatically made potential members of the VLAN by default.

IP subnet-based VLANs

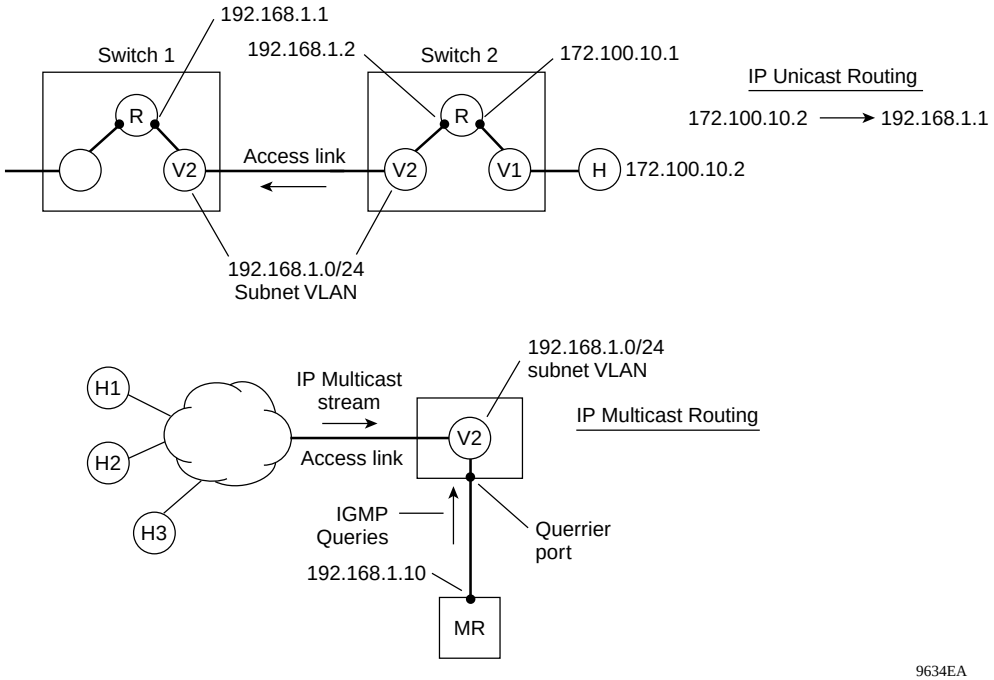
8600 modules support policy-based VLANs based on IP subnets. Access ports can be assigned to multiple subnet-based VLANs. A frame's membership in a subnet-based VLAN is based on the IP source address associated with a mask. Subnet-based VLANs are optionally routable. Using source IP subnet-based VLANs, multiple workstations on a single port can belong to different subnets, similar to multi-netting.

Note: IP subnet-based VLANs cannot be used on segments that act as a transit network.

Figure 4 shows two examples of the incorrect use of IP subnet-based VLANs that result in traffic loss. In the IP unicast routing example, the host on 172.100.10.2 sends traffic to switch 2 (172.100.10.1) destined for the router in switch 1 (192.168.1.1). Switch 2 attempts to route the IP traffic, but that traffic does not arrive at the router in switch 1. Switch 1 will not assign this frame to IP subnet-based VLAN 2 because the traffic's IP source address does not match the IP subnet assigned to VLAN 2. If the access link in VLAN 2 connecting switch 1 and 2 was a tagged link instead, the traffic would be associated with the VLAN tag, not the IP address, and would be forwarded correctly to switch 1.

In the IP multicast routing example, the multicast stream is on an access link that is part of IP subnet-based VLAN 2. Because the source IP address in the multicast data packets received from the access port is not necessarily within the subnet of VLAN 2, the multicast stream will not reach the multicast router (MR).

Figure 4 Incorrect use of an IP subnet-based VLAN

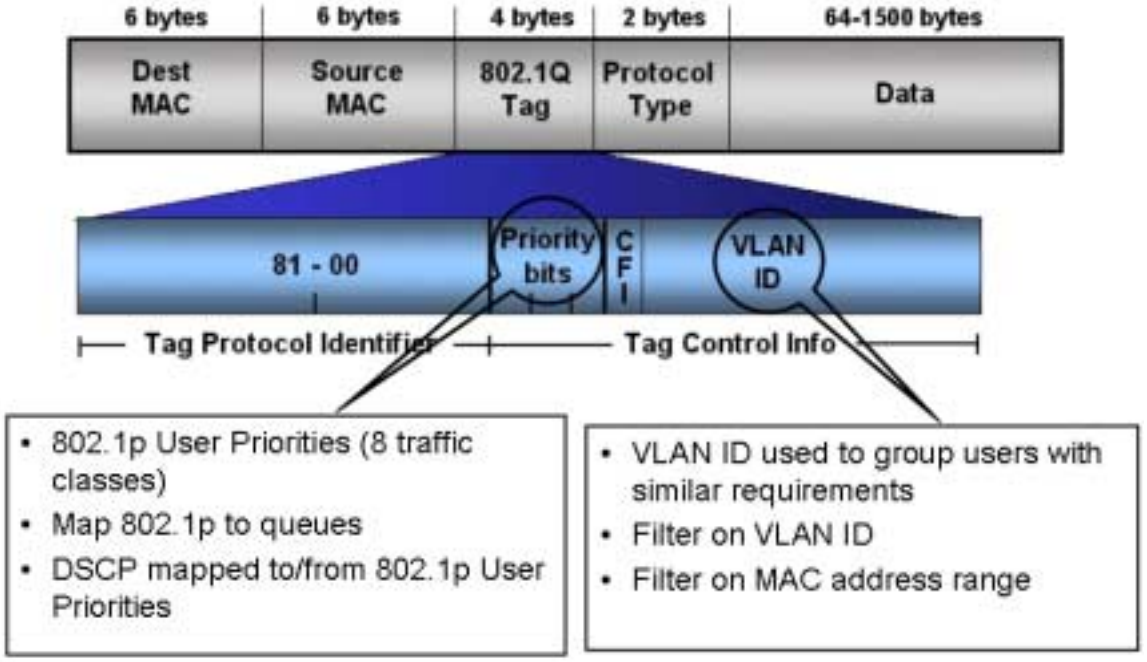


VLAN tagging and port types

Passport 8000 Series switches support the IEEE 802.1Q specification for "tagging" frames and coordinating VLANs across multiple switches.

Figure 5 on page 38 shows how an additional 4-octet ("tag") header is inserted in a frame after the source address and before the frame type. The tag contains the VLAN ID associated with the frame.

Figure 5 VLAN tag insertion



802.1Q tagged ports

Tagging a frame adds four octets to a frame, making it bigger than the traditional maximum frame size. These frames are sometimes referred to as “baby giant” frames. If a device does not support IEEE 802.1Q tagging, it may have problems interpreting tagged frames and receiving baby giant frames.

In the Passport 8000 Series switch, whether or not tagged frames are sent or received depends on what you configure at the port level. Tagging is set as true or false for the port and is applied to all VLANs on that port.

Note: When you enable tagging on an untagged port, the port’s previous configuration of VLANs, STGs, and MLTs is lost. In addition, the port resets and runs Spanning Tree Protocol, thus breaking connectivity while the protocol goes through the normal blocking and learning stages before the forwarding state.

A Passport 8000 Series switch port with tagging enabled sends frames explicitly tagged with a VLAN ID. Tagged ports are typically used to multiplex traffic belonging to multiple VLANs to other IEEE-802.1Q-compliant devices.

If tagging is disabled on a Passport 8000 Series switch port, it does not send tagged frames. A non-tagged port connects Passport 8000 Series switches to devices that do not support IEEE 802.1Q tagging. If a tagged frame is forwarded out to a port with tagging set to false, the Passport 8000 Series Software Release 3.7 removes the tag from the frame before sending it out to the port.

Treatment of tagged and untagged frames

A Passport 8000 Series switch associates a frame with a VLAN based on the data content of the frame and the configuration of the destination port. The treatment of the frame depends on whether it is tagged or untagged.

If a tagged frame is received on a tagged port, with a VLAN ID specified in the tag, the Passport 8000 Series switch directs it to that VLAN, if it is present. For tagged frames received on an untagged port, you can configure that port to either discard the frame or accept it. If you choose not to discard tagged frames, the Passport 8000 Series switch sends the frame to the VLAN identified in the frame's tag.

For untagged frames, VLAN membership is implied from the content of the frame itself. For untagged frames received on a tagged port, you can configure the port to either discard or accept the frame. If you configure a tagged port to accept untagged frames, the port must be assigned to a port-based VLAN in spanning tree group 1 (STG1).

How the frame is forwarded is based on the VLAN on which the frame is received and on the forwarding options available for that VLAN. Passport 8000 Series Software Release 3.7 switches try to associate untagged frames with a VLAN in the following order:

- Does the frame belong to a source MAC-based VLAN? (8600 modules only)
- Does the frame belong to a source IP subnet-based VLAN? (8600 modules only)
- Does the frame belong to a protocol-based VLAN?
- What is the port-based VLAN of the receiving port?

If the frame meets none of the criteria listed above, it is discarded.

VLAN router interfaces

Virtual router interfaces correspond to routing on a virtual port that is associated with a VLAN. This type of routing is the routing of IP traffic to and from a VLAN. Because a given port can belong to multiple VLANs (some of which are configured for routing on the switch and some of which are not), there is no longer a one-to-one correspondence between the physical port and the router interface. For VLAN routing, the router interface for the VLAN is called a virtual router interface because the IP address is assigned to an interface on the routing entity in the switch. This initial interface has a one-to-one correspondence with a VLAN on any given switch.

IP routing and VLANs

Passport 8600 modules support IP routing on the following types of VLANs only:

- Port-based VLANs
- Source IP subnet-based VLANs
- IP protocol-based VLANs
- Source MAC-based VLANs

IP routing is not supported on VLANs based on other protocols, including IP version 6 and user-defined protocol-based VLANs.

IPX routing and VLANs

Passport 8600 modules support IPX routing on IPX-protocol VLANs and on port-based VLANs.

The IPX network number is associated with a VLAN, and the VLAN can comprise one or more ports with one of four supported frame formats: Ethernet II, 802.3-SNAP, 802.2-RAW, and 802.3-LLC.

You can configure up to four IPX protocol-based VLANs on one port as long as each of these VLANs uses a different IPX encapsulation. With port-based VLANs, you can associate the same VID with any or all of the four IPX encapsulation formats.

You can configure IPX protocol-based VLANs and port-based VLANs on the same port, but traffic will route to the protocol-based VLAN and not to the port-based VLAN, given that protocol-based VLANs have precedence over port-based VLANs.

VLAN implementation on Passport 8000 Series switches

This section describes how to implement VLANs on Passport 8000 Series switches and describes default VLANs, unassigned VLANs, and brouter ports. It also summarizes the defaults and rules regarding VLAN creation on Passport 8000 Series switches.

This section includes the following topics:

Default VLAN

Passport 8000 Series switches are factory configured with all ports in a port-based VLAN called the default VLAN. With all ports in the default VLAN, the switch behaves like a layer 2 switch. The VLAN ID of this default VLAN is always 1, and it is always a port-based VLAN. The default VLAN cannot be deleted.

Unassigned VLAN

Internally, a Passport 8000 Series switch supports a placeholder for ports that is called an unassigned port-based VLAN. This unassigned concept is used for ports that are removed from all port-based VLANs. Ports can belong to policy-based VLANs as well as to the unassigned VLAN. If a frame does not meet any policy criteria and there is no underlying port-based VLAN, the port belongs to the

unassigned VLAN and the frame is dropped. Only ports in the unassigned VLAN have no spanning tree group association, so these ports do not participate in Spanning Tree Protocol negotiation; that is, no BPDUs are sent out of ports in the unassigned VLAN.

As it is an internal construct, the unassigned VLAN cannot be deleted. If a user-defined spanning tree group is deleted, the ports are moved to the unassigned VLAN and can later be assigned to another spanning tree group. Moving the ports to the unassigned VLAN avoids creating unwanted loops and duplicate connections. If routing is disabled in these ports, the port is completely isolated and no layer 2 or layer 3 functionality is provided.

The concept of the unassigned VLAN is useful for security concerns or when using a port for monitoring a mirrored port.

Global MAC filtering eliminates the need for configuring multiple Per VLAN filter records for the same MAC. It provides for the ability to discard a list of MAC addresses, globally, on the switch. By using a global list you would not have to configure a MAC Per VLAN.

Brouter ports

A brouter port is actually a one-port VLAN. The difference between a brouter port and a standard IP protocol-based VLAN configured to do routing is that the routing interface of the brouter port is not subject to the spanning tree state of the port.

VLAN rules

The following are VLAN rules for the Passport 8000 Series switch.

- In addition to the default VLAN, the 8100 Series switch can support up to 2000 VLANs; and the Passport 8600 Series switch can support up to 1980 VLANs. VLAN IDs value range is from 1 to 4094.
- If you enable tagging on a port that is in a VLAN, the spanning tree group configuration for that port is lost. To preserve VLAN assignment of ports, enable tagging on the ports before you assign the ports to VLANs.

- A tagged port can belong to multiple VLANs and multiple spanning tree groups. When a tagged port belongs to multiple spanning tree groups, the BPDUs are tagged for all spanning tree groups except for spanning tree group 1. Under the default configuration, the default spanning tree group is number 1.
- An untagged port can belong to one and only one port-based VLAN. A port in a port-based VLAN can belong to other policy-based VLANs.
- An untagged port can belong to one and only one policy-based VLAN for a given protocol. For example, a port can belong to only one policy-based VLAN where the policy is IPX802dot2 protocol.

The following VLAN rules apply to only Passport 8600 modules.

- For every VLAN with MultiLink Trunking that you create, you reduce the number of available VLANs by eight.
- When enhanced operation mode is disabled, a VLAN cannot span multiple spanning tree groups; that is, the ports in the VLAN must all be within one spanning tree group. Spanning tree group IDs can range in value from 1 to 25.

Note: When enhanced operation mode is enabled, VLAN scalability is not impacted.

- A frame's VLAN membership is determined by the following order of precedence, if applicable: IEEE 802.1Q tagged VLAN ID; source MAC-based VLAN; IP subnet-based VLAN; protocol-based VLAN; port-based VLAN.
- The IP subnet-based VLAN must not be assigned to a transit network (for example, a network routed to a bridged subnet).

The following VLAN rules apply only to Passport 8100 modules.

- A packet’s membership in a VLAN is determined in the following order or precedence:

  1) VLAN ID

  2) protocol-based VLAN

  3) port-based VLAN

VLAN features supported on the 8100 and 8600 modules

Support for VLANs and related features is different on different module types of the Passport 8000 Series switch. Table 4 summarizes the features supported on 8600 modules and 8100 modules.

Note: Table 4 is subject to change. Please refer to the release notes that came with your switch to obtain the latest scalability information.

Table 4 VLAN, STG, and MLT support in the Passport 8000 Series switch

Feature	8100 module	8600 module
Number of VLANs	2000 VLANs	1980 VLANs
Port-based VLANs	Supported	Supported
Policy-based VLANs • Protocol-based • Source MAC-based • Source IP subnet-based	 Supported Not supported Not supported	 Supported Supported Supported
IEEE 802.1Q tagging	Supported	Supported
IP routing and VLANs	Not supported	Supported
IPX routing and VLANs	Not supported	Supported
Special VLANs • Default VLAN • Unassigned VLAN • Brouter ports	 Supported Supported Not supported	 Supported Supported Supported
Stacked VLAN	Not supported	Supported
Number of spanning tree groups	1	64 (with only 25 actually supported)
Passport 8000 Series Software Release 3.7 Spanning Tree FastStart	Supported	Supported
MLT	6	32
Number of links per MLT	4	8

MultiLink trunking and VLAN scalability

In release 3.2 and earlier, the maximum number of VLANs depend on whether the VLANs reside on an MLT trunk. With Enhanced operation mode, you can now increase the maximum number of VLANs when using MLT (1980) and SMLT (989). Enhanced mode requires 8600 E or M modules.

Caution: When Enhanced operation mode is enabled, only 8600 E- and M-modules are initialized (other modules are placed offline). To avoid losing modules and network connectivity, replace non-E-modules or move the network connections to an E-module before enabling Enhanced mode.

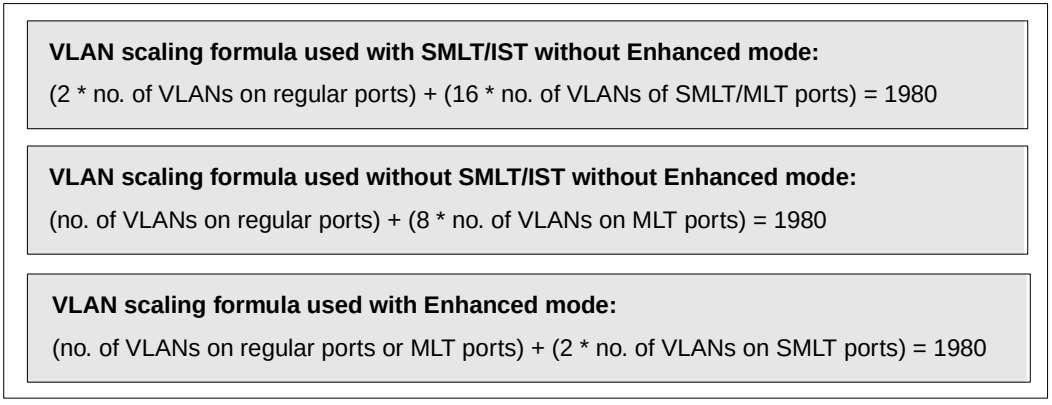
For instructions on configuring Enhanced operation mode, see:

- "Configuring Enhanced Operation mode" on page 152 (Device Manager)
- "Configuring Enhanced Operation mode" on page 248 (CLI)

VLAN scaling formulas

Figure 6 shows the formulas used for VLAN scaling:

Figure 6 Formulas used for VLAN scaling



Maximum VLAN support comparison with Enhanced mode

Table 5 shows the maximum number of VLANs available with and without Enhanced operation mode.

Table 5 Maximum numbers of port/protocol-based VLANs

VLAN type	Maximum VLAN support with Enhanced mode enabled	Maximum VLAN support with Enhanced mode disabled
MLT	1980	240
IST/SMLT	989	120

Module behavior comparison with Enhanced mode

Table 6 compares the behavior of 8600 modules with and without Enhanced operational mode:

Table 6 Comparison—Module behavior with and without Enhanced mode

Module type	Enhanced operation mode setting	Behavior
E-module or M-module	Enable (true)	The module is initialized and comes online. It can be configured with up to 1980 VLANs with MLT.
E-module or M-module	Disable (false)	The module is initialized and comes online. It can be configured with up to 240 VLANs with MLT.
Legacy module	Enable (true)	The module is not initialized and remains offline. The following error message is displayed and a trap is sent: `[12/18/01 15:17:25] Card taken off-line: Slot=1 Type= -- [12/18/01 15:17:25] ERROR Code=0x3006b Task=rcStart chCardIn: can't initialize a non ETICKET card in enhanced operation mode`
Legacy module	Disable (false)	The module is initialized and remains online. It can be configured with up to 240 VLANs with MLT.

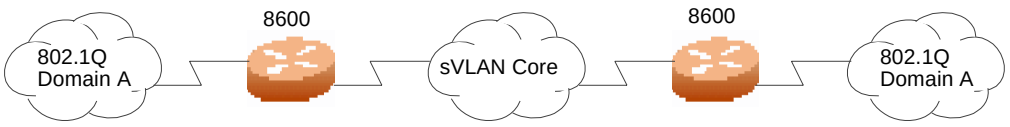
Stacked VLANs

Note: This information applies to Passport 8600 modules only.

A stacked VLAN (sVLAN) transparently tunnels packets through the sVLAN domain by adding an additional 4-byte header to each packet.

Figure 7 shows a basic sVLAN model using Passport 8600 switches.

Figure 7 sVLAN



Routing cannot be enabled on an sVLAN port. sVLAN user-to-network interface (UNI) ports are VLAN unaware and classify any traffic into the sVLAN which is configured on the port. sVLAN network-to-network interface (NNI) ports connect sVLAN switches together and support multiple sVLANs per port.

Note: You can enable sVLANs on all ports. If the port belongs to an MLT, however, you should perform all sVLAN configurations at the MLT level.

SVLAN specifications

sVLANs provide the following features:

- VLAN transparency for IEEE 802.1Q tagged or untagged traffic through service provider core networks
- A solution to VLAN scalability issues by allowing you to summarize customer VLANs into core sVLANs
- Use layered architecture to improve scalability

SVLAN rules

The following are sVLAN configuration rules.

- IP filters are not supported on sVLAN.
- To apply QoS to sVLAN, use the Per VLAN QoS option.
- Since regular VLANs are not supported on an sVLAN NNI port, sVLAN switches cannot be managed in-band. An out-of-band or parallel network is recommended for managing the devices.
- When creating an sVLAN spanning tree group, the tagged BPDU address of the spanning tree group should be different from the standardized BDPU MAC address.
- The sVLAN is created with the UNI and NNI ports.
- An sVLAN cannot span multiple spanning tree groups; that is, the ports in the sVLAN must all be within one spanning tree group. Spanning tree group IDs can range in value from 1 to 64.
- sVLANs cannot have routing enabled.
- sVLAN UNI and NNI ports are applicable on a per Octapid basis. All ports on an Octapid can either be normal ports or sVLAN NNI/UNI ports. For more information, see Appendix A, “Tap and OctaPID assignment” on page 349.

SVLAN Levels

You can stack sVLANs in a hierarchy to achieve greater VLAN scalability. An sVLAN level defines the hierarchy for the operating switch. When configuring the switch, you must specify only one level at a time.

You must configure UNI ports on both ends of the tunnel at the same level. Since sVLAN switching is MAC-addressed based, the normal issues of VLAN switching apply.

- If you build sVLAN networks with multiple levels, the network MAC addresses you specify must all be unique.

- Independent VLAN learning is only applicable within the outer level of sVLAN and does not take inner tags into account.

Note: Spanning Tree Protocol (STP) is not supported in multi-level sVLAN networks. It is supported for single level sVLAN networks only.

Figure 8 shows a one layer sVLAN.

Figure 8 One layer sVLAN

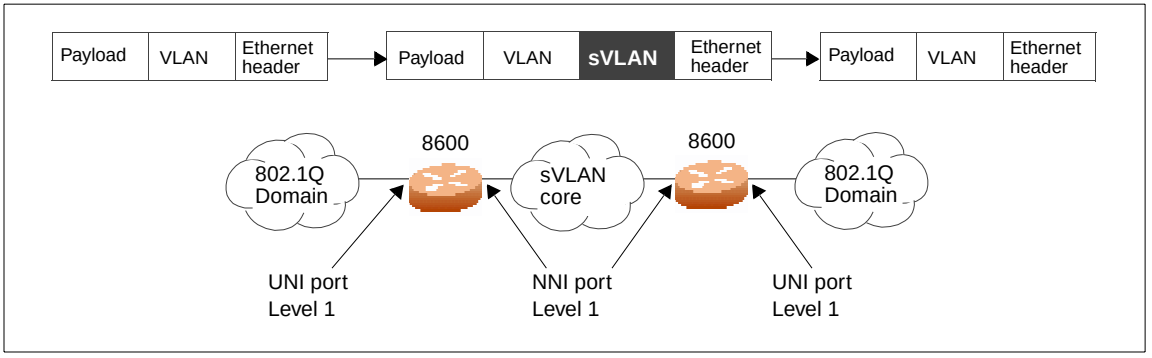
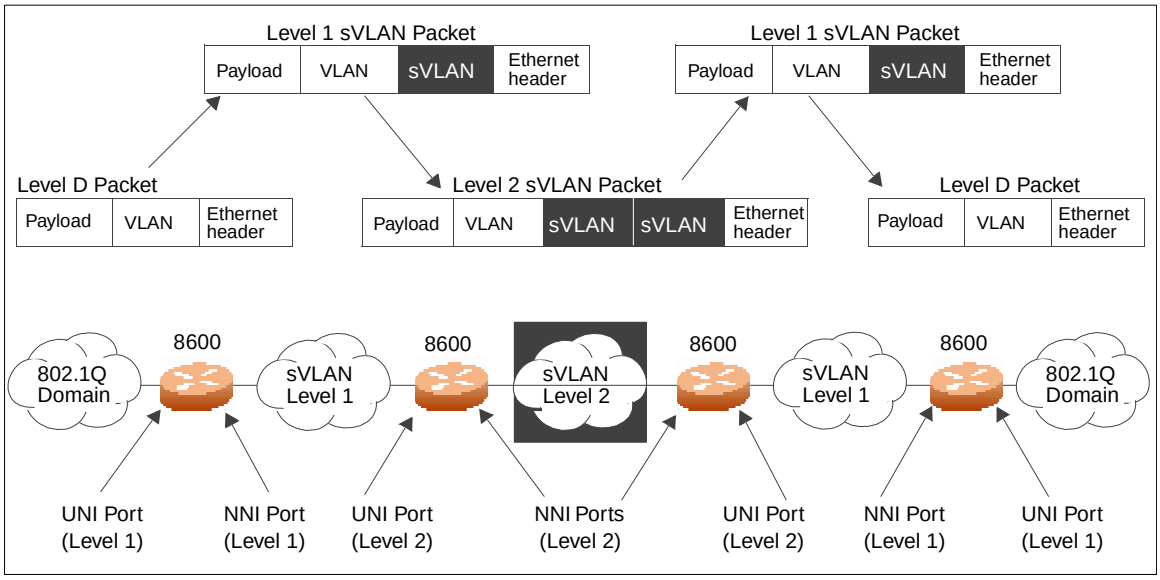


Figure 9 shows a two layer sVLAN.

Figure 9 Two layer sVLAN



SVLAN UNI and NNI ports

The ports in the switch can be configured as sVLAN user-to-network interface (UNI), sVLAN network-to-network interface (NNI), or normal.

Note: You must change the switch level to 1 or above before you configure sVLAN, UNI or NNI ports.

You must configure the ports to which you want to provide VLAN transparency as UNI ports. UNI ports can only belong to one sVLAN. When you configure a UNI port in the CLI, the tagged-frames-discard parameter is automatically enabled.

NNI ports interconnect the switches in the core network, drop untagged frames on ingress, and insert the sVLAN tag at the egress. NNI ports can belong to multiple sVLANs. An NNI port sends sVLAN tagged frames. When you configure an NNI port in the CLI, the untagged-frames-discard parameter is automatically enabled.

- If a Spanning Tree Group (STG) contains both UNI and NNI ports, you should change the standardized MAC addresses used for BPDUs to a non-standardized BPDU MAC address to avoid interference with regular customer BPDUs.

- The UNI and NNI ports are kept in sVLAN type STG.
- All the ports in the MLT should have the same port type (normal/UNI/NNI).
- Large frame support is automatically enabled on UNI or NNI ports.

When you change the sVLAN port type from normal to UNI or NNI, all the affected ports are removed from the configured STGs and VLANs. Similarly, when you change the sVLAN port type from UNI or NNI to normal, all the affected ports are removed from the configured STGs and VLANs and added to the default STG and default VLAN.

Note: The affected ports are all the ports in the Octapid. See Appendix A, "Tap and OctaPID assignment" on page 349.

Note: An NNI port belonging to default VLAN and default STG is not saved across reboots. To avoid this, do not configure an NNI port under default VLAN/STG.

Spanning tree protocol

The operation of the spanning tree protocol (STP) is defined in the IEEE 802.1D standard. The STP detects and eliminates logical loops in a bridged or switched network. When multiple paths exist, the spanning tree algorithm configures the network so that a bridge or switch uses only the most efficient path. If that path fails, the protocol automatically reconfigures the network to make another path become active, thus sustaining network operations. You can control path redundancy for VLANs by implementing the STP.

A network may include multiple instances of STP. The collection of ports in one spanning tree instance is called a Spanning Tree Group (STG).

- 8600 modules support STP and up to 25 spanning tree groups
- 8100 modules support STP and only one spanning tree group

This section includes the following topics:

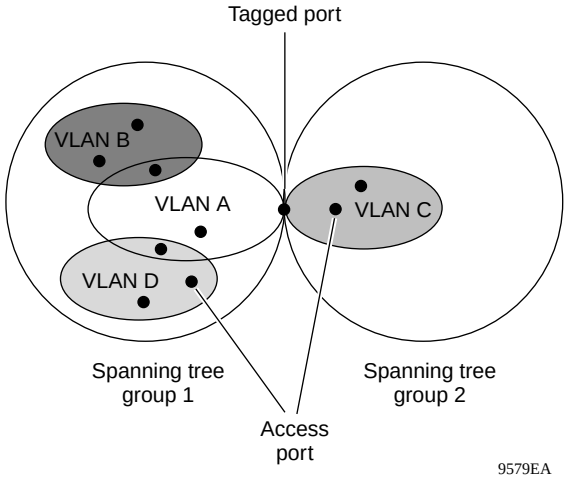
Spanning tree groups

Each STG consists of a collection of ports that belong to the same instance of the STP protocol. These STP instances are completely independent from each other. For example, they send their own Bridge Protocol Data Units (BPDUs), they have their own timers etc.

For 8600 modules, multiple STGs are possible within the same switch; that is, the routing switch can participate in the negotiation for multiple spanning trees.

Figure 10 shows multiple spanning tree groups.

Figure 10 Multiple spanning tree groups



Spanning Tree protocol controls

The ports associated with a VLAN and VLANs themselves must be contained within a single spanning tree group. Not allowing a VLAN to span multiple STGs avoids problems with spanning tree blocking ports and causing a loss of connectivity within the VLAN.

Each untagged port can belong to one and only one STG, while tagged ports can belong to more than one STG. When a tagged port belongs to more than one STG, the spanning tree Bridge Protocol Data Units (BPDUs) are tagged to distinguish the BPDUs of one STG from those of another STG. BPDUs from STG 1 are not tagged. The tagged BPDUs are transmitted using a multicast MAC address as tagged frames with a VLAN ID, and you specify the multicast MAC address and the VLAN ID. Because tagged BPDUs are not part of the IEEE 802.1D standard, not all devices can interpret tagged BPDUs.

You can enable or disable the Spanning Tree Protocol at the port or at the spanning tree group level. If you disable the protocol at the group level, received BPDUs are handled like a MAC-level multicast and flooded out of the other ports of the STG. Note that an STG can contain one or more VLANs. Remember that MAC broadcasts are flooded out on all ports of a VLAN; a BPDU is a MAC-level message, but the BPDU is flooded out of all ports on the STG, which may encompass many VLANs.

When STP is globally enabled on the STG, BPDU handling depends on the STP setting of the port:

- When STP is enabled on the port, received BPDUs are processed in accordance with STP.
- When STP is disabled on the port, the port stays in a forwarding state, received BPDUs are dropped and not processed, and no BPDU is generated.

An alternative to disabling the Spanning Tree Protocol is to enable Passport 8000 Series Software Release 3.7 Spanning Tree FastStart.

Spanning Tree FastStart

Spanning Tree FastStart is an enhanced port mode supported by Passport 8000 Series switches. If you enable Spanning Tree FastStart on a port with no other bridges, Spanning Tree FastStart brings the port up more quickly following switch initialization or a spanning tree change. The port goes through the normal blocking and learning states before the forwarding state, but the hold times for these states is the bridge hello timer (2 seconds by default) instead of the bridge forward delay timer (15 seconds by default). If the port sees a BPDU, it will revert to regular behavior.

FastStart is intended for access ports where only one device is connected to the switch (as in workstations with no other spanning tree devices). It may not be desirable to wait the usual 30 to 35 seconds for spanning tree initialization and bridge learning.

Note: Use Spanning Tree FastStart with caution. This procedure is contrary to that specified in the IEEE 802.1D standard for Spanning Tree Protocol (STP), in which a port enters the blocking state following the initialization of the bridging device or from the disabled state when the port is enabled through configuration.

Understanding STGs and VLANs

For the purposes of Spanning Tree Protocol negotiation, the ports on a Passport 8000 Series switch can be divided into groups of ports where each group of ports performs its own spanning tree negotiation with neighboring devices. In a Passport 8000 Series switch, these groups of ports are called spanning tree groups (STGs).

- The Passport 8100 Switch supports one STG.
- The Passport 8600 Switch supports 25 STGs.

The ports in a VLAN are always a subset of the ports in an STG. A VLAN can include all the ports in a given STG, and there can be multiple VLANs in an STG, but a VLAN will never have more ports than exist in the STG. Because VLANs are always subsets of STGs, the recommended practice is to plan STGs and then create VLANs.

In the Passport 8000 Series switch default configuration, a single STG encompasses all the ports in the switch. For most applications, this configuration is sufficient. The default STG is assigned ID 1 (STG1).

If a VLAN spans multiple switches, it must be within the same STG across all switches; that is, the ID of the STG in which it is defined must be the same across all devices.

Spanning tree protocol topology change detection

Change detection enables the detection of topology changes and sends a topology change notification (TCN) to the Root on a per port basis. Change detection is enabled by default. When change detection is enabled and a topology change occurs, a trap is sent with the following information so that you can identify the device:

- the MAC address of the STG sending the TCN
- the port number
- the STG ID

You can disable change detection on ports where a single end station is connected, and where powering that end station on and off would trigger the TCN. Change detection is referenced in IEEE STD 802.1D.

Topology change detection configuration rules

When working with the change detection setting:

- You can configure change detection only on access ports. This also applies to link aggregation ports.
- If you disable change detection and then change the port from access to tagging-enabled, the switch automatically sets change-detection to `enabled` for the port. This also applies to link aggregation ports.
- In a link aggregation group with access ports, modifications to change detection for a member port are automatically applied to the remaining member ports.

To configure change detection using Device Manager, see “Configuring topology change detection” on page 183.

To configure change detection using the CLI, see “Configuring topology change detection” on page 271.

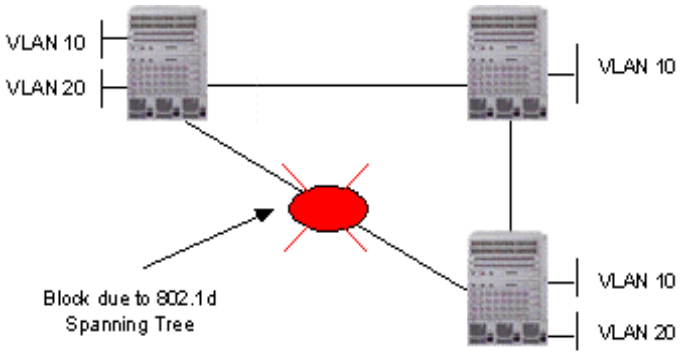
Per-VLAN Spanning Tree Plus (PVST+)

Your Nortel Networks Passport 8600 switch (and Cisco System* switches), both support standards-based IEEE 802.1d spanning tree protocol (STP) in addition to supporting proprietary mechanisms for multiple instances of spanning tree.

Unfortunately, the IEEE 802.1d spanning tree only provides one instance of the STP that can lead to incomplete connectivity for certain VLANs, depending on the network topology.

For example, Figure 11 shows a network where one or more VLANs span only some switches. In this example, the IEEE 802.1d spanning tree protocol can block a VLAN path if that VLAN does not span across all switches.

Figure 11 802.1d Spanning Tree

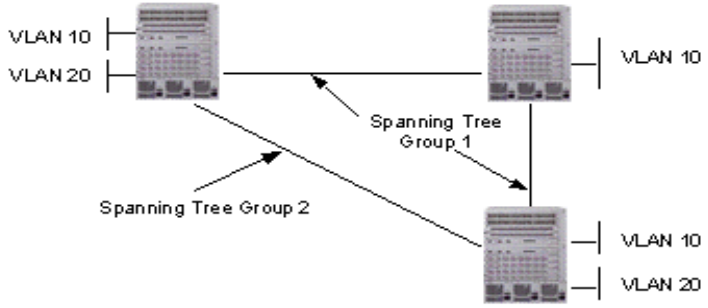


You can avoid this issue by configuring multiple spanning tree instances, as shown in Figure 12 on page 57.

Your Passport 8600 switch uses a tagged BPDU address, which is associated with a VLAN tag ID. The VLAN tag ID is applied to one or more VLANs, and is used among Passport 8600 switches to prevent loops. The same tagged BPDU address must be configured on all Passport 8600 switches in the network.

Cisco Systems proprietary implementation of multiple spanning tree (pre-IEEE 802.1s) is called PVST/PVST+ (*Per VLAN Spanning Tree*), which uses a spanning tree instance Per VLAN.

Figure 12 Multiple instances of Spanning Tree



With software release 3.7.0, you can configure your Passport 8600 switch using either of two methods: Passport 8600 tagged BPDU or PVST+.

Similar to the Passport 8600 switch implementation of multiple STP instances, PVST+ uses the standard IEEE 802.1d spanning tree protocol for VLAN 1; all other VLANs use PVST BPDUs.

You can use IEEE 802.1Q VLAN tagging to tunnel the multicast PVST BPDUs within a IEEE 802.1Q region. The standard BPDUs for VLAN 1 are all addressed to the well-known STP multicast address 01-80-C2-00-00-00, while PVST BPDUs in other VLANs are addressed to the multicast address of 01-00-0C-CC-CC-CD.

You can use PVST+ to load balance the VLANs by changing the VLAN bridge priority.

Nortel Networks is actively working on the standard implementation of multiple STP groups (IEEE 802.1s). Please contact your Nortel Networks representative for more information.

For PVST+ configuration examples with included CLI commands, refer to "Per-VLAN Spanning Tree Plus (PVST+)" on page 338.

Link aggregation (MLT, IEEE 802.3ad, VLACP, SMLT)

Link aggregation allows you to bundle a set of ports into a port group, which then is represented as one logical interface to the upper layer protocols.

Your Passport 8000 switch supports multiple types of link aggregation:

- MultiLink Trunking (MLT) is a statically configured link bundling method.
- IEEE 802.3ad-based link aggregation supports a dynamic link aggregation function, which can add links to a trunk group dynamically, as they become available.
- Both MLT and IEEE 802.3ad-based link aggregation are defined as point-to-point functions; although Split MultiLink Trunking (SMLT) allows you to connect an MLT point to two SMLT end points. SMLT can connect two SMLT end points to two other SMLT endpoints as well.

  SMLT allows not only *module* redundancy, but also allows *system* redundancy, while allowing bandwidth aggregation at the same time. In addition, SMLT functionality has been extended to include LACP for dynamic link aggregation.
- VLACP provides an end-to-end failure detection mechanism, which notifies the Passport 8600 switch of uni-directional or bi-directional link failures.

Note: See Chapter 12, “Configuration examples,” on page 327, for configuration examples, including CLI commands, for concepts described in this section.

This section includes the following topics:

MultiLink Trunking

MultiLink Trunking (MLT) is a point-to-point connection that aggregates multiple ports so that they logically act like a single port, but with the aggregated bandwidth. Grouping multiple ports into a logical link provides higher aggregate throughput on a switch-to-switch or switch-to-server application.

MultiLink Trunking provides media and module redundancy. Module redundancy is provided in the form of Distributed MLT (DMLT), which allows you to aggregate similar ports from different modules.

Note: MLT links must be statically configured to be trunk group members.

This section includes the following topics:

MLT traffic distribution algorithm

An MLT can be used to aggregate bandwidth between two switches. The Passport 8600 switch uses one of two algorithms to determine which active port in the MLT is used for each packet. The MLT algorithms are intended to provide load sharing while ensuring that each packet flow does not arrive out of sequence.

Note: The algorithms are the same traffic distribution algorithms used for the IEEE 802.3ad based link aggregation.

The MLT traffic distribution algorithms are:

- For any bridged packet except IP:

  MOD (DestMAC[5:0] XOR SrcMAC[5:0], # of active links)

- For any bridged and routed IP or routed IPX:

  MOD (DestIP(X)[5:0] XOR SrcIP(X)[5:0], # of active links)

MultiLink Trunking rules

All Passport 8000 Series switch MLTs operate under the following basic set of rules:

- MLT is supported on 10BASE-T, 100BASE-TX, 100BASE-FX, Gigabit Ethernet ports, and on POS and ATM module ports.
- All ports in an MLT must be of the same media type (copper or fiber) and have the same speed and duplex settings.
- All ports in an MLT must be in the same spanning tree group.
- MLT is compatible with the Spanning Tree Protocol.
- IEEE 802.1Q tagging is supported on an MLT.

Passport 8600 module MLTs have the following general features and requirements:

- Up to 32 MLT groups are supported with as many as eight same-type ports belonging to a single MLT.
- The ports in an MLT can span modules, providing module redundancy.
- All ports in an MLT must be in the same spanning tree group, unless they are tagged; then they can belong to multiple STGs.

Passport 8100 module MLTs have the following features and requirements:

- Up to six MLT groups are supported with as many as four same-type ports belonging to a single MLT.
- All ports in an MLT must be in the one spanning tree group.
- To optimize performance, the switch will distribute traffic to an MLT on the same module. If there is no MLT on the module, a round robin algorithm determines which MLT should receive the traffic. This algorithm is based on the source MAC address and the port on which that MAC address was learned.

Multicast flow distribution over MLT

MultiLink Trunking (MLT) provides a mechanism for distributing multicast streams over an MLT. The mechanism is based on source-subnet and group addresses, and allows you to choose the address and the bytes in the address for the distribution algorithm.

Note: This is the same multicast flow distribution algorithm used for the IEEE 802.3ad-based link aggregation.

As a result, you can now distribute the load on different ports of the MLT and achieve an even distribution of the streams. In applications such as TV distribution, multicast traffic distribution is particularly important, because bandwidth requirements can be substantial when a large number of TV streams are employed.

Note: The multicast distribution over MLT feature is supported only on 8000 Series E-modules. As a result, all the cards that have ports in an MLT must be 8000 Series E-cards in order to enable multicast flow distribution over MLT.

Multicast distribution algorithm

To determine the port for a particular Source, Group (S, G) pair:

Use the number of active MLT ports to MOD the number generated by the XOR for each byte of the masked group address, with the masked source address.

By default, the group mask and source mask is 255.255.255.255. A byte with a value of 255 in the mask means that the corresponding byte in the group or source address is taken into account when the algorithm is applied.

For example, consider:

Group address G[0].G[1].G[2].G[3], Group Mask GM[0].GM[1].GM[2].GM[3], Source Subnet address S[0].S[1].S[2].S[3], Source Mask SM[0].SM[1].SM[2].SM[3]

Then, the Port =:

(((((G[0] AND GM[0]) xor (S[0] AND SM[0])) xor ((G[1] AND GM[0]) xor (S[1] AND SM[1]))) xor ((G[2] AND GM[2]) xor (S[2] AND SM[2]))) xor ((G[3] AND GM[3]) xor (S[3] AND SM[3]))) MOD (active ports of the MLT)

Example 1:

The algorithm used for traffic distribution causes the distribution to be sequential if the streams are similar to those in this example.

For this example, assume that the MLT ports are 1/1-1/4, that mask configuration is 0.0.0.0 for the source mask and 0.0.0.255 for the group mask, and that source A.B.C.D sends to groups:

X.Y.Z.1

X.Y.Z.2

X.Y.Z.3.— X.Y.Z.10

The algorithm chooses link 1/1 for group X.Y.Z.1, then X.Y.Z.2 goes on 1/2, X.Y.Z.3 goes on 1/3. X.Y.Z.4 goes on 1/4, X.Y.Z.5 goes on 1/1 and so on.

Example 2:

In this configuration example, only the first byte of the grp-mask, and the first two bytes of the src-subnet mask are considered when distributing the streams.

```
config sys mcast-mlt-distribution grp-mask 255.0.0.0
config sys mcast-mlt-distribution src-mask 255.255.0.0
config sys mcast-mlt-distribution enable
config sys mcast-mlt-distribution redistribution enable
```

Note: When you configure flow distribution over MLT, Nortel Networks recommends that you choose source and group masks that result in the most even traffic distribution over the MLT links. For example, if you find in the network group addressing that group addresses change incrementally, while there are few sources always sending to different groups, use a source mask of 0.0.0.0 and a group mask of 255.255.255.255. In most cases, this will provide a sequential distribution of traffic on the MLT links.

For a detailed description of commands used to configure Multicast flow distribution over MLT, see the publication, *Configuring IP Routing Multicast Protocols*.

Multicast traffic redistribution

The overall goal of traffic redistribution is to achieve a distribution of the streams on the MLT links in the event of an MLT configuration change.

For example, you can add or delete ports. By default, redistribution is disabled. When you add, or remove a link from the MLT, the active streams continue flowing on their original links if redistribution is disabled. If redistribution is enabled, however, the active streams are redistributed according to the distribution algorithm on the links of the MLT.

Note: This may cause minor traffic interruptions.

To minimize the effect of redistribution of multicast traffic on the MLTs, the implementation does not move the streams to the appropriate links all at once. Instead, it redistributes a few streams at every time tick of the system.

To that end, when an MLT port becomes inactive and redistribution is disabled, only the affected streams are redistributed on the remaining active ports.

If redistribution is enabled, all the streams are redistributed on the MLT ports based on the assignment provided by the distribution algorithm. For more information, see "Multicast distribution algorithm" on page 61.

When a new port becomes active in an MLT and redistribution is disabled, existing streams will remain on their original links. If you need to redistribute the streams dynamically to split the load on all the links of the MLT, you can enable redistribution. This will result in a few streams being redistributed every system time tick.

For a detailed description of the commands used to configure Multicast flow distribution over MLT, see the *Configuring IP Routing Multicast Protocols* guide

IEEE 802.3ad-based link aggregation (IEEE 802.3 2002 clause 43)

IEEE 802.3ad-based link aggregation allows you to aggregate one or more links together to form Link Aggregation Groups, such that a MAC client can treat the Link Aggregation Group as if it were a single link.

Although IEEE 802.3ad-based link aggregation and MultiLink Trunking (MLT) features provide similar services, MLT is statically defined, whereas IEEE 802.3ad-based link aggregation is dynamic and provides more functionality.

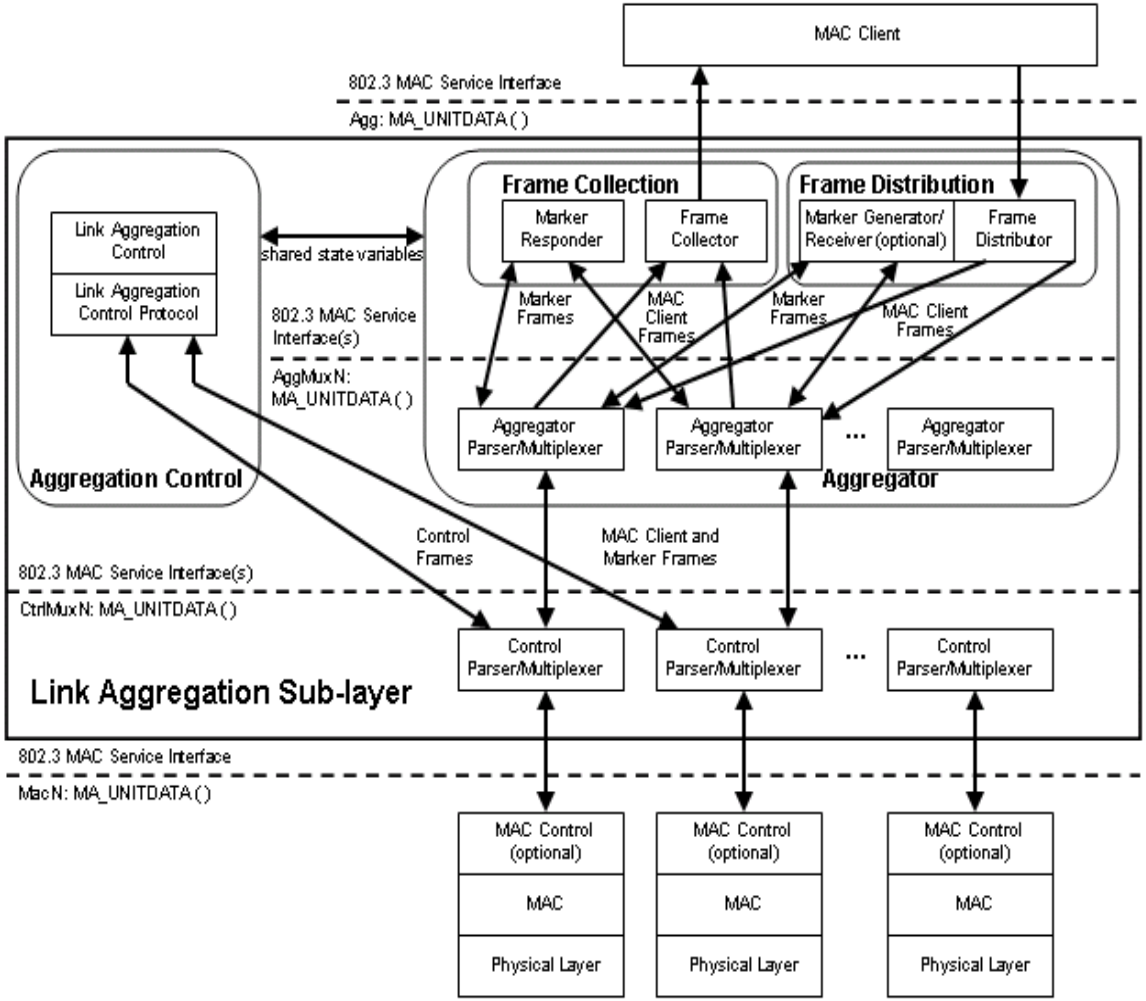
This section includes the following topics:

Overview

The IEEE 802.3ad standard comprises service interfaces, the Link Aggregation Control Protocol (LACP), the Marker Protocol, link Aggregation selection logic, parser/multiplexer, frame distribution, and Frame collection functions.

Figure 13 shows the major functions of IEEE 802.3ad defined as Multiple Links Aggregation.

Figure 13 Link Aggregation Sublayer example (according to IEEE 802.3ad)



Link Aggregation Control Protocol (LACP)

The main purpose of LACP is to manage switch ports and their port memberships to link aggregation trunk groups (LAGs). LACP can dynamically add or remove LAG ports, depending on their availability and states.

The interfaces between the LACP module and the other modules is shown in Figure 13 on page 65

Link aggregation operation

As shown in Figure 13 on page 65, the Link Aggregation sublayer comprises the following functions:

- Frame Distribution:

  This block is responsible for taking frames submitted by the MAC Client and submitting them for transmission on the appropriate port, based on a frame distribution algorithm employed by the Frame Distributor.

  Frame Distribution also includes an optional Marker Generator/Receiver used for the Marker protocol. For the Passport 8600 switch, the Marker Receiver function only is implemented. Refer to "MultiLink Trunking" on page 59 for details about the frame distribution function.

- Frame Collection:

  This block is responsible for passing frames received from the various ports to the MAC Client. Frame Collection also includes a Marker Responder, used for the Marker protocol.

- Aggregator Parser/Multiplexers:

  — During transmission operations, these blocks pass frame transmission requests from the Distributor, Marker Generator, and/or Marker Responder to the appropriate port.

  — During receive operations, these blocks distinguish among Marker Request, Marker Response, and MAC Client PDUs, and pass each to the appropriate entity (Marker Responder, Marker Receiver, and Collector, respectively).

- Aggregator:

  The combination of Frame Distribution and Collection, along with the Aggregator. Parser/Multiplexers, is referred to as the Aggregator.

- Aggregation Control:

  This block is responsible for the configuration and control of Link Aggregation. It incorporates a Link Aggregation Control Protocol (LACP) that can be used for automatic communication of aggregation capabilities between Systems and automatic configuration of Link Aggregation.

- Control Parser/Multiplexers:

  — During transmission operations, these blocks pass frame transmission requests from the Aggregator and Control entities to the appropriate port.

  — During receive operations, these blocks distinguish Link Aggregation Control PDUs from other frames, passing the LACPDUs to the appropriate sublayer entity, and all other frames to the Aggregator.

Principles of link aggregation

Link aggregation allows you to group switch ports together to form a link group to another switch or server, thus increasing aggregate throughput of the interconnection between the devices while providing link redundancy.

Link aggregation employs the following principles and concepts:

- A MAC Client communicates with a set of ports through an Aggregator, which presents a standard IEEE 802.3 service interface to the MAC Client. The Aggregator binds to one or more ports within a System.
- It is the responsibility of the Aggregator to distribute frame transmissions from the MAC Client to the various ports, and to collect received frames from the ports and pass them to the MAC Client transparently.
- A System may contain multiple aggregators, serving multiple MAC Clients. A given port will bind to (at most) a single Aggregator at any time. A MAC Client is served by a single Aggregator at a time.
- The binding of ports to aggregators within a System is managed by the Link Aggregation Control function for that System, which is responsible for determining which links may be aggregated, aggregating them, binding the ports within the System to an appropriate Aggregator, and monitoring conditions to determine when a change in aggregation is needed.
- Such determination and binding may be under manual control through direct manipulation of the state variables of Link Aggregation (for example, Keys) by a network manager.

In addition, automatic determination, configuration, binding, and monitoring may occur through the use of a Link Aggregation Control Protocol (LACP).

The LACP uses peer exchanges across the links to determine, on an ongoing basis, the aggregation capability of the various links, and continuously provides the maximum level of aggregation capability achievable between a given pair of Systems.

- Frame ordering must be maintained for certain sequences of frame exchanges between MAC Clients.

  The Distributor ensures that all frames of a given conversation are passed to a single port. For any given port, the Collector is required to pass frames to the MAC Client in the order that they are received from that port. The Collector is otherwise free to select frames received from the aggregated ports in any order. Since there are no means for frames to be mis-ordered on a single link, this guarantees that frame ordering is maintained for any conversation.

- Conversations may be moved among ports within an aggregation, both for load balancing and to maintain availability in the event of link failures.
- The standard does not impose any particular distribution algorithm on the Distributor. Whatever algorithm is used should be appropriate for the MAC Client being supported.

  Refer to "MultiLink Trunking" on page 59 for details about the frame distribution function.

- Each port is assigned a unique, globally administered MAC address.

  The MAC address is used as the source address for frame exchanges that are initiated by entities within the Link Aggregation sublayer itself (for example, LACP and Marker protocol exchanges).

- Each Aggregator is assigned a unique, globally administered MAC address, which is used as the MAC address of the aggregation from the perspective of the MAC Client, both as a source address for transmitted frames and as the destination address for received frames.

  The MAC address of the Aggregator may be one of the MAC addresses of a port in the associated Link Aggregation Group

LACP and MLT

When you configure standards-based link aggregation, you must enable the "aggregatable" field. After you enable the aggregatable field, the LACP aggregator is one-to-one mapped to the specified MLT.

For example, when you configure a link aggregation group (LAG), use the following steps:

1. Assign a numeric key to the ports you want to include in the LAG.
2. Configure the LAG to be aggregatable.
3. Enable LACP on the port.
4. Create an MLT and assign the same key to that MLT.

   The MLT/LAG will only aggregate those ports whose key match its own.

The newly created MLT/LAG adopts its member ports' VLAN membership when the first port is attached to the aggregator associated with this Link Aggregation Group (LAG). When a port is detached from an aggregator, the port is deleted from the associated LAG port member list. When the last port member is deleted from the LAG, the LAG is deleted from all VLANs and STGs.

After the MLT is configured as aggregatable, you cannot add or delete ports or VLANs manually.

To enable tagging on ports belonging to LAG, first disable LACP on the port, then enable tagging on the port and enable LACP.

LACP and spanning tree interaction

The operation of LACP module is only affected by the physical link state or its LACP peer status. When a link goes up and down, the LACP module will be notified. The STP forwarding state does not affect the operation of LACP module. LACPDU can be sent even if the port is in STP blocking state.

Unlike legacy MLTs, configuration changes (such as speed, duplex mode, and so on) to a LAG member port is not applied to all the member ports in this MLT. Instead, the changed port is taken out of the LAG and the corresponding aggregator and user is alerted when such a configuration is created.

In contrast to MLT, IEEE 802.3ad-based link aggregation does not expect BPDUs to be replicated over all ports in the trunk group, therefore you must enter the following command to disable the parameter on the spanning tree group for LACP-based link aggregation:

```
#config/stg/x/ntstg disable
```

Be aware that this parameter is applicable to all trunk groups that are members of this spanning tree group. This is necessary when interworking with devices that only send BPDUs out one port of the LAG.

Link aggregation rules

Passport 8600 switch link aggregation groups operate under the following rules:

- All ports in a link aggregation group must be operating in full-duplex mode.
- All ports in a link aggregation group must be running same data rate.
- All ports in a link aggregation group must be in the same VLAN(s).
- Link aggregation is compatible with the Spanning Tree Protocol (STP).
- Link aggregation group(s) must be in the same STP group(s).
- If the `NTSTG` parameter is set to false, STP BPDU transmits only on one link.
- Ports in a link aggregation group can exist on different modules.
- Link aggregation groups are formed using LACP.
- A maximum of 32 link aggregation groups are supported.
- A maximum of 8 active links are supported per LAG.
- A maximum of 8 standby links are supported per LAG.
- Up to 16 ports can be configured in a LAG (8 active and 8 standby ports).

Link aggregation examples

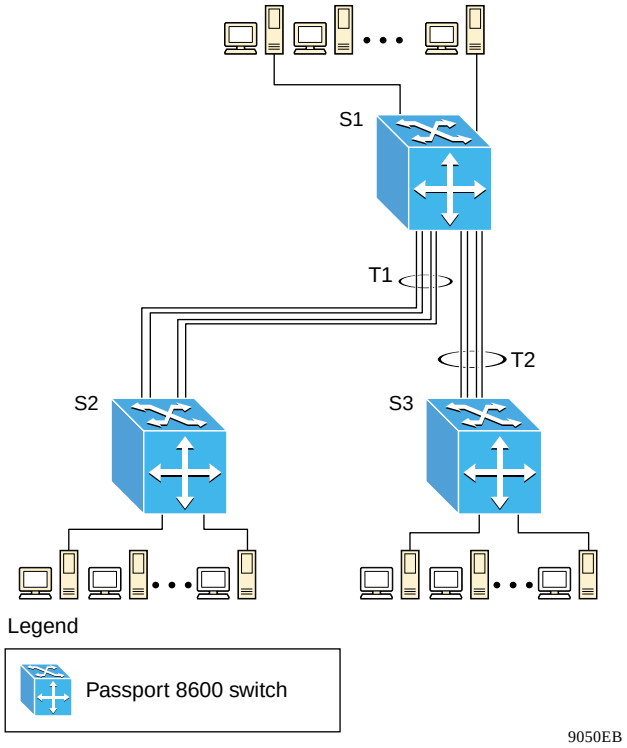
This section provides three link aggregation examples and includes the following topics:

- "Switch-to-switch example," next
- "Switch-to-server MLT example" on page 72
- "Client/server MLT example" on page 73

Switch-to-switch example

Figure 14 shows two MLTs (T1 and T2) connecting switch S1 to switches S2 and S3.

Figure 14 Switch-to-switch MLT configuration



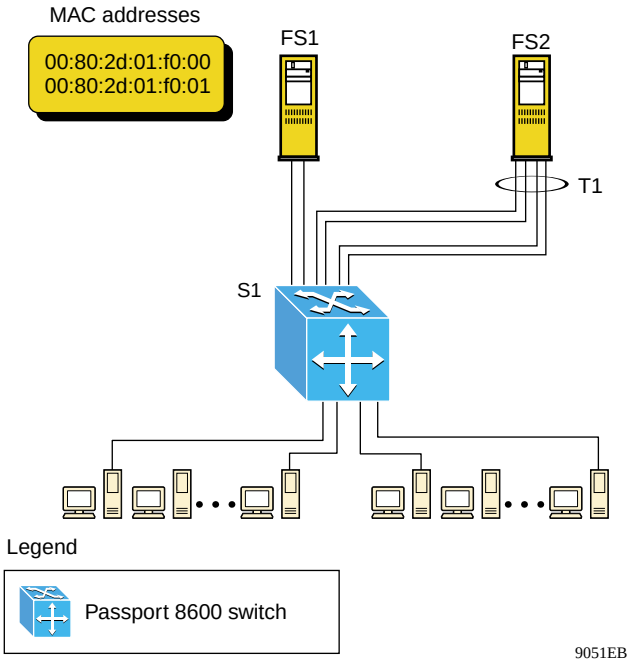
Each of the trunks shown in Figure 14 can be configured with multiple switch ports to increase bandwidth and redundancy. When traffic between switch-to-switch connections approaches single port bandwidth limitations, you can create a MultiLink Trunk to supply the additional bandwidth required to improve performance.

Switch-to-server MLT example

Figure 15 shows a typical switch-to-server trunk configuration. In this example, file server FS1 utilizes dual MAC addresses, using one MAC address for each network interface card (NIC). No MLT is configured on FS1. FS2 is a single MAC server (with a 4-port NIC) and is configured as MLT configuration, T1.

As shown in this example, One port on FS1 is blocked, thus unused; where FS2 benefits from having aggregated bandwidth on MLT T1.

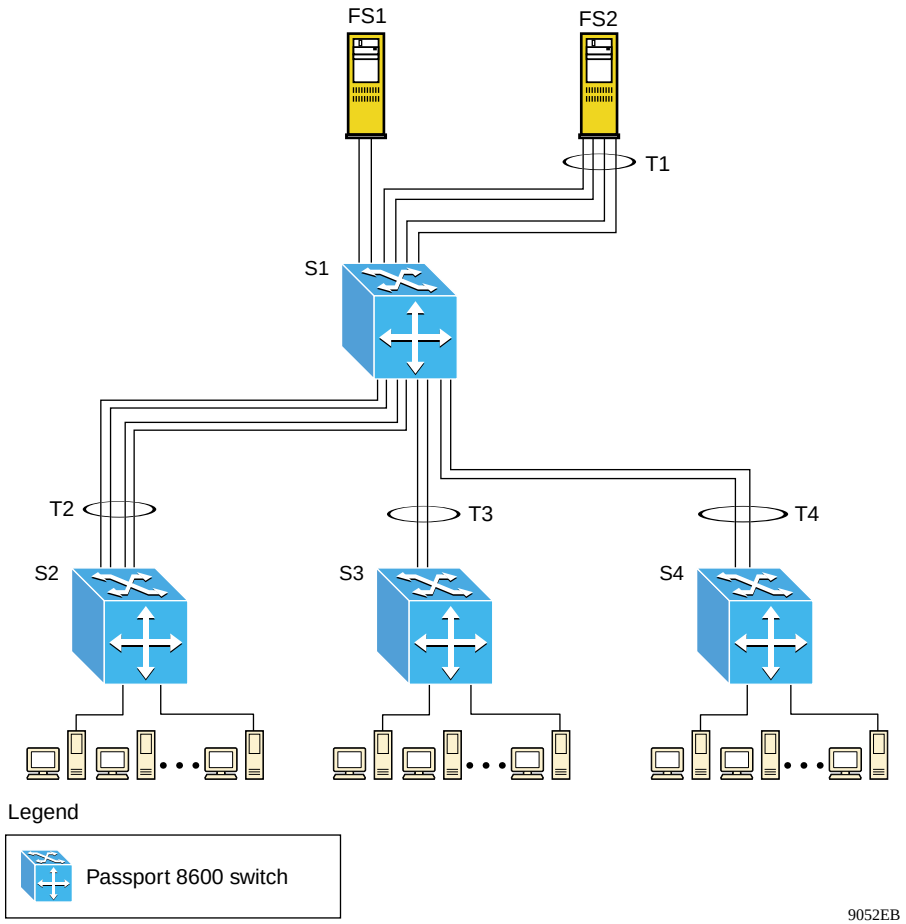
Figure 15 Switch-to-server MLT configuration



Client/server MLT example

Figure 16 shows an example of how MultiLink Trunks can be used in a client/server configuration. In this example, both servers are connected directly to Passport 8600 switch S1. FS2 is connected through a MLT configuration (T1). The switch-to-switch connections are through MLT T2, T3, and T4. Clients accessing data from the servers (FS1 and FS2) are provided with maximized bandwidth through T1, T2, T3, and T4. On Passport 8600 switches, trunk members (the ports that comprise each MLT) do not have to be consecutive switch ports; they can be selected across different modules for module redundancy.

Figure 16 Client/Server MLT configuration



With spanning tree enabled, ports that belong to the same MultiLink Trunk operate as follows:

- All ports in the MLT must belong to the same spanning tree group if spanning tree is enabled.
- Identical bridge protocol data units (BPDUs) are sent out of each port.
- The MLT port ID is the ID of the lowest numbered port.
- If identical BPDUs are received on all ports, the MLT mode is forwarding.

Note: You can disable ntstg (ntstg <enable | disable>) if you do not want to receive BPDUs on all ports.

If no BPDU is received on a port or if BPDU tagging and port tagging do not match, the individual port is taken offline.

- Path cost is inversely proportional to the active MLT bandwidth.

Virtual LACP (VLACP)

Virtual LACP is an LACP extension, which is used for end-to-end failure detection.

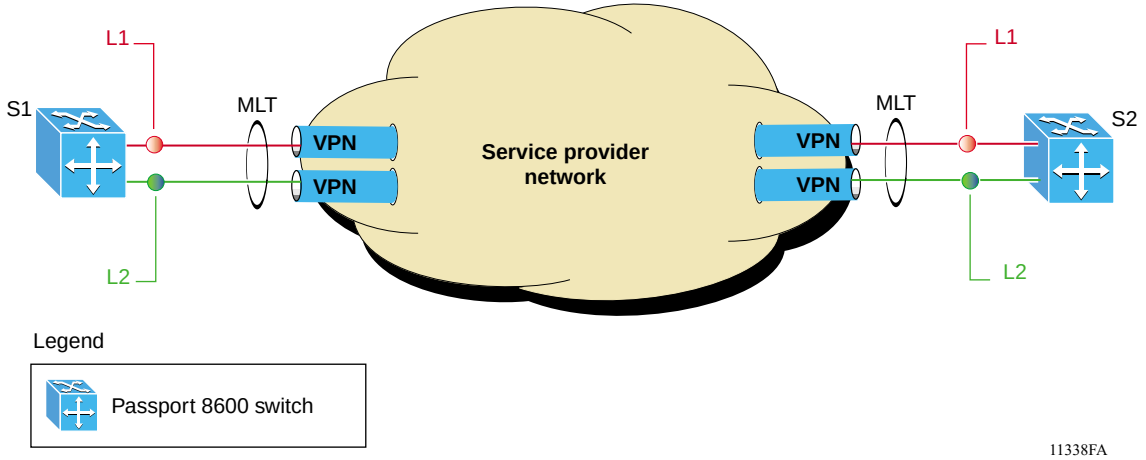
Ethernet has been extended to detect remote link failures through functions such as “Remote fault indication” or “Far-end fault indication” mechanisms.

A major limitation of these functions is that they terminate at the next Ethernet hop; therefore failures cannot be determined on an end-to-end basis.

For example, as shown in Figure 17 on page 75, when Enterprise networks connect their aggregated Ethernet trunk groups through a service provider network connection (for example, through a VPN), far-end failures cannot be signaled with Ethernet-based functions that operate end-to-end through the service provider cloud.

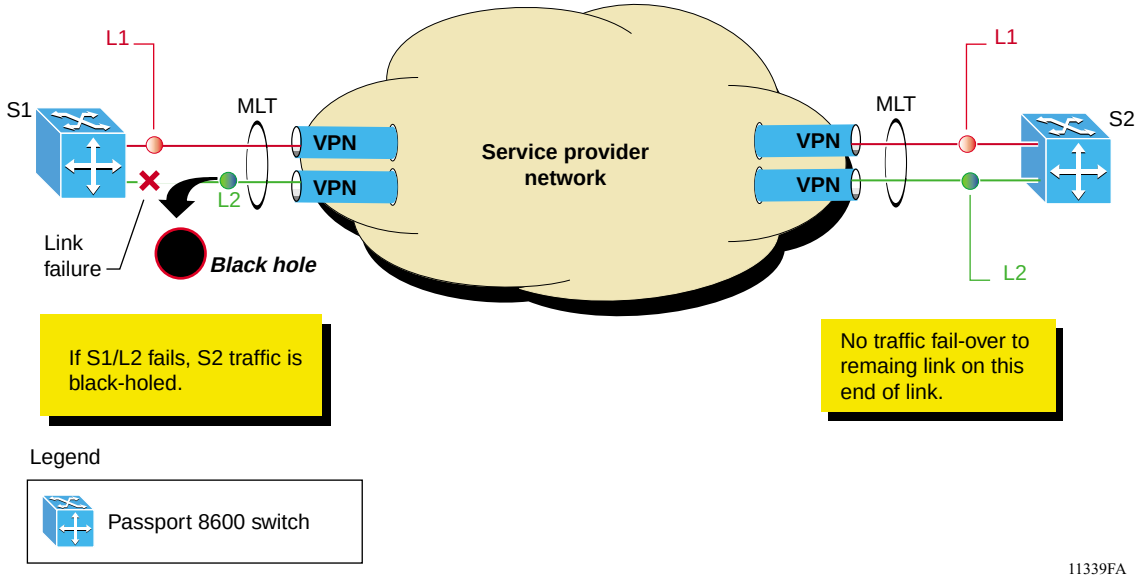
For this example, the MLT (between Enterprise switches S1 and S2) extends through the service provider (SP) network.

Figure 17 Problem description (1 of 2)



As shown in Figure 18, if the L2 link on S1 (S1/L2) fails, the link-down failure is not propagated over the SP network to S2. Thus S2 continues to send traffic over the S2/L2 link, which is black-holed because the S1/L2 link has failed.

Figure 18 Problem description (2 of 2)



Note that LACP, as defined by IEEE, is a protocol that exist between 2 bridge end-points; therefore the LACPDUs are terminated at the next (SP) interface.

Nortel Networks* has developed an extension to LACP, which is called *Virtual LACP (VLACP)*. This extension to LACP can provide an end-to-end failure detection mechanism. With VLACP, far-end failures can be detected, which allows MLT to properly failover when end-to-end connectivity is not guaranteed for certain links in an aggregation group. VLACP prevents the failure scenario shown in Figure 18 on page 75.

When used in conjunction with SMLT, VLACP allows you to switch traffic around entire network devices before L3 protocols detect a network failure, thus minimizing network outages.

Note: The fast periodic time value of 200 ms is not supported for this software release. The minimum supported fast periodic time value is 400 ms.

SMLT

This section describes the Split MultiLink Trunking (SMLT) feature and includes the following topics:

Note: For help with common terms and acronyms used with SMLT, refer to the "Glossary" on page 355.

Overview

Link Aggregation technologies have become popular for improving link bandwidth and/or to protect against link failures. IEEE 802.3ad is the standardized link aggregation protocol, although various vendors have developed their own proprietary implementations. IEEE 802.3ad is defined for point-to-point applications, however, it was not designed to recover around nodal failure.

Split MultiLink Trunking (SMLT) is an extension to Link Aggregation, which improves the level of Layer 2/Layer 3 resiliency by providing nodal protection in addition to link failure protection and flexible bandwidth scaling. SMLT achieves this by allowing edge switches using IEEE 802.3ad to dual-home to two SMLT aggregation switches. SMLT is transparent to those attached devices supporting IEEE 802.3ad.

Because SMLT inherently avoids loops due to its superior enhanced-link-aggregation-control-protocol, when designing networks using SMLT, it is not necessary to use the IEEE 802.1D/w Spanning Tree protocols to enable loop free triangle topologies.

This is accomplished by implementing a method that allows two aggregation switches to appear as a single device to edge switches, which are dual-homed to the aggregation switches. The aggregation switches are interconnected using an Inter-Switch Trunk (IST), which allows them to exchange addressing and state information (permitting rapid fault detection and forwarding path modification). Although SMLT is primarily designed for Layer 2, it also provides benefits for Layer 3 networks as well.

Note: Layer 2 Edge switches must support some form of link aggregation (such as MLT or IEEE 802.3ad-based link aggregation) to allow communications with an SMLT aggregation switch.

Advantages of SMLT

SMLT improves the reliability of layer 2 (L2) networks that operate between user access switches and the network center aggregation switch by providing:

- Loadsharing among all links
- Fast failover in case of link failures
- Elimination of single point of failure
- Fast recovery, in case of nodal failure
- Provides a transparent and interoperable solution
- Removes STP convergence issues

These advantages are described in more detail in the sections that follow.

Single point of failure elimination:

SMLT helps eliminate all single points of failure and create multiple paths from all user access switches to the core of the network. In case of failure, SMLT recovers as quickly as possible so that no unused capacity is created. Finally, SMLT provides a transparent and interoperable solution that requires no modification on the part of the majority of existing user access devices.

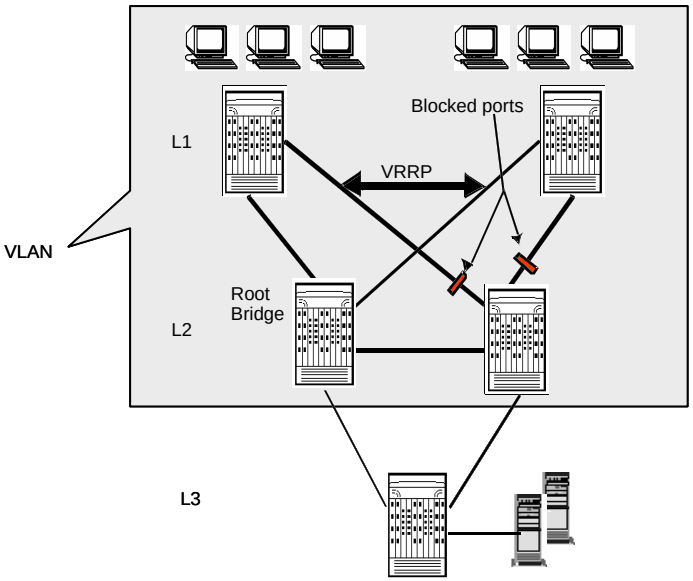
SMLT, compared to spanning tree protocol:

Networks that are designed to have user access switches dual-homed to two aggregation switches and have VLANs spanning two or more user access switches experience the following design constraints:

- Spanning Tree must be used to detect loops
- No load sharing exists over redundant links
- Slow network convergence exists in case of failure

Figure 19 shows a typical aggregator switch configuration that is dependent upon STP for loop detection.

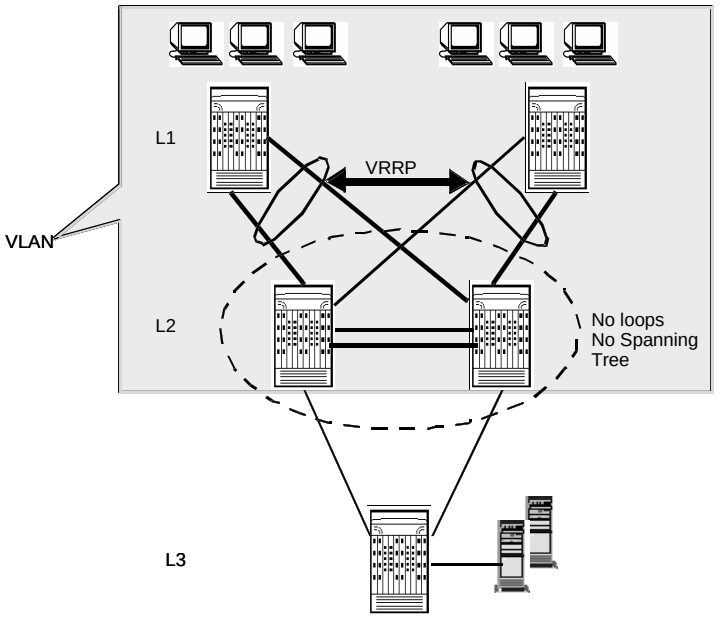
Figure 19 Resilient networks with Spanning Tree Protocol



As shown in Figure 20 on page 80, with the introduction of SMLT, all dual-homed layer 2 frame-switched network devices are no longer dependent upon the Spanning Tree Protocol for loop detection because an properly designed SMLT network inherently does not have any logical loops.

Similarly, layer 3 networks can now benefit from SMLT as well.

Figure 20 Resilient networks with SMLT



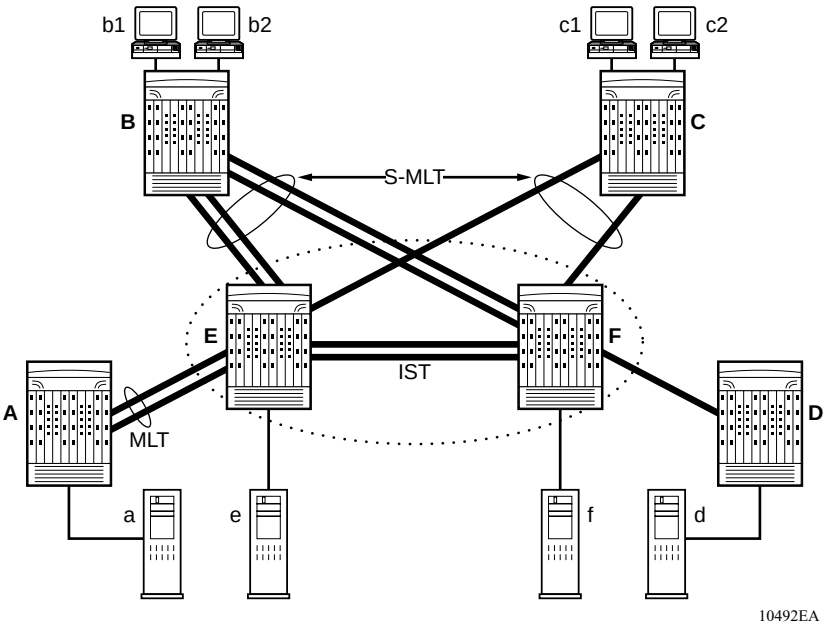
SMLT solves the Spanning Tree problem by combining two aggregation switches into one “logical” MLT entity, thus making it transparent to any type of edge switch. In the process, it provides quick convergence, while load sharing across all available trunks.

How does SMLT work?

Figure 21 illustrates an SMLT configuration with a pair of Passport 8600 switches (E and F) as aggregation switches. Also included are four separate user access switches (A, B, C, and D). Refer to the following sections for a description of the components shown in this SMLT example:

- "Inter-switch trunks (ISTs)," next
- "CP-Limit and SMLT IST" on page 82
- "Other SMLT aggregation switch connections" on page 83

Figure 21 8000 Series switches as SMLT aggregation switches



Inter-switch trunks (ISTs)

SMLT aggregation switches must be connected via an Inter-switch trunk (IST). For example, User access switches B and C are connected to the aggregation switches via multilink trunks split between the two aggregation switches. As shown in Figure 21, the implementation of SMLT only requires two SMLT capable aggregation switches. Those switches must be connected via an inter-switch trunk (IST).

Aggregation switches use the IST to:

- Confirm that they are alive and exchange MAC address forwarding tables.
- Send traffic between single switches attached to the aggregation switches.
- Serve as a backup if one SMLT link fails.

Since the IST is required for the SMLT, for proper operation Nortel Networks recommends that you use multiple links on the IST to ensure reliability and high availability. Nortel Networks recommends using Gigabit Ethernet links for IST connectivity in order to provide enough bandwidth for potential cross traffic.

Note: ATM and POS are not supported for use as IST links.

CP-Limit and SMLT IST

Control packet rate limit (CP-Limit) controls the amount of multicast and/or broadcast traffic that can be sent to the CPU from a physical port. It protects the CPU from being flooded by traffic from a single, unstable port. The CP-Limit default settings are:

- default state = enabled
- default multicast packets-per-second (pps) value = 15,000
- default broadcast pps value = 10,000

Note: When you configure SMLT links, Nortel Networks recommends setting the multicast packets-per-second value to 6000 pps.

If the actual rate of packets-per-second sent from a port exceeds the defined rate, then the port is administratively shut down to protect the CPU from continued bombardment.

Disabling IST ports in this way could impair network traffic flow, as this is a critical port for SMLT configurations.

Note: Nortel Networks recommends that an IST MLT contain at least 2 physical ports. Nortel Networks also recommends that CP-Limit be disabled on all physical ports that are members of an IST MLT.

Disabling CP-Limit on IST MLT ports forces another, less-critical port to be disabled if the defined CP-Limits are exceeded. In doing so, you preserve network stability should a protection condition (CP-Limit) arise. Please note that, although it is likely that one of the SMLT MLT ports (risers) would be disabled in such a condition, traffic would continue to flow uninterrupted through the remaining SMLT ports.

Note: CP-Limit can only be configured from the CLI.

The command syntax to disable CP-limit is:

```
config ethernet <slot/port> cp-limit <enable|disable>
```

Other SMLT aggregation switch connections

Figure 21 on page 81 also includes end stations connected to each of the switches.

In this example, a, b1, b2, c1, c2, and d are clients and printers, while e and f might be servers or routers.

User access switches B and C may use any method for determining which link of their multilink trunk connections to use for forwarding a packet, as long as the same link is used for a given Source/Destination (SA/DA) pair. This is true, regardless of whether or not the DA is known by B or C. SMLT aggregation switches always send traffic directly to a user access switch and only use the IST for traffic that they cannot forward in another more direct way.

The examples that follow explain the process in more detail.

This section includes the following topics:

Example 1- Traffic flow from a to b1 or b2

Assuming a and b1/b2 are communicating via layer 2, traffic flows from A to switch E and is then forwarded over its direct link to B. Traffic coming from b1 or b2 to a is sent by B on one of its MLT ports.

B could then send traffic from b1 to a on the link to switch E, and traffic from b2 to a on the link to F. In the case of traffic from b1, switch E forwards the traffic directly to switch A, while traffic from b2, which arrived at F, is forwarded across the IST to E and then on to A.

Example 2- Traffic flow from b1/b2 to c1/c2

Traffic from b1/b2 to c1/c2 will be always be sent by switch B down its MLT to the core. No matter which switch (E or F) it arrives at, it will then be sent directly to C through the local link.

Example 3- Traffic flow from a to d

Traffic from a to d and vice versa is forwarded across the IST because it is the shortest path. This is treated purely as a standard link with no account taken of SMLT and the fact that it is also an IST.

Example 4- Traffic flow from f to c1/c2

Traffic from f to c1/c2 will be sent out directly from F. Return traffic from c1/c2 allows you to have one active VRRP Master per IP subnet. It will then be passed across the IST if switch C sends it down the link to E.

SMLT-on-Single-CPU

Beginning with Passport 8600 software Release 3.5.1 and with the latest hardware revisions, a new enhancement has been added to improve SMLT failover behaviors for single CPU/SF configurations.

Prior to this release, Nortel Networks recommendation for using SMLT required that two switch fabric modules be installed in a chassis running SMLT. This was a requirement because SMLT clients did not reroute traffic around SMLT aggregation switches with a single failed CPU, thus packet loss could have been expected in this rare failure case.

The new feature establishes a polling mechanism between the CPU and the interface modules. Because single CPU/SF configurations do not benefit from standard CPU/SF redundancy, in the rare event that a CPU failure should occur on the aggregation switch, this enhancement forces the interface modules to go offline and allows network redundancy configurations to activate faster.

You can configure this feature using the CLI, refer to "Configuring SMLT-on-single-CPU" on page 304.

This feature is applicable to all I/O cards capable of supporting the new Single CPU/Switch Fabric reliability enhancement. By default, the SMLT-on-single-cp feature is disabled.

Note: This feature is only required, if you plan to enable SMLT on aggregation switches with only one CPU (and you are not using LACP). There are no other advantages to using this feature when the aggregation switch includes two CPUs.

Single port SMLT

Single port SMLT lets you configure a split multilink trunk using a single port. The single port SMLT behaves just like an MLT-based SMLT and can coexist with SMLTs in the same system. Single port SMLT lets you scale the number of split multilink trunks on a switch to a maximum number of available ports.

Split MLT links may exist in the following combinations on the SMLT aggregation switch pair:

- MLT-based SMLT + MLT-based SMLT
- MLT-based SMLT + single link SMLT
- single link SMLT + single link SMLT

Rules for configuring single port SMLT:

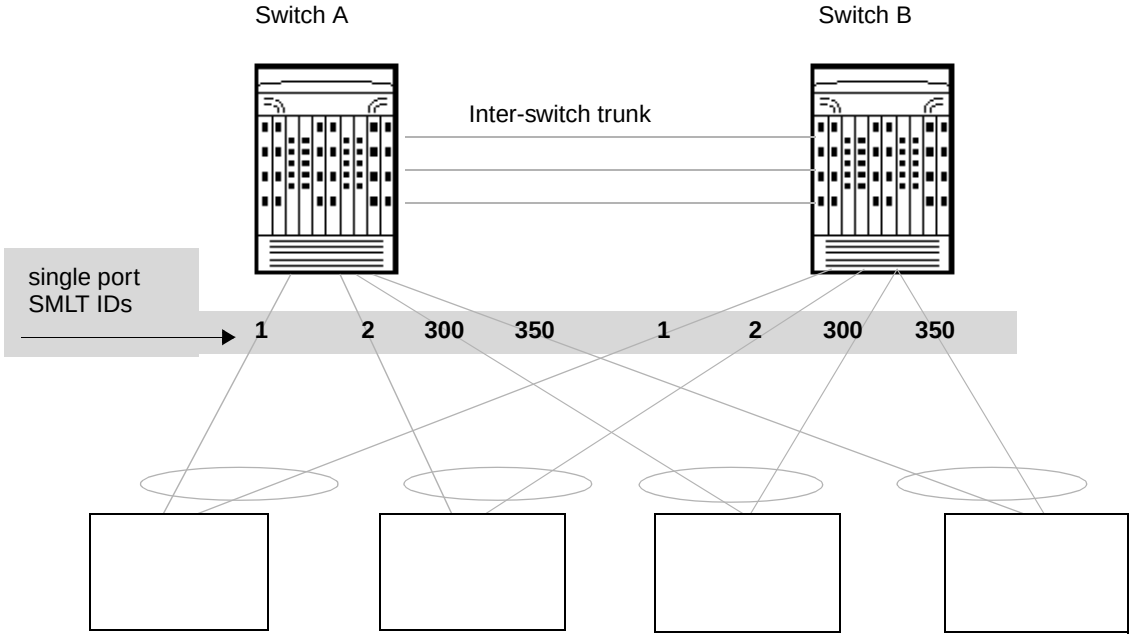
- The dual-homed device connecting to the aggregation switches must be capable of supporting MLT.
- Single port SMLT is supported on Ethernet, POS, and ATM ports.

Note: Single port SMLT is not supported on 8681 10 Gig Ethernet ports with release 3.5.

- Each single port SMLT is assigned an SMLT ID from 1 to 512.
- Single port SMLT ports can be designated as Access or Trunk (that is, IEEE 802.1Q tagged or not), and changing the type does not affect their behavior.
- You cannot change a single port SMLT into an MLT-based SMLT by adding more ports. You must delete the single port SMLT, and then reconfigure the port as SMLT/MLT.
- You cannot change an MLT-based SMLT into a single port SMLT by deleting all ports but one. You must first remove the SMLT/MLT and then reconfigure the port as single port SMLT.
- A port cannot be configured as MLT-based SMLT and as single port SMLT at the same time.

Figure 22 shows a configuration in which both aggregation switches have single port SMLTs with the same IDs. This configuration allows as many single port SMLTs as there are available ports on the switch.

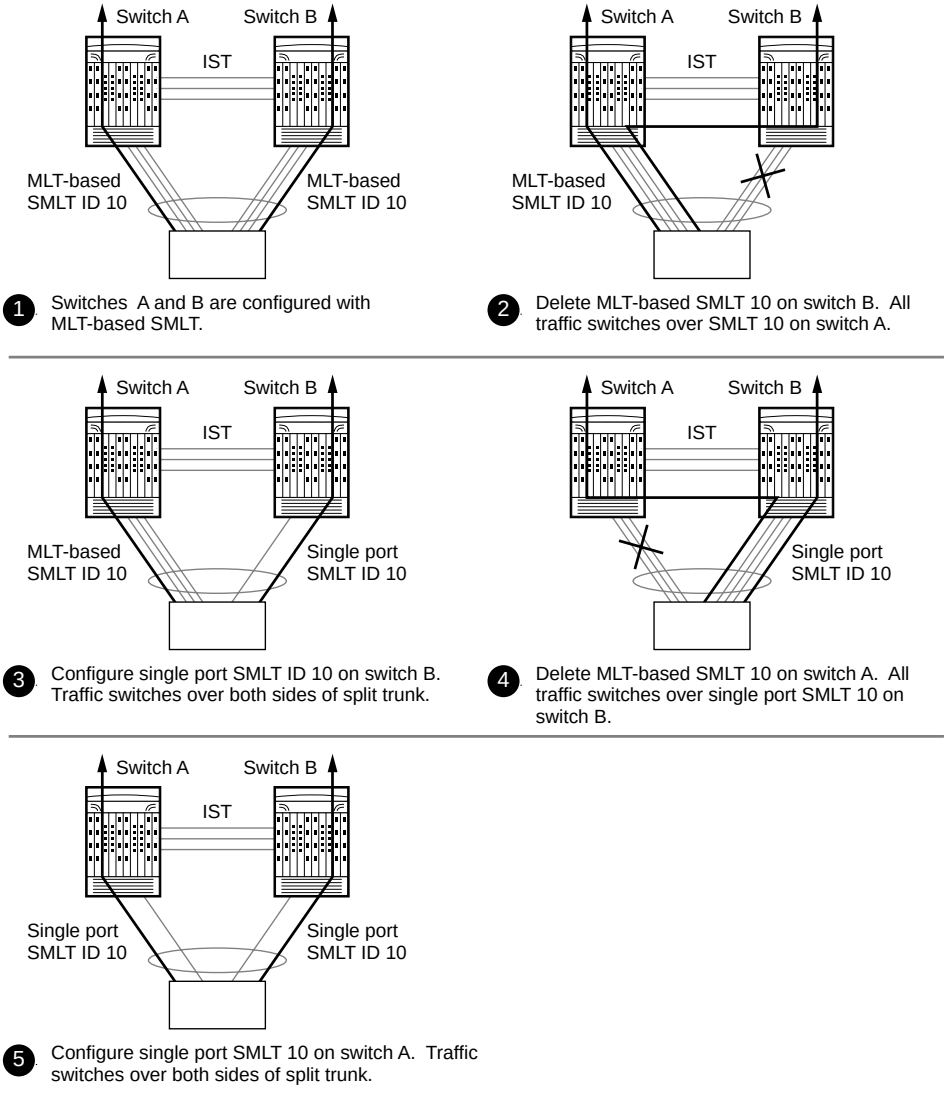
Figure 22 Single port SMLT example



Using MLT-based SMLT with single port SMLT

You can configure a split trunk with a single port SMLT on one side and an MLT-based SMLT on the other. Both must have the same SMLT ID. In addition to general use, Figure 23 shows how this configuration can be used for upgrading an MLT-based SMLT to a single port SMLT without taking down the split trunk.

Figure 23 Changing a split trunk from MLT-based SMLT to single port SMLT



To configure single port SMLT using Device Manager, see "Configuring single port SMLT" on page 177.

To configure single port SMLT using the CLI, see "Creating a single port SMLT" on page 245.

Interaction between SMLT and IEEE 802.3ad

With this release the Passport 8600 switch fully supports the IEEE 802.3ad Link aggregation control protocol; not only on MLT and DMLT links, but also extended to a pair of SMLT switches.

With this extension, the Passport 8600 switch now provides a standardized external link aggregation interface to third party vendor IEEE 802.3ad implementations. With previous software versions, interoperability was provided through a static configuration; now a dynamic link aggregation mechanism is provided.

- MLT peers and SMLT client devices can be network switches, and can also be any type of server/workstation that supports link bundling through IEEE 802.3ad.
- Single-link and multilink SMLT solutions support dual-homed connectivity for more than 350 attached devices, thus allowing you to build dual-homed server farm solutions.
- Interaction between SMLT and IEEE 802.3ad:

  Nortel Networks tightly coupled the IEEE link aggregation standard with the SMLT solution in order to provide seamless configuration integration while also detecting failure scenarios during network setup or operations.

Supported scenarios:

SMLT/IEEE Link aggregation interaction supports all known SMLT scenarios where an IEEE 802.3ad SMLT pair can be connected to SMLT clients, or where two IEEE 802.3ad SMLT pairs can be connected to each other in a square or full mesh topology.

Failure scenarios:

- Wrong ports connected

- Mismatched SMLT IDs assigned to SMLT client:

  SMLT switches can detect if SMLT IDs are not consistent. The SMLT aggregation switch, which has the lower IP address, does not allow the SMLT port to become a member of the aggregation, thus avoiding misconfigurations.

- SMLT client switch does not have automatic aggregation enabled (LACP disabled):

  SMLT aggregation switches can detect that aggregation is not enabled on the SMLT client, thus no automatic link aggregation is established until the configuration is resolved.

- Single CPU failures

  In the case of a CPU failure in a system with only one switch fabric, the link aggregation control protocol on the other switch (or switches) detects the remote failure and triggers all links connected to the failed system to be removed out of the link aggregation group. This process allows failure recovery for the network along a different network path.

Note: Only dual-homed devices will benefit from this enhancement.

SMLT network design considerations

If you use LACP in an SMLT/Square configuration, the LACP must have the same keys for that SMLT/LAG; otherwise, the aggregation may fail if a switch failure occurs.

For more information, refer to the *Network Design Guidelines.*

Use the following procedure when designing an SMLT network:

1. Define a separate VLAN for the IST protocol:

   ```
   config mlt 1 ist create ip <value> vlan-id <value>
   ```

2. Disable CP-limit on the IST ports:

   ```
   config ethernet <slot|port> cp-limit disable
   ```

3. Keep CP-limit enabled on the SMLT ports and change multicast-limit value to 6000:

   ```
   config ethernet <slot|port> cp-limit enable
   multicast-limit 6000
   ```

4. Disable loop detect on SMLT ports:

   ```
   config ethernet <slot|port> loop-detect disable
   ```

5. Enable tagging on SMLT links:

   ```
   config ethernet <slot/port> perform-tagging enable
   ```

6. Enable drop untagged frames on SMLT links:

   ```
   config ethernet <slot/port> untagged-frames-discard
   enable
   ```

SMLT and IP routing

This section describes SMLT and IP routing interactions and includes the following topics:

SMLT and VRRP

VRRP allows you to have one active primary router per IP subnet, with all other network VRRP interfaces in backup mode.

With SMLT, this becomes less efficient. Users that access switches aggregated into two Split-MLT switches, send their shared traffic load (based on source and destination MAC or IP addresses) on all uplinks towards the SMLT aggregation switches.

VRRP, however, has only one active routing interface enabled. All other interfaces are in backup (standby) mode. In this case all traffic is forwarded over the IST link towards the primary VRRP switch. Potentially, all traffic which arrives at the VRRP backup interface is forwarded over, so there will be not enough bandwidth on the IST to carry all the aggregated riser traffic.

A small enhancement in VRRP overcomes this issue, however, by ensuring that the IST trunk is not used in such a case for primary data forwarding.

VRRP backup master

If enabled, the VRRP backup master feature also acts as an IP router for packets destined for the logical VRRP IP address. Thus, all traffic is directly routed to the subnetworks it is destined for and not L2- switched to the VRRP master. This eliminates a potential limitation in the available IST bandwidth.

Note: The VRRP backup master feature for SMLT is to be used only on interfaces that have been defined for SMLT to avoid potential frame duplication problems. It cannot be used in conjunction with HUBs to avoid frame duplication. Also, it is not to be used on brouter or VLAN interfaces.

RSMLT

SMLT sub-second failover benefits are only supported in Layer 2 networks. When routing is involved, depending on the specific routing protocol, this convergence time can cause network interruptions ranging from seconds to minutes.

The Nortel Networks RSMLT feature extends the sub-second failover benefit to core topologies by providing an *active-active* router concept to core SMLT networks.

Supported scenarios are: SMLT triangles, squares and SMLT full mesh topologies, with routing enabled on the core VLANs.

Routing protocols can be any of the following protocol types: IP Unicast Static Routes, RIP1, RIP2, OSPF, BGP and IPX RIP.

In the case of core router failures RSMLT takes care of the packet forwarding, thus eliminating dropped packets during the routing protocol convergence.

For detailed information about RSMLT, see *Configuring IP Routing Operations*.

Chapter 2
Configuring VLANs using Device Manager

This chapter describes how to configure VLANs on a Passport 8600 module or a Passport 8100 module with Device Manager.

This chapter includes the following topics:

For conceptual information about VLANs, See “VLANs” on page 27.

Displaying defined VLANs

To display all defined VLANs, their configurations, and their current status:

➡ From the Device Manager menu bar, choose VLAN > VLANs.

The VLAN dialog box opens with the Basic tab displayed, which shows all defined VLANs (Figure 24).

Figure 24 VLAN dialog box—Basic tab

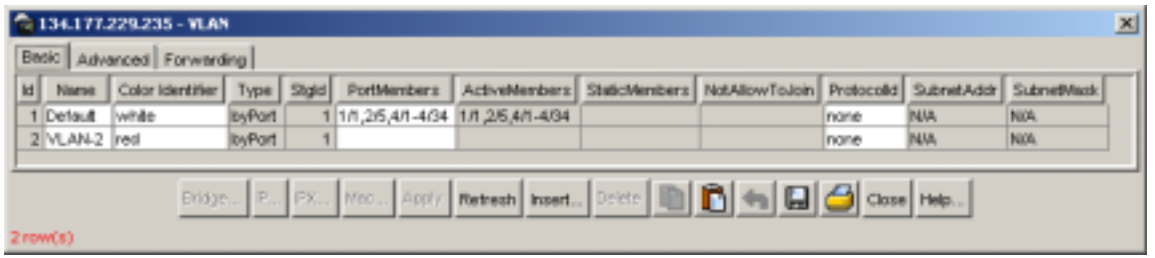


Table 7 describes the VLAN Basic tab fields.

Table 7 VLAN Basic tab fields

Field	Description
Id	VLAN ID (1 - 4092) for the VLAN.
Name	Name of the VLAN.
Color Identifier	A proprietary color scheme to associate a color with the VLAN. Color does not affect how frames are forwarded.
Type	Type of VLAN: • byPort • byIpSubnet • byProtocolId (8600 modules and 8100 modules) • bySrcMac (8600 modules only) • bySvlan (8600 modules only)
StgId	The ID of the spanning tree group to which the VLAN belongs.
PortMembers	The slot/port of each possible VLAN member.
ActiveMembers	The slot/port of each activeVLAN member, including all static members and potential members meeting the policy.
StaticMembers	Slot/port of each static (always) member of a protocol-based VLAN.
NotAllowToJoin	The slot/ports that are never allowed to become a member of the protocol-based VLAN.

Table 7 VLAN Basic tab fields (continued)

Field	Description
ProtocolId	Specify the network protocol for protocol-based VLANs. This value is taken from the Assigned Numbers RFC. • ip (IP version 4) • ipx802dot3 (Novell IPX on Ethernet 802.3 frames) • ipx802dot2 (Novell IPX on IEEE 802.2 frames) • ipxSnap (Novell IPX on Ethernet SNAP frames) • ipxEthernet2 (Novell IPX on Ethernet Type 2 frames) • appleTalk (AppleTalk on Ethernet Type 2 and Ethernet SNAP frames) • decLat (DEC LAT protocol) • decOther (Other DEC protocols) • sna802dot2 (IBM SNA on IEEE 802.2 frames) • snaEthernet2 (IBM SNA on Ethernet Type 2 frames) • netBIOS (NetBIOS protocol) • xns (Xerox XNS) • vines (Banyan VINES) • ipv6 (IP version 6) • usrDefined (user-defined protocol) • RARP (Reverse Address Resolution protocol) • PPPoE (Point-to-point protocol over Ethernet) **Note**: if the VLAN type is port-based, *None* is displayed in the Basic tab ProtocolId field.
SubnetAddr	The source IP subnet address (IP subnet-based VLANs only).
SubnetMask	The source IP subnet mask (IP subnet-based VLANs only).

Creating a VLAN

This section describes how you can create VLANs using the following procedures:

- "Creating a port-based VLAN" on page 96
- "Configuring an IP address for a VLAN" on page 99
- "Configuring a network address and encapsulation for a VLAN" on page 100
- "Creating a source IP subnet-based VLAN" on page 102
- "Creating a protocol-based VLAN" on page 105

- "Configuring user-defined protocols in protocol-based VLANs" on page 108
- "Creating a source MAC address-based VLAN" on page 112

When creating a VLAN, keep in mind the rules described in "VLAN rules" on page 42.

Creating a port-based VLAN

To create a port-based VLAN:

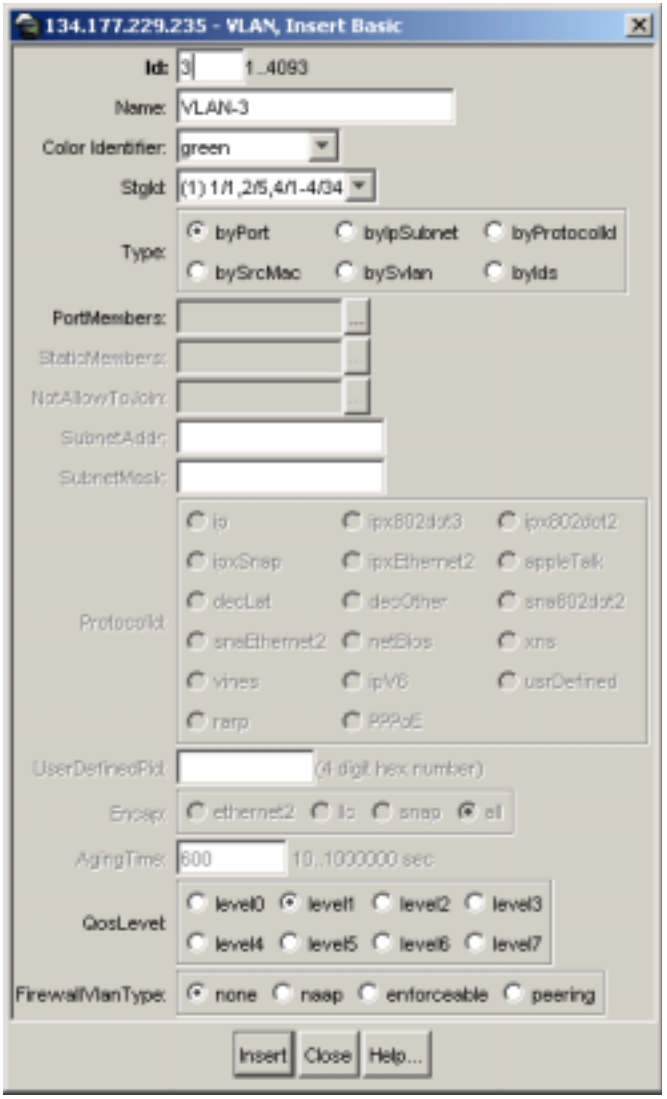
1 From the Device Manager menu bar, choose VLAN > VLANs.

The VLAN dialog box opens with the Basic tab displayed, which shows all defined VLANs (see Figure 24 on page 94).

2 In the Basic tab, click Insert.

The VLAN, Insert Basic dialog box opens (Figure 25).

Figure 25 VLAN, Insert Basic dialog box—for port-based VLANs



3 In the ID field, enter an unused VLAN ID (1 - 4094), or use the ID provided.

— (Optional) In the Name field, type the VLAN name, or use the name provided.

— (Optional) In the Color Identifier field, click the down arrow and choose a color from the dropdown list, or use the color provided.

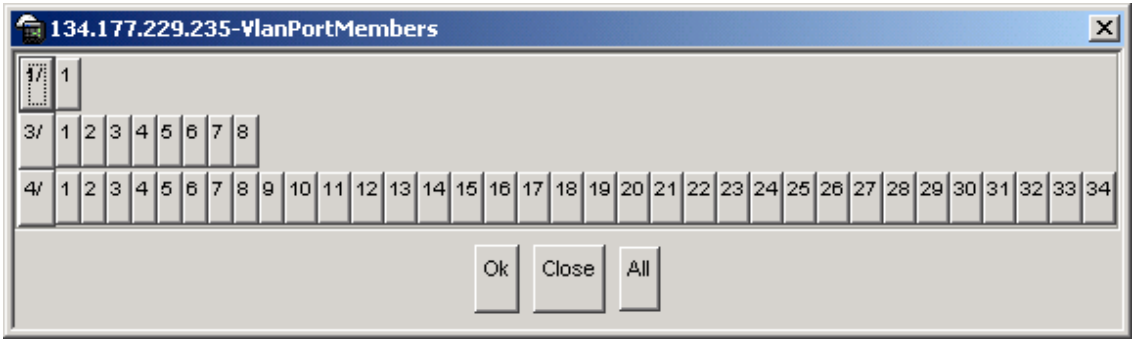
4 In the StgId field, type or select the spanning tree group ID of the VLAN.

5 In the Type field, select byPort.

6 In the PortMembers field, click the ellipsis (...).

The VlanPortMembers dialog box opens (Figure 26).

Figure 26 VlanPortMembers dialog box



7 Click the ports that are always members. The ports that are selected are recessed, while the non selected ports are not recessed. Port numbers that are shown in gray indicates the ports cannot be selected as VLAN port members. (For example, you cannot select ports that do not have the same spanning tree group ID as that of the new VLAN.)

8 Click Ok.

The Port Membership dialog box closes and the port members appear in the Insert Basic dialog box.

9 In the VLAN, Insert Basic dialog box, click Insert.

The Insert dialog box closes and the new VLAN is displayed in the Basic tab.

10 In the Basic tab, do one of the following:

a If you are configuring a Passport 8600 switch module, click Close.

The VLAN is configured and the VLAN dialog box closes.

b If you are configuring a VLAN for a Passport 8100 switch module, use one of the following procedures to configure routing:

— "Configuring an IP address for a VLAN," next.

— "Configuring a network address and encapsulation for a VLAN" on page 100.

Configuring an IP address for a VLAN

To configure an IP address for a VLAN:

1. From the Device Manager menu bar, choose VLAN > VLANs.

   The VLAN dialog box opens with the Basic tab displayed (Figure 24 on page 94).

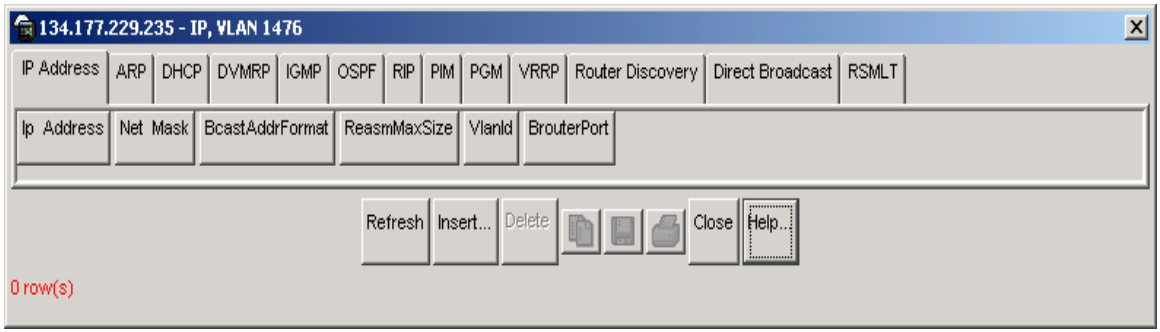
2. In the Basic tab, select the VLAN for which you are configuring an IP address.

   The VLAN is highlighted.

3. Click IP.

   The IP, VLAN dialog box for the selected VLAN opens with the IP Address tab displayed (Figure 27).

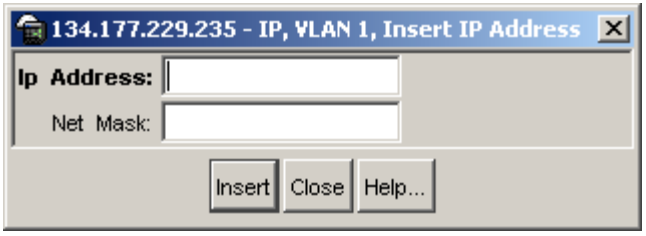
Figure 27 IP, VLAN dialog box



4. Click Insert.

   The Insert IP Address dialog box opens.

Figure 28 Insert IP Address dialog box



5 Enter an IP address and NetMask for routing.

6 Click Insert.

The Insert IP dialog box closes and the IP address and Net Mask appear in the IP, VLAN dialog box.

7 In the IP, VLAN dialog box and the VLAN dialog box, click Close.

The IP subnet-based VLAN is configured.

Configuring a network address and encapsulation for a VLAN

To configure an IPX network address and select an encapsulation method:

1 From the Device Manager menu bar, choose VLAN > VLANs.

The VLAN dialog box opens with the Basic tab displayed (Figure 24 on page 94).

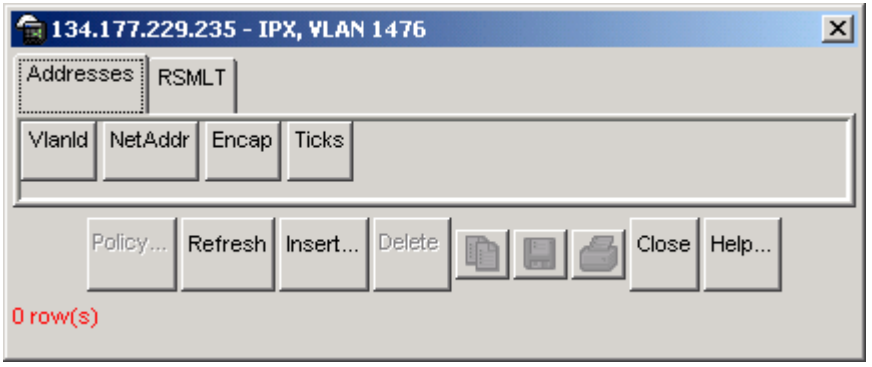
2 In the Basic tab, select the VLAN for which you are configuring a network address and encapsulation.

The VLAN is highlighted.

3 Click IPX.

The IPX, VLAN dialog box for the selected VLAN opens with the Addresses tab displayed (Figure 29).

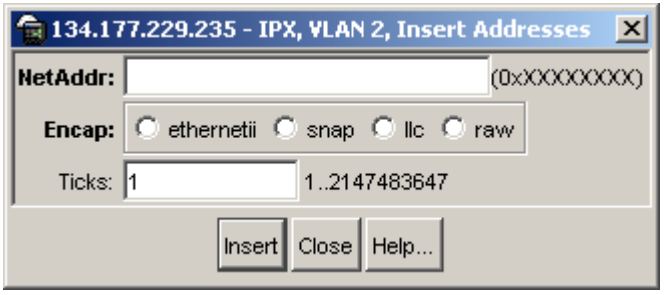
Figure 29 IPX, VLAN dialog box



4 Click Insert.

The IPX, VLAN, Insert Addresses dialog box opens.

Figure 30 IPX, VLAN, Insert Addresses dialog box



5 In the NetAddr field, enter a network address for routing.

6 In the Encap field, click an encapsulation method (Ethernet II, SNAP, LLC, or RAW).

7 Click Insert.

The IPX, VLAN, Insert Addresses dialog box closes and the network address and encapsulation method appear in the IPX, VLAN dialog box.

8 In both the IP, VLAN dialog box and the VLAN dialog box, click Close.

The network address and encapsulation method are configured for the VLAN.

Creating a source IP subnet-based VLAN

To create a source IP subnet-based VLAN:

1. From the Device Manager menu bar, choose VLAN > VLANs.

   The VLAN dialog box opens with the Basic tab displayed (see Figure 24 on page 94).

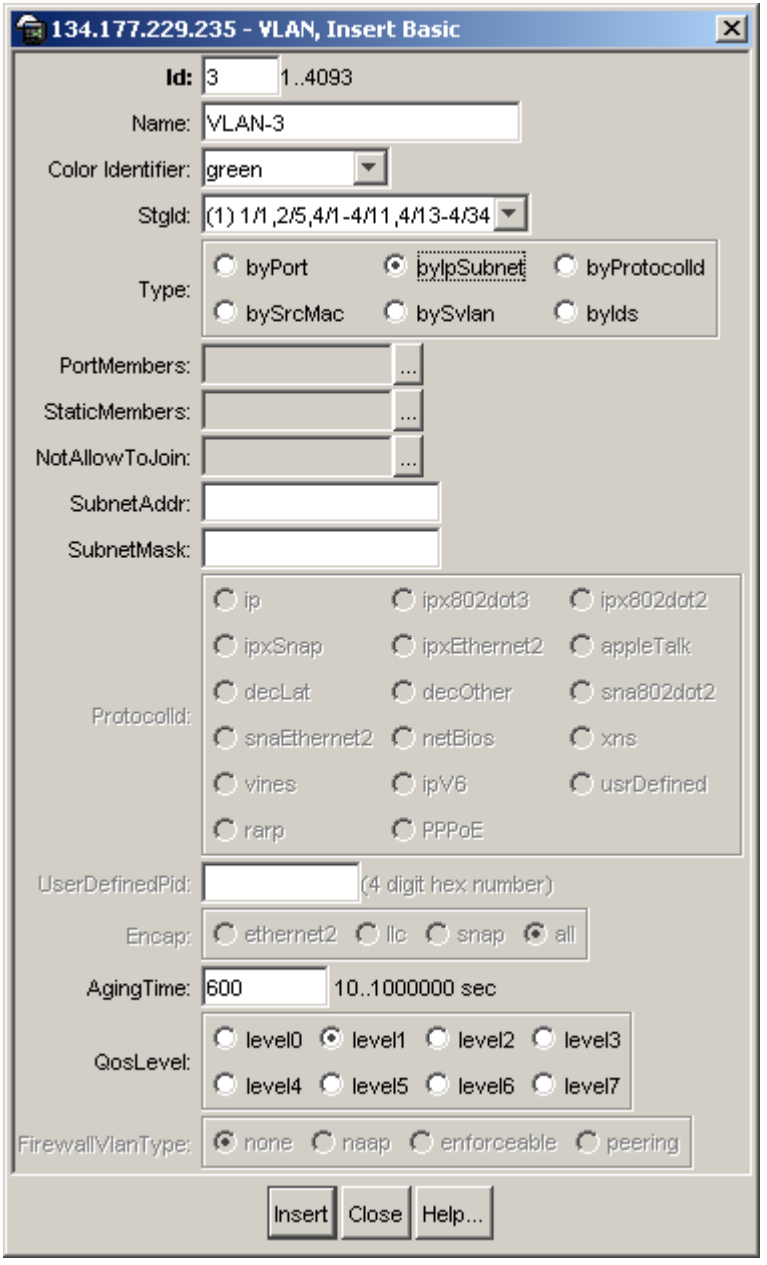
2. In the VLAN dialog box—Basic tab, click Insert.

   The VLAN, Insert Basic dialog box opens (see Figure 31 on page 103).

3. In the Type field, click byIpSubnet.

   The fields needed to set up IP subnet-based VLANs are activated (see Figure 31 on page 103).

Figure 31 VLAN, Insert Basic dialog box—for IP subnet-based VLANs



4 In the ID field, type the VLAN ID.

5 (Optional) In the Name field, type the VLAN name.

If no name is entered, a default is created.

6 (Optional) In the Color Identifier field, select the color or use the color provided.

This color is used by VLAN Manager to visually distinguish the VLANs in a network.

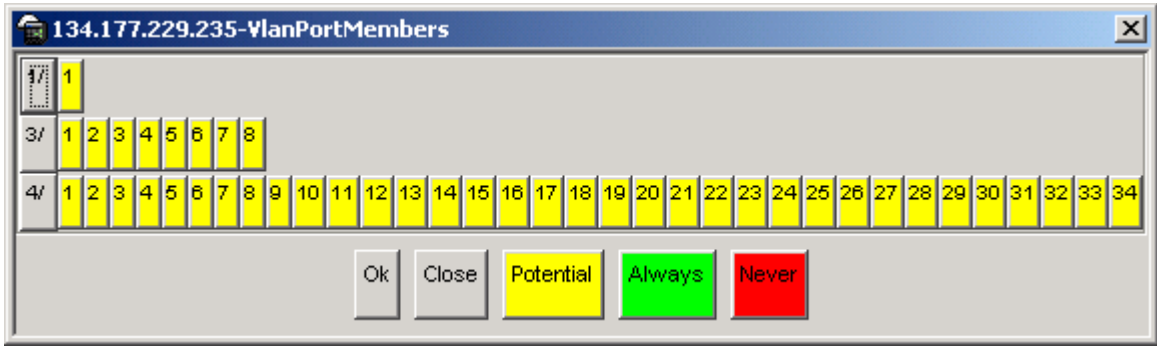
7 In the StgId field, select the spanning tree group ID of the VLAN.

8 Specify port membership by clicking the ellipsis (...) for one of the following:

- PortMembers (use this for VLAN by IpSubnet, Protocolid, or SrcMac)
- StaticMembers
- NotAllowedToJoin

The VlanPortMembers dialog box opens (Figure 32).

Figure 32 VlanPortMembers dialog box



9 Click each port to achieve the desired color:

- Yellow—Potential members, treated as always members
- Green—Always members, static
- Red—Never members, not allowed to join

Note: In a source IP subnet-based VLAN, a potential member becomes an active member of the VLAN when a frame is received from the specified source IP address.

10 Click OK.

The Port Membership dialog box closes, and the port members appears in the VLAN, Insert Basic dialog box.

11 In the source IP subnet address field, enter an IP address for the VLAN.

12 In the IP subnet mask field, enter an IP subnet mask for the VLAN.

13 In the AgingTime field, enter the timeout period in seconds for aging out the dynamic VLAN member ports, or use the 600 second default.

14 (Optional) In the QosLevel field, click a quality of service level (0 - 7).

15 Click Insert.

The VLAN, Insert Basic dialog box closes, and the source IP subnet-based VLAN appears in the Basic tab.

Creating a protocol-based VLAN

To create a protocol-based VLAN:

1 From the Device Manager menu bar, choose VLAN > VLANs.

The VLAN dialog box opens with the Basic tab displayed (see Figure 24 on page 94).

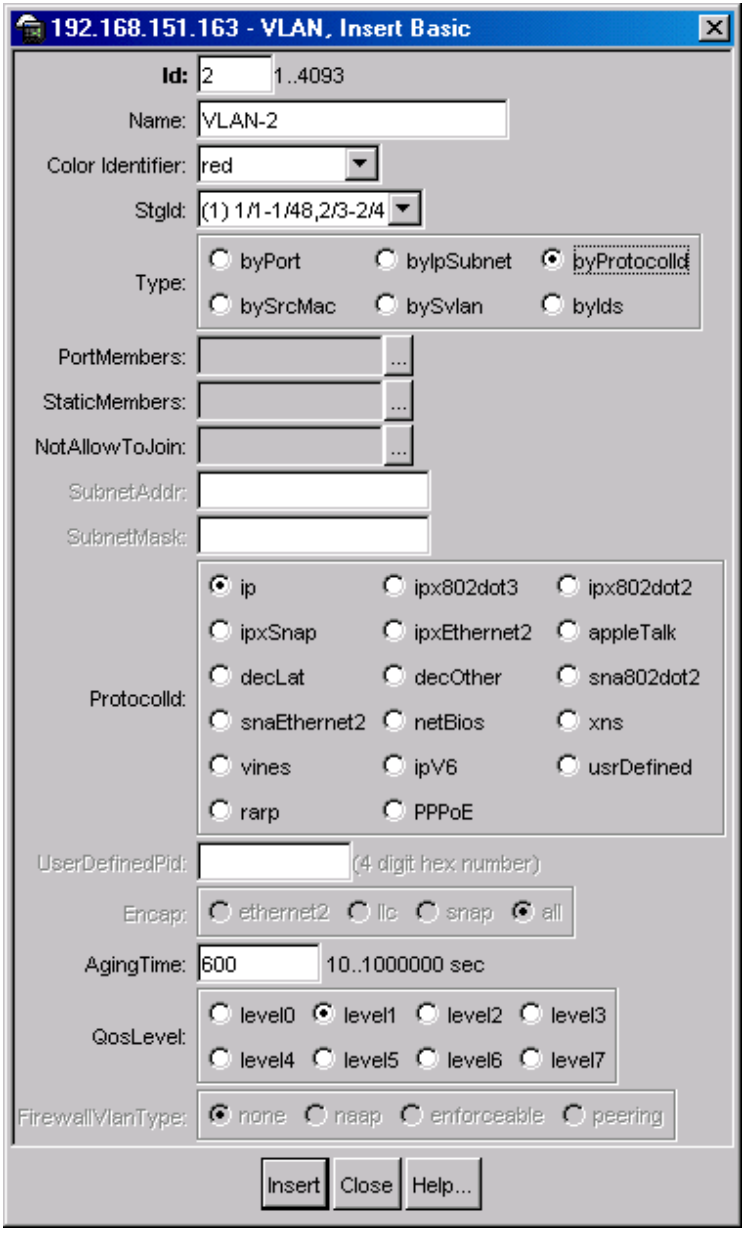
2 In the VLAN dialog box—Basic tab, click Insert.

The VLAN, Insert Basic dialog box opens (see Figure 33 on page 106).

3 In the Type field, click byProtocolId.

The dialog box activates additional fields needed to set up protocol-based VLANs (see Figure 33 on page 106).

Figure 33 VLAN, Insert Basic dialog box—for protocol-based VLANs



4 In the ID field, type the unique VLAN ID, or use the ID provided.

5 (Optional) In the Name field, type the VLAN name, or use the name provided.

6 (Optional) In the Color Identifier field, select the color, or use the color provided.

This color is used by VLAN Manager to visually distinguish the VLANs in a network.

7 In the StgID field, select the spanning tree group ID of the VLAN.

8 To specify the VLAN port membership, click the ellipsis (...) for one of the following fields.

- Port Members
- StaticMembers
- NotAllowedToJoin

The VlanPortMembers dialog box opens (see Figure 32 on page 104).

9 In the VlanPortMembers dialog box, click each port button to achieve the desired membership color.

- Yellow: Potential members—dynamic. Potential members are treated as always members.
- Green: Always members—static
- Red: Never members—not allowed to join

When you have two VLANs with potential members and you want to move ports from one VLAN to the other, you must first change their port membership to Never. Then you can assign the ports to the other VLAN. This requirement applies to both the 8600 modules and 8100 modules.

Note: When a protocol-based VLAN is created, all ports in the underlying STG will automatically be added as potential members if they are not already members of an existing protocol-based VLAN of the same type.

Note: In a protocol-based VLAN for an 8600 module, a potential member becomes an active member of the VLAN when a frame of the specified protocol is received.

10 Click OK.

The VlanPortMembers dialog box closes and the port members are added to the Insert Basic dialog box.

11 In the ProtocolID field, select a protocol ID.

To configure a non-standard protocol, see ""Configuring user-defined protocols in protocol-based VLANs" on page 108.

12 Do one of the following:

- For Passport 8100 switch modules, go to Step 13.
- For Passport 8600 switch modules, in the AgingTime field, specify the timeout period, in seconds, for aging out the dynamic member ports of the VLAN, or use the default of 600 seconds.

13 In the QosLevel field, click a level (0-7).

14 Click Insert.

The VLAN, Insert Basic dialog box closes, and the protocol-based VLAN is added to the Basic tab of the VLAN dialog box.

15 Do one of the following:

- If you are configuring a Passport 8600 switch module, click Close.

  The VLAN is configured and the VLAN dialog box closes.

- If you are configuring an Passport 8100 switch module, use one of the following procedures to configure routing:
  - "Configuring an IP address for a VLAN" on page 99
  - "Configuring a network address and encapsulation for a VLAN" on page 100

Configuring user-defined protocols in protocol-based VLANs

You can create user-defined protocol-based VLANs in support of networks with non-standard protocols.

To create a user-defined protocol for a protocol-based VLAN:

1 From the Device Manager menu bar, choose VLAN > VLANs.

The VLAN dialog box opens with the Basic tab displayed (see Figure 27 on page 99).

2 In the VLAN dialog box—Basic tab, click Insert.

The VLAN, Insert Basic dialog box opens (see Figure 34 on page 111).

3 In the Type field, click byProtocolId.

4 To specify the VLAN port membership, click the ellipsis (...) for one of the following fields.

- Port Members
- StaticMembers
- NotAllowedToJoin

The VlanPortMembers dialog box opens (see Figure 32 on page 104).

5 In the VlanPortMembers dialog box, click each port button to achieve the desired membership color.

- Yellow: Potential members—dynamic. Potential members are treated as always members.
- Green: Always members—static
- Red: Never members—not allowed to join

Note: In a user-defined protocol-based VLAN on an 8600 module, a potential member becomes an active member when a frame from the specified protocol is received. On an 8100 module, all potential members are active members.

6 In the Protocolid field, click usrDefined.

The UserDefinedPID field becomes editable and also the Encap field becomes active(Figure 34 on page 111).

7 In the UserDefinedPID field, enter the PID for the protocol in the format: 0x (protocol type in hexadecimal).

In the 8600 modules, the 16-bit PID assigned to a protocol-based VLAN specifies either an Ethertype, a DSAP/SSAP, or a SNAP PID, depending on whether the frame encapsulation is Ethernet 2, 802.2, or LLC-SNAP, respectively.

In the 8100 modules, the 16-bit PID assigned to a protocol-based VLAN only specifies an Ethertype for Ethernet 2 frame encapsulation.

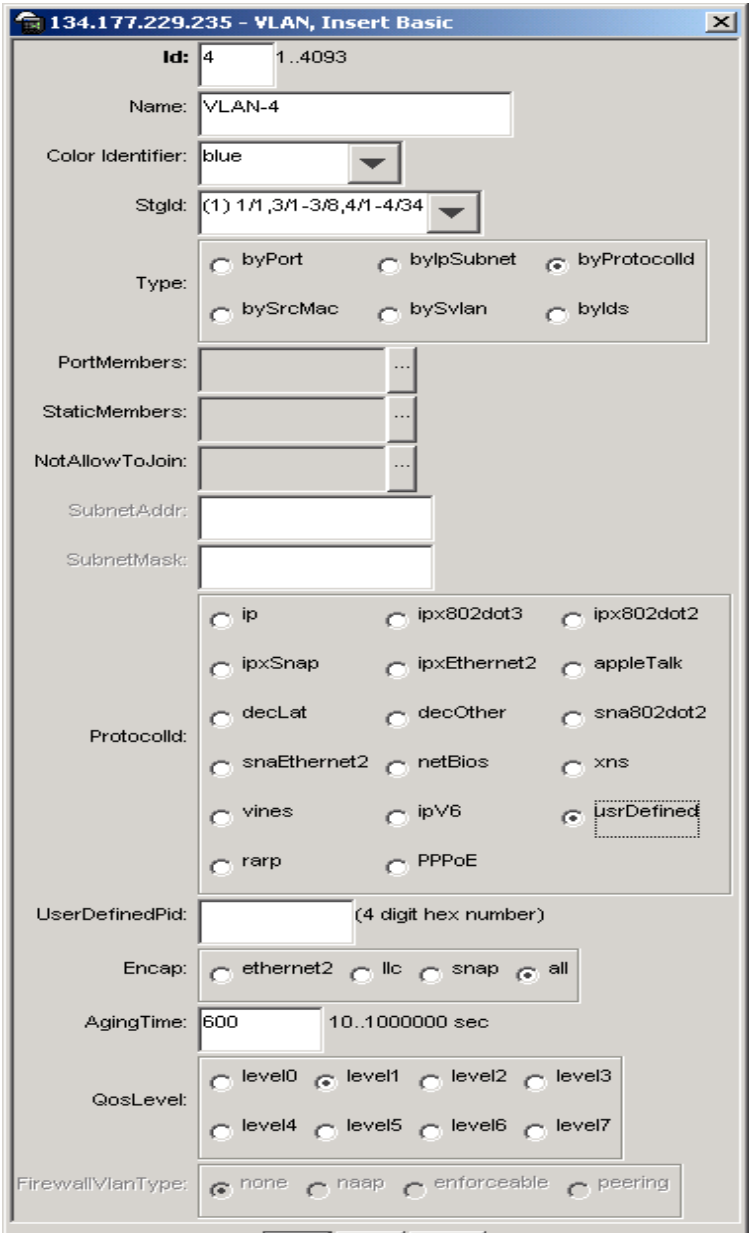
The following PIDs are not valid:

- PID0x0000 through 0x05dc: overlap with the 802.3 frame length
- PIDs of predefined protocols (for example, IP, IPX, AppleTalk)
- PID 0x8100: reserved by 802.1Q to identify tagged frames
- PID0x9000: used by the diagnostic loopback frames
- PID0x8808: used by 802.3x pause frames
- PID0x4242: overlaps with the BPDU DSAP/SSAP

8 Do one of the following:

- For Passport 8100 switch modules, go to Step 9.
- For Passport 8600 switch modules, in the AgingTime field, specify the timeout period, in seconds, for aging out the dynamic member ports of the VLAN, or use the default of 600 seconds.

Figure 34 VLAN, Insert a user-defined, protocol-based VLAN



9 In the QosLevel field, click a level (0-7).

10 Click Insert.

The VLAN, Insert Basic dialog box closes, and the protocol-based VLAN is added to the Basic tab of the VLAN dialog box.

11 Click Close.

The non-standard protocol-based VLAN is configured.

Creating a source MAC address-based VLAN

Before creating a source MAC-based VLAN, you must first enable source MAC address-based VLANs in the system (If you have not done so previously).

This section includes the following topics:

Enabling source MAC address-based VLANs on the system

To enable source MAC address-based VLANs on the system:

1 From the Device Manager menu bar, choose Edit > Chassis.

The Chassis dialog box opens with the System tab displayed.

2 Click the Chassis tab.

The Chassis tab opens (see Figure 35 on page 114).

3 Uncheck (disable) the GlobalFilterEnable checkbox field:

- Global filters is disabled when the GlobalFilterEnable checkbox is not checked.
- Global filters is enabled when the GlobalFilterEnable checkbox is checked.

4 Click Apply.

5 Check (enable) the VlanBySrcMacEnable checkbox field:

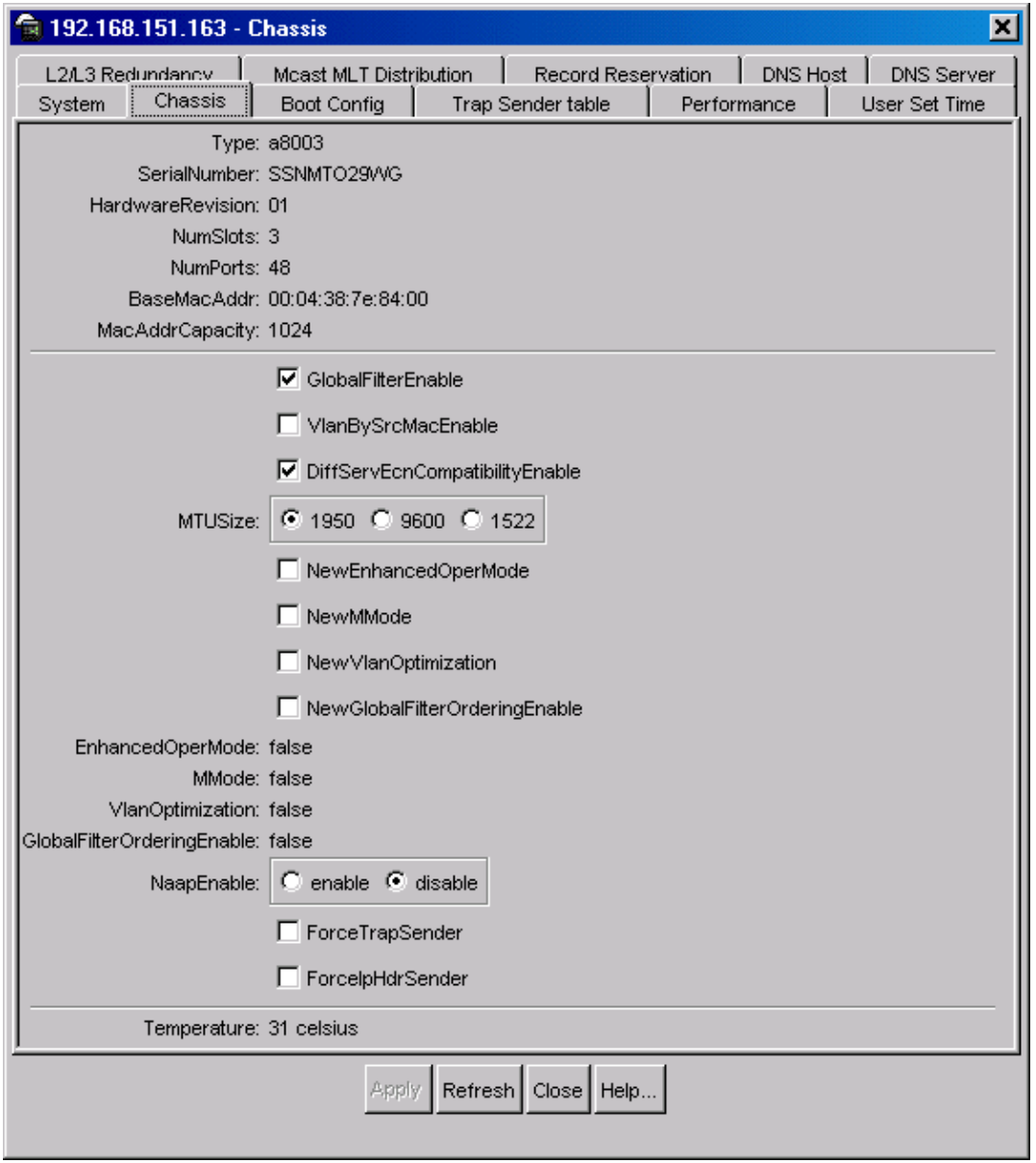
- MAC-based VLANs is disabled when the GlobalFilterEnable checkbox is not checked.

- MAC-based VLANs is enabled when the GlobalFilterEnable checkbox is checked.

6 Click Apply.

The Chassis dialog box closes and source MAC address-based VLANs are enabled on the system.

Figure 35 Chassis tab—enabling VLAN by source MAC address



Configuring a source MAC address-based VLAN

Before configuring a source MAC address-based VLAN, you must first enable source MAC address-based VLANs on the system (refer to "Enabling source MAC address-based VLANs on the system" on page 112).

To configure a source MAC-address-based VLAN:

1. From the Device Manager menu bar, choose VLAN > VLANs.

   The VLAN dialog box opens with the Basic tab displayed (see Figure 24 on page 94).

2. Click Insert.

   The VLAN, Insert Basic dialog box opens (see Figure 25 on page 97).

3. In the Type field, click bySrcMac.

   The fields needed to set up source MAC-based VLANs become editable (see Figure 36 on page 117).

4. In the ID field, type the unique VLAN ID.
5. (Optional) In the Name field, type the VLAN name, or use the one provided.
6. (Optional) In the Color Identifier field, select a color, or use the one provided.

   This color is used by VLAN Manager to visually distinguish the VLANs in a network.

7. In the StgId field, click the down arrow, and select a spanning tree group ID for the VLAN.
8. To specify the VLAN port membership, click the ellipsis (...) for one of the following fields.

   - Port Members
   - StaticMembers
   - NotAllowedToJoin

   The VlanPortMembers dialog box opens (see Figure 32 on page 104).

9. Click each port until the desired color is achieved.

- Yellow—Potential members, dynamic (Potential members are treated as always members.)
- Green—Always members, static
- Red—Never members, not allowed to join

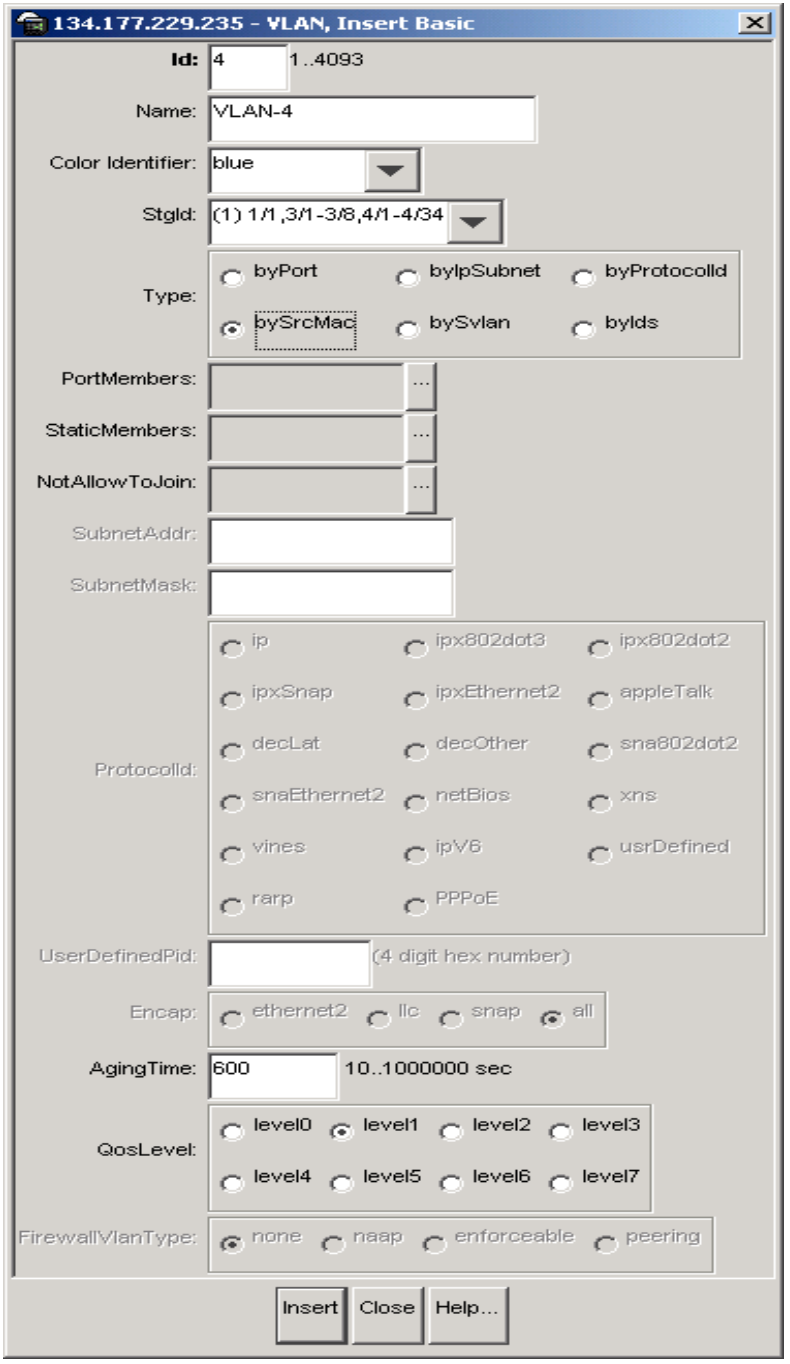
10 Click OK.

The VlanPortMembers dialog box closes, and the selected port members appear in the VLAN, Insert Basic dialog box.

11 In the Aging Time field, specify the timeout period in seconds for aging out the dynamic member ports of the VLAN, or use the default of 600 seconds.

12 (Optional) In the QosLevel field, click a quality of service level, or use the default, level 1.

Figure 36 VLAN, Insert Basic dialog box—for source MAC-based VLANs



13 In the VLAN, Insert Basic dialog box, click Insert.

The VLAN, Insert Basic dialog box closes, and the VLAN appears in the Basic tab.

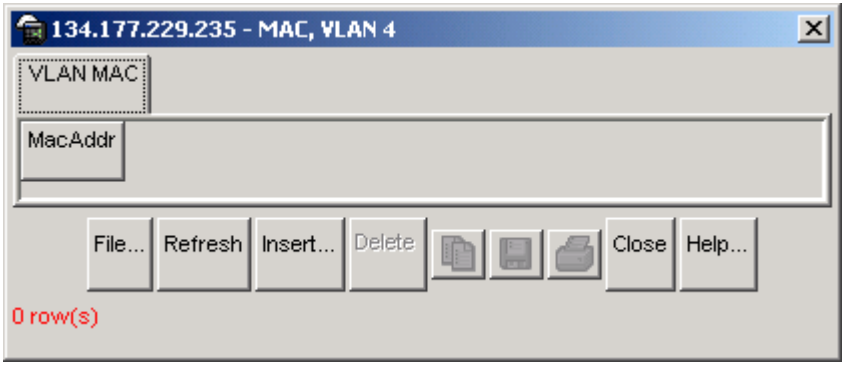
14 In the VLAN Basic tab, select the newly created VLAN.

The VLAN is highlighted.

15 Click Mac.

The MAC, VLAN dialog box opens (Figure 37).

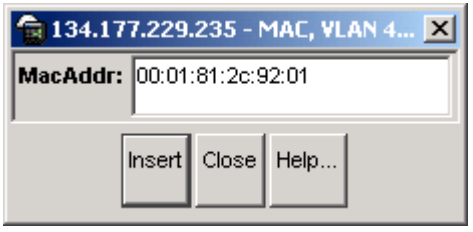
Figure 37 MAC, VLAN dialog box



16 Click Insert.

The Insert VLAN MAC dialog box opens (Figure 38).

Figure 38 Insert VLAN MAC dialog box



17 In the MacAddr field, type a source MAC address for the VLAN.

18 Click Insert.

The Insert VLAN MAC dialog box closes and the MAC address appears in the MAC, VLAN dialog box.

19 Click Close > Close.

The MAC, VLAN and VLAN dialog boxes close, and the Source MAC address-based VLAN is configured.

Note: In a source MAC-based VLAN, a potential member becomes an active member of the VLAN when a frame with the specified source MAC address is received.

Creating a source MAC address-based VLAN using batch files

Before configuring a source MAC address-based VLAN, you must first enable source MAC address-based VLANs on the system (refer to "Enabling source MAC address-based VLANs on the system" on page 112).

To create a source MAC address-based VLAN using batch files:

1 From the Device Manager menu bar, choose VLAN > VLANs.

The VLAN dialog box opens with the Basic tab displayed (see Figure 27 on page 99).

2 Click Insert.

The VLAN, Insert Basic dialog box opens (see Figure 25 on page 97).

3 In the Type field, click bySrcMac.

The fields needed to set up source MAC-based VLANs become editable.

4 In the ID field, type the unique VLAN ID.

5 (Optional) In the Name field, type the VLAN name, or use the one provided.

6 (Optional) In the Color Identifier field, select a color, or use the one provided.

This color is used by VLAN Manager to visually distinguish the VLANs in a network.

7 In the StgId field, click the down arrow, and select a spanning tree group ID for the VLAN.

8 To specify the VLAN port membership, click the ellipsis (...) for one of the following fields.

- Port Members
- StaticMembers
- NotAllowedToJoin

The VlanPortMembers dialog box opens (see Figure 32 on page 104).

9 Click each port until the desired color is achieved.

- Yellow—Potential members, dynamic (Potential members are treated as always members.)
- Green—Always members, static
- Red—Never members, not allowed to join

Note: In a source MAC address-based VLAN, a potential member becomes an active member of the VLAN when a frame with the specified source MAC address is received.

10 Click OK.

The VlanPortMembers dialog box closes, and the selected port members appear in the VLAN, Insert Basic dialog box.

11 In the Aging Time field, specify the timeout period, in seconds, for aging out the dynamic VLAN member ports, or use the default of 600 seconds.

12 (Optional) In the QosLevel field, click a quality of service level, or use the default, level 1.

13 Click Insert.

The VLAN, Insert Basic dialog box closes, and the VLAN appears in the Basic tab.

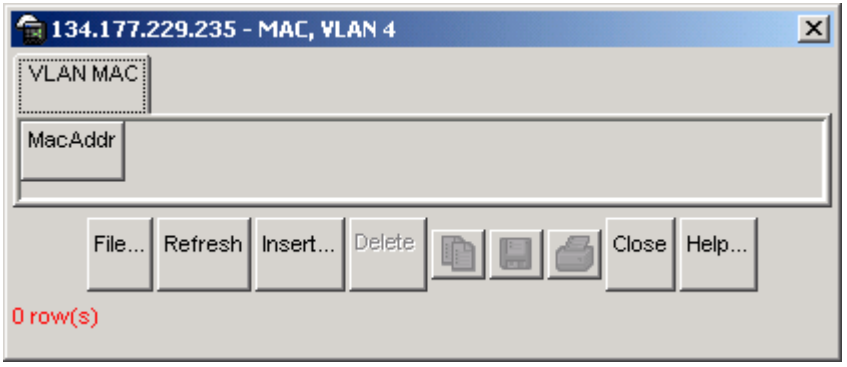
14 In the VLAN Basic tab, select the newly created VLAN.

The VLAN is highlighted.

15 Click Mac.

The MAC, VLAN dialog box opens (see Figure 39 on page 122).

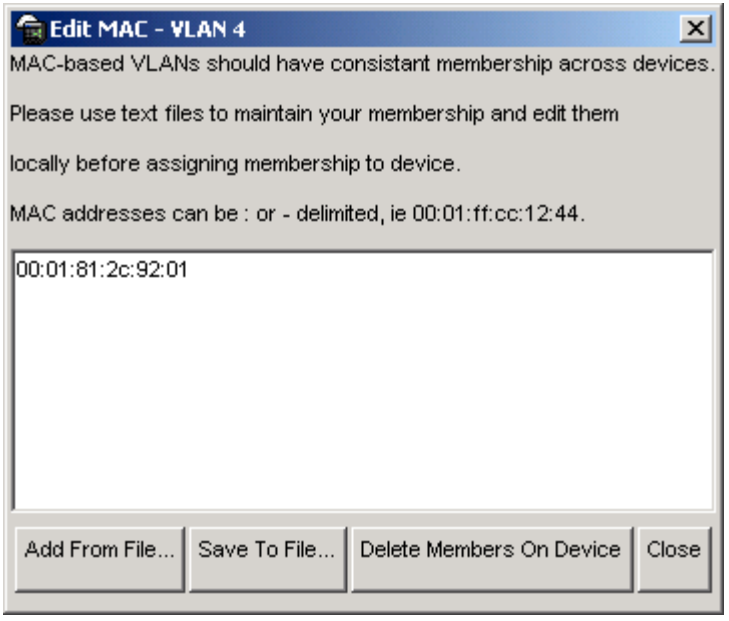
Figure 39 MAC, VLAN dialog box



16 Click File.

The Edit MAC VLAN dialog box opens (Figure 40).

Figure 40 Edit MAC VLAN dialog box



17 Do one of the following:

- To add a MAC address from a file, click Add From File and use the selection dialog box to browse for the file location.
- To save a MAC address to a file, select it, click Save to File, and use the selection dialog box to browse for a save location.

- To delete a MAC address, select it, and click Delete Members on Device.

18 Click Close.

The Edit MAC dialog box closes.

19 Click Close in the MAC VLAN, and VLAN dialog boxes.

The source MAC address-based VLAN is configured.

Managing a VLAN

This section includes the following topics:

Note: After you create a VLAN, you cannot change the VLAN-type. You must first delete the VLAN, and then create a new VLAN of a different type.

Changing VLAN port membership

To change a VLAN's port membership:

1. On the Device Manager menu bar, choose VLAN > VLANs.

   The VLAN dialog box opens with the Basic tag displayed (see Figure 24 on page 94).

2. Double-click the PortMember field for the VLAN whose ports you want to change.

   The VLAN's Port Member dialog box opens.

3. Click the port members to add or remove.
4. Click Ok.

   The Port Member dialog box closes and the changes appear in the Basic tab.

5. In the VLAN dialog box, click Apply.

   The VLAN's port membership is changed and the VLAN dialog box closes.

Configuring advanced VLAN features

The Advanced tab contains advanced fields including the Action field, which may be useful in troubleshooting.

1 From the Device Manager menu bar, choose VLAN > VLANs.

The VLAN dialog box opens with the Basic tab displayed (see Figure 24 on page 94).

2 Click the Advanced tab.

The Advanced tab opens (Figure 41).

Figure 41 VLAN dialog box—Advanced tab

Table 8 describes the VLAN Advanced tab fields.

Table 8 Advanced tab fields

Field	Description
Id	The VLAN ID.
Name	The name of the VLAN.
IfIndex	The logical interface index assigned to the VLAN; select a value from 2049 to 4095.
Type	Type of VLAN: • byPort • byIpSubnet • byProtocolId (8600 modules and 8100 modules) • bySrcMac (8600 modules only) • bySvlan (8600 modules only) • byIds

Table 8 Advanced tab fields (continued)

Field	Description
ProtocolId	Specify the network protocol for protocol-based VLANs. This value is taken from the Assigned Numbers RFC. • ip (IP version 4) • ipx802dot3 (Novell IPX on Ethernet 802.3 frames) • ipx802dot2 (Novell IPX on IEEE 802.2 frames) • ipxSnap (Novell IPX on Ethernet SNAP frames) • ipxEthernet2 (Novell IPX on Ethernet Type 2 frames) • appleTalk (AppleTalk on Ethernet Type 2 and Ethernet SNAP frames) • decLat (DEC LAT protocol) • decOther (Other DEC protocols) • sna802dot2 (IBM SNA on IEEE 802.2 frames) • snaEthernet2 (IBM SNA on Ethernet Type 2 frames) • netBIOS (NetBIOS protocol) • xns (Xerox XNS) • vines (Banyan VINES) • ipv6 (IP version 6) • usrDefined (user-defined protocol) • RARP (Reverse Address Resolution protocol) • PPPoE (Point-to-point protocol over Ethernet) **Note**: if the VLAN type is port-based, *None* is displayed in the Basic tab ProtocolId field.
Encap	Displays the encapsulation method. Values are: • Ethernet II • SNAP • LLC • RAW
AgingTime	The timeout period in seconds for aging out the dynamic member ports of policy-based VLANs.
MacAddress	The MAC address assigned to the virtual router interface for this VLAN. *This field is relevant only when the VLAN is configured for routing*. This MAC address is used as the Source MAC in routed frames, ARP replies, or RIP and OSPF frames.

Table 8 Advanced tab fields (continued)

Field	Description
Vlan Operation Action	One of the following VLAN-related actions: • flushMacFdb—flush MAC forwarding table for VLAN • flushArp—flush ARP table for VLAN • flushIp—flush IP route table for VLAN • flushDynMemb—flush dynamic VLAN port members • all—flush all tables for VLAN • flushSnoopMem—flush dynamically learned multicast group membership • triggerRipUpdate—set automatic triggered updates for RIP • flushSnoopMRtr—flush learned multicast router ports
Result	Result code for action.
UserDefinedPid	Specifies the 16-bit user-defined network protocol identifier when the ProtocolID field is set to usrDefined for a protocol-based VLAN type. Note: when in Enhanced mode, you cannot create more than 748 UserDefined protocol-based VLANs.
UserPriority	User-assigned priority level.
QosLevel	User-assigned Quality of Service level.
FirewallVlanType	The firewall type used for this VLAN. Values are: • None • NAAP • Enforceable • Peering

Configuring a VLAN to accept tagged or untagged frames

Perform the following steps to configure a VLAN to accept tagged or untagged frames from a port:

1. In the Device Manager Main window, select the port.

   The port is highlighted.

2. From the Device Manager menu bar, choose Edit > Port.

   The Port dialog box opens with the Interface tab displayed (see Figure 42 on page 129).

3 Click the VLAN tab.

The VLAN tab opens (see Figure 43 on page 130).

Figure 42 Port dialog box—Interface tab

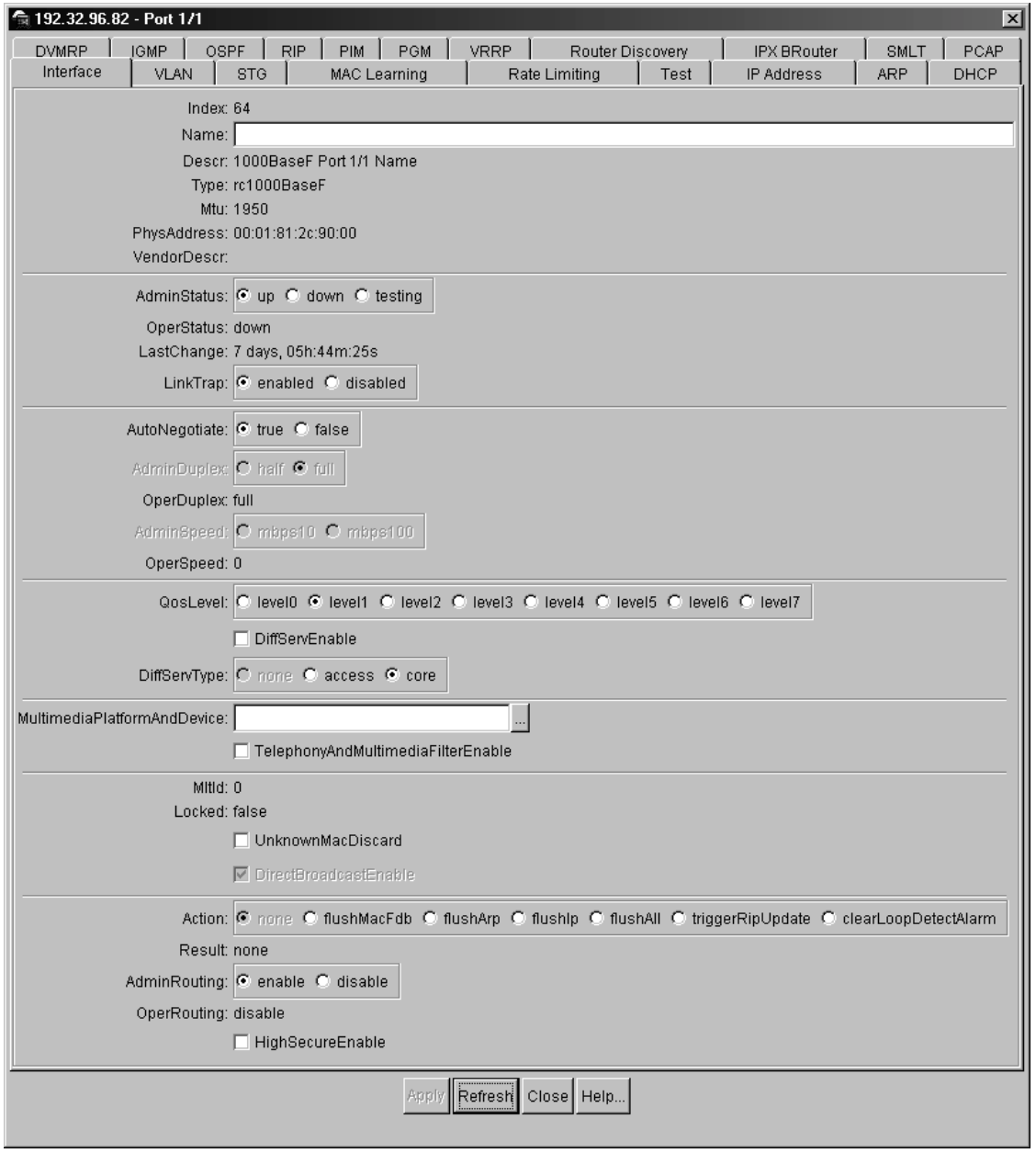
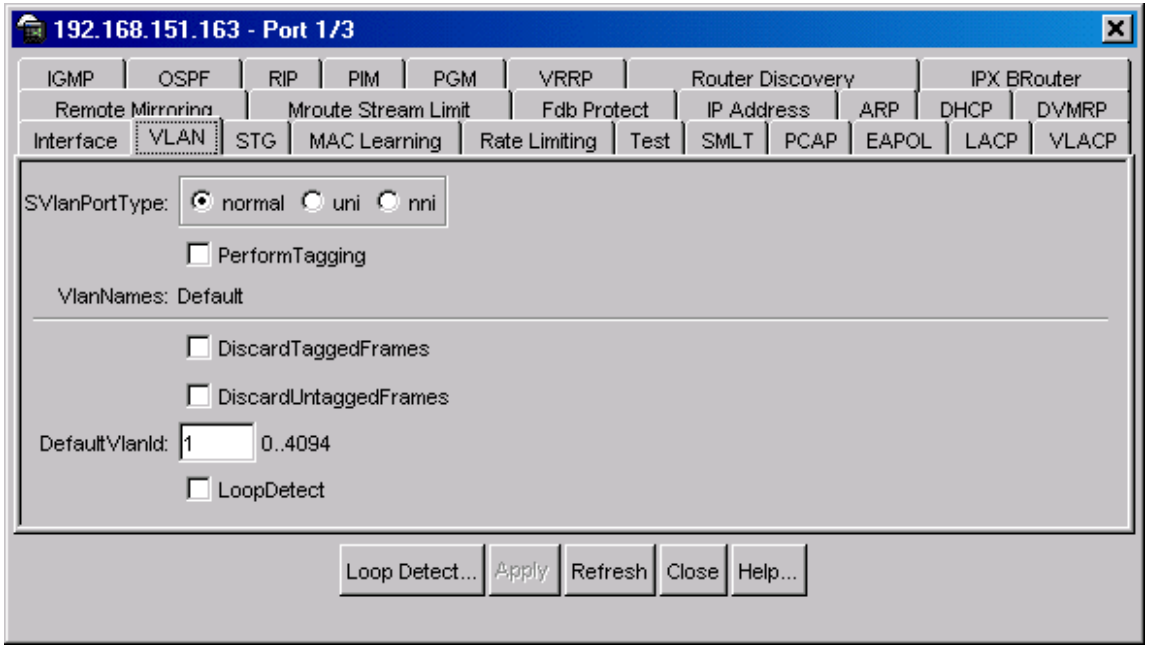


Figure 43 Port dialog box—VLAN tab



4 To configure tagging on the port, click the PerformTagging field. This setting is applied to all VLANs associated with the port.

If the box is checked, tagging is enabled. All frames sent from this port are tagged. You can either discard the tagged frames (go to Step 5) or forward them to a VLAN (go to Step 6).

- If the box is unchecked, tagging is disabled. The port does not send tagged frames. The switch removes the tag before sending the frame out of the port. You can either discard the untagged frames (go to Step 5) or forward them to a VLAN (go to Step 6).

Note: When you enable tagging on an untagged port, the port's previous configuration of VLANs, STGs, and MLTs is lost. In addition, the port resets and runs Spanning Tree Protocol, thus breaking connectivity while the protocol goes through the normal blocking and learning states before the forwarding state.

5 Do one of the following:

- To discard tagged frames on a port for which tagging is disabled, click DiscardTaggedFrames.
- To discard untagged frames on a port for which tagging is enabled, click DiscardUntaggedFrames.

Note: To optimize performance, on untagged ports in configurations where you do not expect to see tagged frames, you should set DiscardTaggedFrames to true. However, on untagged ports for interconnecting switches, it is probably better to set DiscardTaggedFrames to false.

6 To designate a default VLAN to associate with discarded frames, enter a VLAN ID in the Default VLAN ID field (or use the default VLAN 1).

7 Click Apply > Close.

Tagging is configured for the port.

Configuring MAC address auto-learning on a VLAN

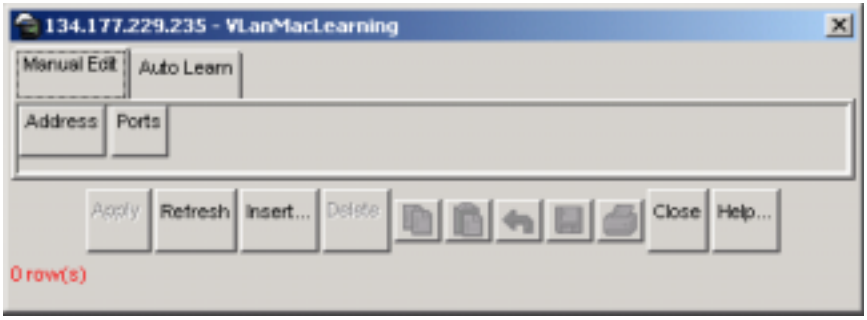
You can use MAC address auto-learning to define VLAN ports that you want to automatically learn MAC addresses.

To configure MAC address learning for a VLAN:

1 From the Device Manager menu bar, choose VLAN > MAC Learning.

The VlanMacLearning dialog box opens with the Manual Edit tab displayed (see Figure 44 on page 132).

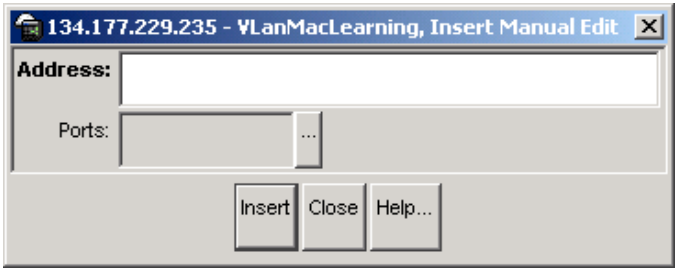
Figure 44 VlanMacLearning, Edit tab



2 Click Insert.

The VLAN MAC Learning, Insert Manual Edit dialog box opens (Figure 45).

Figure 45 VLAN MAC Learning, Insert Manual Edit dialog box

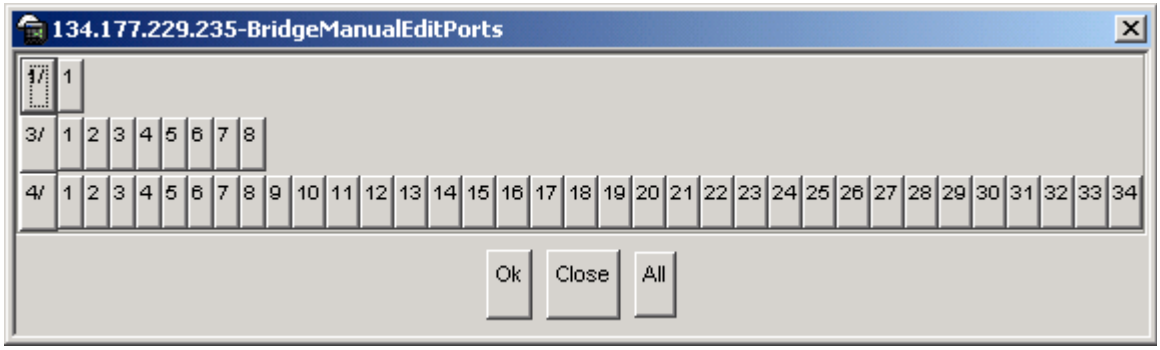


3 In the Address field, enter the source MAC address.

4 In the Ports field, click the ellipsis (...).

The BridgeManualEditPorts dialog box opens and shows the available ports (Figure 46).

Figure 46 Bridge Manual Edit Ports dialog box



5 Click the ports you want to perform the VLAN MAC learning, and click Close.

The BridgeManualEditPorts dialog box closes and the port numbers are added to the Insert Manual Edit dialog box.

6 In the Insert Manual Edit dialog box, click Insert.

The Insert Manual Edit dialog box closes and the MAC address and ports are added to the VLAN MAC Learning Manual Edit dialog box.

7 In the VLAN MAC Learning Manual Edit dialog box, click Close.

VLAN MAC learning is configured and the dialog box closes.

Table 9 describes the Insert Manual Edit tab fields.

Table 9 VLAN MAC Learning, Insert Manual Edit tab fields

Field	Description
Address	The source MAC address of an entry.
Ports	The allowed ports on which the MAC address of this entry are learned.

Modifying auto-learned MAC addresses

Use the Auto Learn tab to change a MAC address which has been automatically learned to one which can be manually edited.

To modify a MAC address that was automatically learned:

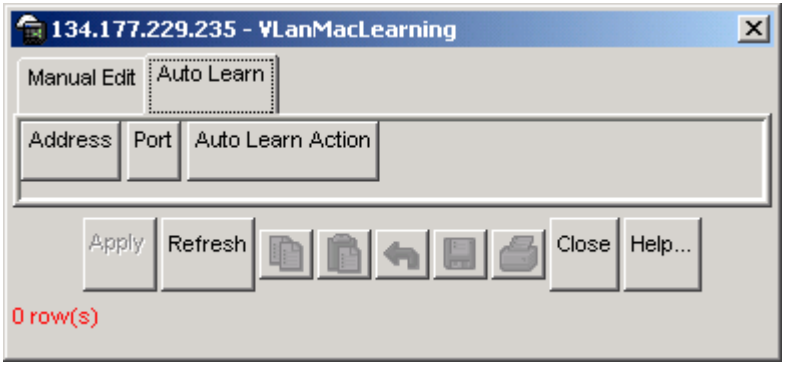
1. On the Device Manager menu bar, choose VLAN > MAC Learning.

   The VlanMacLearning dialog box opens with the Manual Edit tab displayed (see Figure 41 on page 125).

2. Click the Auto Learn tab.

   The Auto Learn tab opens and displays automatically learned MAC addresses (see (Figure 47).

Figure 47 VlanMacLearning dialog box—Auto Learn tab



3. Double-click in the Auto Learn Action field for the address you want to change, and select convertToManualEdit from the dropdown list.
4. Click Apply.

   The Auto Learn Action is changed.

Table 10 describes the VLAN Auto Learn tab fields.

Table 10 VLAN Auto Learn tab fields

Field	Description
Address	The source MAC address of the auto-learned entries.
Port	The port where the MAC address was learned.
Auto Learn Action	This field is for converting an auto-learned MAC address entry to a manual edit MAC address entry. The variable provides a mechanism for you to move a MAC address entry from the auto-learned table to the Manual Edit table. Settings: • None • convertToManualEdit

Managing VLAN bridging

Bridging occurs in layer 2 of the OSI model, where only the MAC address in the packet header is considered when forwarding. With the Passport 8000 Series switch, all bridging is done within the context of a VLAN where each VLAN has its own bridging configuration and forwarding table.

This section includes the following topics:

Configuring and monitoring bridging

To configure and monitor bridging:

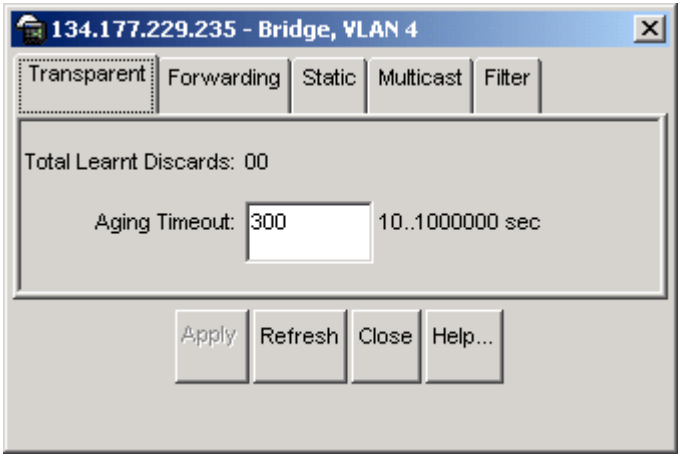
1 From the Device Manager menu bar, choose VLAN > VLANs.

The VLAN dialog box opens with the Basic tab displayed (see Figure 27 on page 99).

2 In the VLAN dialog box, select a VLAN and click Bridge.

The Bridge, VLAN dialog box opens with the Transparent tab displayed (Figure 48).

Figure 48 Bridge, VLAN dialog box—Transparent tab



3 In the Aging Timeout field, enter an interval, in seconds (10 - 1000000) for aging out dynamically learned forwarding information, or keep the default (300 seconds).

4 Click Apply and then click Close.

Your changes are applied and the Bridge, VLAN dialog box closes.

Table 11 describes the Bridge VLAN—Transparent tab fields.

Table 11 Bridge VLAN—Transparent tab fields

Field	Description
Total Learnt Discards	The total number of Forwarding Database entries that have been or would have been learned but have been discarded due to a lack of space in the Forwarding Database. If this counter is increasing, it indicates that the Forwarding Database is regularly becoming full (a condition that affects subnetwork performance). If this counter has a significant value but is not presently increasing, it indicates that the problem has been occurring but is not persistent.
AgingTimeout	The timeout period in seconds for aging out dynamically learned forwarding information.The IEEE 802.1D-1990 standard recommends a default of 300 seconds. You can assign an actual aging time up to two times the AgingTime value.

Viewing the forwarding database for a specific VLAN

The Forwarding tab shows the forwarding database for the VLAN and contains unicast information about bridge forwarding and/or filtering. This information is used by transparent bridging to determine how to forward a received frame.

To view all entries in the forwarding database, for a specific VLAN:

1 From the Device Manager menu bar, choose VLAN > VLANs.

The VLAN dialog box opens with the Basic tab displayed (Figure 49).

Figure 49 VLAN dialog box—Basic tab

2 In the VLAN dialog box—Basic tab, select a VLAN and click Bridge.

The Bridge, VLAN dialog box opens with the Transparent tab displayed (see Figure 48 on page 136).

3 In the Bridge VLAN dialog box, click the Forwarding tab.

The Bridge VLAN dialog box—Forwarding tab opens (Figure 50).

Figure 50 Bridge, VLAN dialog box—Forwarding tab

Table 12 describes the Bridge VLAN Forwarding tab fields.

Table 12 Bridge VLAN Forwarding tab fields

Field	Description
Status	Values include: • self—one of the bridge's addresses • learned—a learned entry that is being used • mgmt—a static entry
MacAddress	A unicast MAC address for which the bridge has forwarding and/or filtering information.
VlanId	The ID of the VLAN.
Port	Either a value of zero (0) or the port number of the port on which a frame having the specified MAC address has been seen. A value of 0 indicates a self-assigned MAC address.
Monitor	Select true or false to copy packets with a MAC address in the source or destination field. Used with port mirroring.
QosLevel	Quality of Service level.
SmltRemote	Specifies whether you want to use split multilink trunking.

Viewing all forwarding database entries

To view all entries in the forwarding database:

1 From the Device Manager menu bar, choose VLAN > VLANs.

The VLAN dialog box opens with the Basic tab displayed (Figure 51).

Figure 51 VLAN dialog box—Basic tab

2 In the VLAN dialog box—Basic tab, click the Forwarding tab.

The VLAN dialog box—Forwarding tab opens (Figure 52).

Figure 52 VLAN dialog box—Forwarding tab

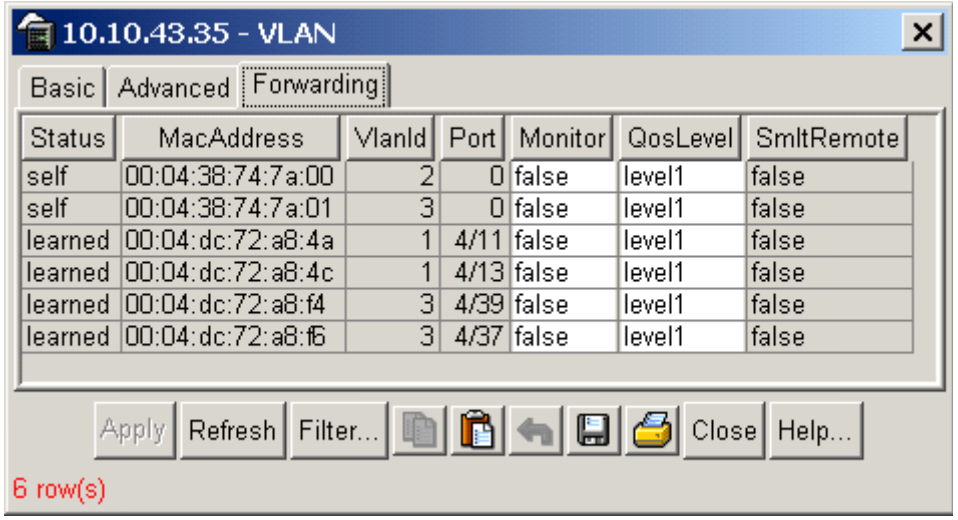


Table 13 describes the VLAN dialog box—Forwarding tab fields.

Table 13 Forwarding tab fields

Field	Description
Status	Values include: • self — one of the bridge's addresses • learned — a learned entry that is being used • mgmt— a static entry
MacAddress	A unicast MAC address assigned to the virtual router interface of this VLAN.
Vlanid	The ID of the VLAN. This value corresponds to the lower 12 bits in the IEEE 802.1Q VLAN Tag.
Port	Either the value zero (0), or the port number of the port on which a frame having the specified MAC address has been seen. has been seen. A value of 0 indicates that the port number has not been learned but that the bridge does have some forwarding/ filtering information about this address (for example, in the dot1dStaticTable). Assign the port value to this object whenever it is learned even for addresses for which the corresponding value of rcBridgeFdbStatus is not learned(3).
Monitor	Select true or false to copy packets with a MAC address in the source or destination field. Used with port mirroring.
QosLevel	The assigned Quality of Service level for all traffic from a VLAN.
SmltRemote	Specifies wither you want to use split multilink trunking.

3 Click Filter

The VLAN, Forwarding- Filter dialog box opens (Figure 53).

You can use this dialog box to select the criteria for filtering the forwarding data base records.

Figure 53 VLAN, Forwarding-Filter dialog box

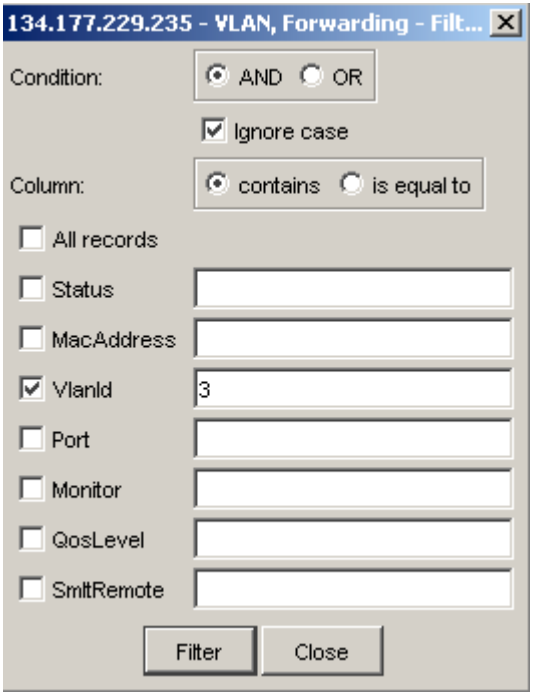


Table 14 describes the VLAN, Forwarding-Filter dialog box fields.

Table 14 VLAN, Forwarding-Filter dialog box

Field	Description
Condition	When criteria are entered into more than one field, the search will look for VLAN records as follows: • matching both criteria if AND is clicked • matching either criteria if OR is clicked Click Ignore case if you do not want the search to be case-sensitive.
Column	Sets the filtering to match on either of the following criteria: • contains • is equal to
All records	Sets all records to true to display all forwarding database records.

Table 14 VLAN, Forwarding-Filter dialog box

Field	Description
Status	Set Status to enable and specifiy the Status criteria if matching on Status should be performed. • self — one of the bridge's addresses • learned — a learned entry that is being used • mgmt— a static entry
MacAddress	Set MacAddress to enable if matching on a MAC address should be performed.
VlanID	Set VlanID to enable and specify the VLAN ID if matching on a VLAN ID should be performed.
Port	Set Port to enable and specify a port if matching on a port should be performed.
Monitor	Set Monitor to enable if matching monitoring setting should be performed.
QoSlevel	Set QoSlevel to enable if matching on the assigned Quality of Service level for all traffic from a VLAN should be performed.
SmltRemote	Set SmltRemote to enable if matching on split multilink trunking should be performed.

Clearing learned MAC addresses from the forwarding database

For troubleshooting, you may need to manually flush the bridge forwarding database of learned MAC addresses.

You can perform this procedure for all MAC addresses as described in the following sections:

- "Clearing learned MAC addresses by VLAN," next
- "Clearing learned MAC addresses for all VLANs by port" on page 143

Clearing learned MAC addresses by VLAN

To clear the Forwarding database of learned MAC addresses for a VLAN:

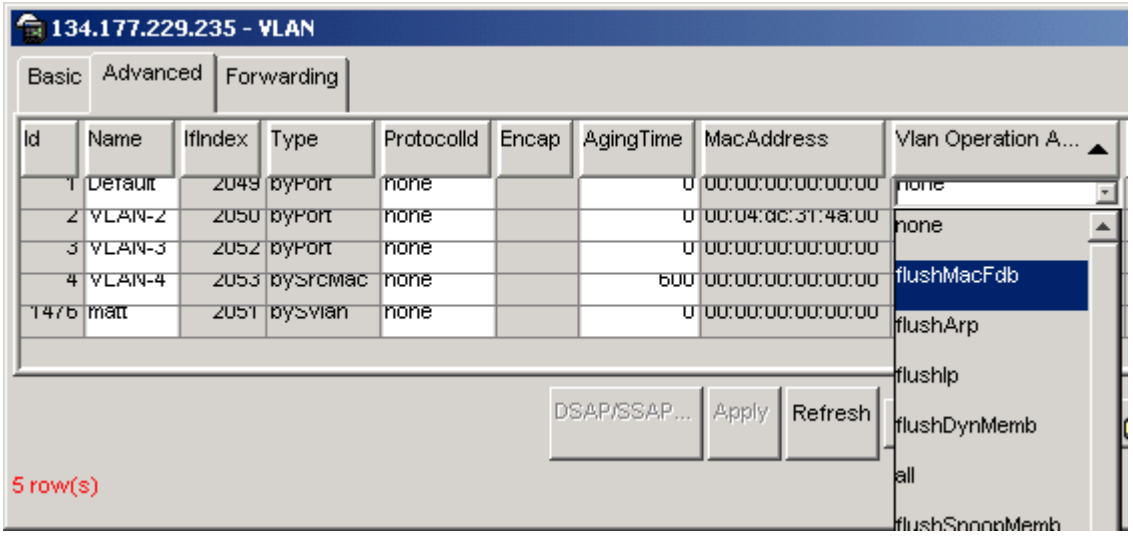
1 From the Device Manager menu bar, choose VLAN > VLANs.

The VLAN dialog box opens with the Basic tab displayed (see Figure 27 on page 99).

2 In the VLAN dialog box, click the Advanced tab.

The Advanced tab opens (see Figure 54 on page 143).

Figure 54 VLAN dialog box—Advanced tab—flushing the forwarding database



3 Double-click in the VLAN Operation Action field, and choose FlushMacFdb from the dropdown list.

4 Click Apply.

The VLAN is set for flushing the bridge forwarding database.

Clearing learned MAC addresses for all VLANs by port

To clear learned MAC addresses from the forwarding database for all VLANs by port:

1 From the Device Manager Main window, select a port.

The port is highlighted.

2 From the menu bar, choose Edit > Port.

The Port dialog box opens with the Interface tab displayed (see Figure 42 on page 129).

3 In the Action field, click FlushMacFdb.

4 Click Apply.

All learned MAC addresses are cleared from the forwarding database for VLANs associated with this port.

5 Click Close.

Configuring static forwarding

The Static tab contains static forwarding information configured by local or network bridge management. The information is used to specify the set of ports that are allowed to forward frames.

Entries are valid for unicast and for group/broadcast addresses.

To configure forwarding information:

1 From the Device Manager menu bar, choose VLAN > VLANs.

The VLAN dialog box opens with the Basic tab displayed (see Figure 27 on page 99).

2 In the VLAN dialog box, select a VLAN and then click Bridge.

The Bridge, VLAN dialog box opens (see Figure 48 on page 136).

3 In the Bridge, VLAN dialog box, click the Static tab.

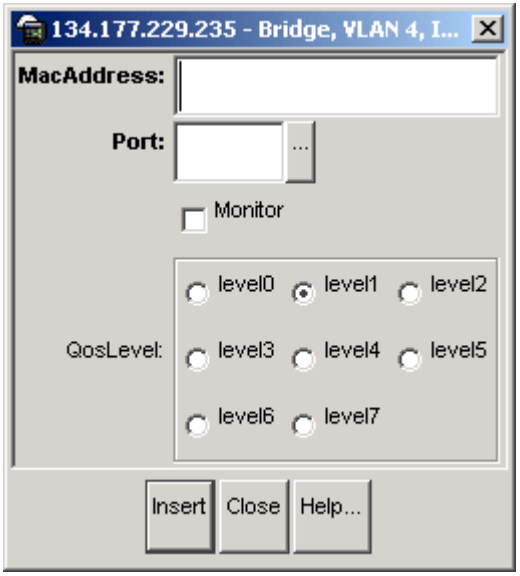
The Static tab is displayed (Figure 55).

Figure 55 Bridge, VLAN—Static tab

4 In the Static tab, click Insert.

The Bridge, VLAN Insert Static dialog box opens (Figure 56).

Figure 56 Bridge, VLAN Insert Static dialog box



5 In the MacAddress field, enter a forwarding destination MAC address.

6 In the Port field, click the ellipsis (...).

The Bridge Static Port dialog box opens.

7 Select the port on which the frame is received.

8 Click OK.

The Bridge Static Port dialog box closes and the selected port appears in the Insert Static dialog box.

9 To copy packets with a MAC address in the source or destination field, click Monitor.

10 In the QoS field, click a quality of service level (0 - 8), or keep the default, level 1.

11 Click Insert.

The Insert Static dialog box closes and the static information appears in the Bridge, VLAN Static tab.

12 Click Close.

The static forwarding information is configured, and the Bridge VLAN dialog box closes.

Table 15 describes the bridge, VLAN static fields.

Table 15 Bridge VLAN static fields

Field	Description
MacAddress	The destination MAC address in a frame to which this entry's forwarding information applies. This object can take the value of a unicast address.
Port	The port number of the port on which the frame is received.
Monitor	Setting to copy packets with a MAC address in the source or destination field. Used with port mirroring. In Static tab, display = true or false.
QosLevel	Quality of Service level.
Status	In the Static tab, displays the status of this entry. Select one of the following values: • permanent—in use and will remain so after the next bridge reset. This is the default value. • deleteOnReset—in use and will remain so until the next bridge reset. • deleteOnTimeout—currently in use and will remain so until it is aged. • other—in use but the conditions under which it will remain so are different from other values.

MAC-layer bridge packet filtering

To perform MAC-layer bridging, the switch must know the destination MAC-layer address of each device on each attached network so it can forward packets to the appropriate destination. MAC-layer addresses are then stored in the bridging table, and you can filter packet traffic based on the destination MAC-layer address information.

For MAC address filtering, the Passport 8000 Series switch supports Bridge MIB filtering (RFC 1493). The number of MAC filters is limited to 100. You can create a filter entry in much the same way as you create a static MAC entry, by entering a MAC address and the port on which it resides. In the MAC filter record, you can also specify ports to discard source or destination packets for the MAC address on a port.

Configuring a MAC-layer bridge filter

To configure a MAC layer bridge filter:

1. From the Device Manager menu bar, choose VLAN > VLANs.

   The VLAN dialog box opens with the Basic tab displayed (see Figure 27 on page 99).

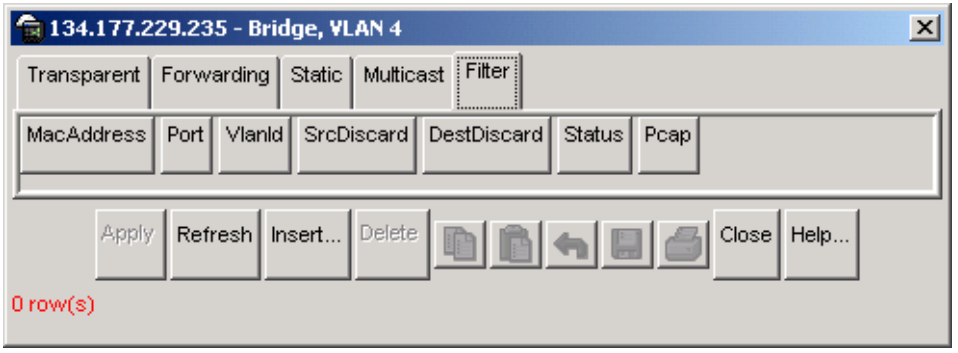
2. In the VLAN dialog box, select a VLAN and click Bridge.

   The Bridge, VLAN dialog box opens (see Figure 48 on page 136).

3. In the Bridge, VLAN dialog box, click the Filter tab.

   The Filter tab opens (Figure 57)

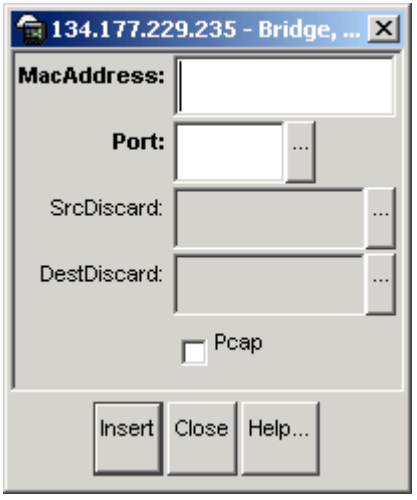
Figure 57 Bridge, VLAN Filter dialog box



4 From the Filter tab, click Insert.

The Bridge, VLAN Insert Filter dialog box opens (Figure 58).

Figure 58 Bridge, VLAN Insert Filter dialog box



5 In the MacAddress field, enter the MAC address used to match the destination address of incoming packets.

6 In the Port field, click the ellipsis (...)

The BridgeFilterPort dialog box opens.

7 Click the port where this MAC address is found, and click OK.

The BridgeFilterPort dialog box closes and the port is added to the Port field on the Bridge, VLAN, Insert Filter dialog box.

8 In the Source Discard field, click the ellipsis (...).

The Bridge Filter Source Discard dialog box opens.

9 Click the ports from which you do not want packet traffic received by this MAC address, and click OK.

The dialog box closes and the ports are added to the Source Discard field in the Bridge, VLAN, Insert Filter dialog box.

10 In the Destination Discard field, click the ellipsis (...).

The Bridge Filter Destination Discard dialog box opens.

11 Click the ports to which you do not want packet traffic sent from this MAC address, and click OK.

The dialog box closes and the ports are added to the Destination Discard field in the Bridge, VLAN, Insert Filter dialog box.

12 Click Insert.

The Insert Filter dialog box closes and the filter appears in the Filter tab.

13 In the Bridge VLAN dialog box and the VLAN dialog box, click Close.

The MAC layer bridge filter is configured.

Table 16 describes the Bridge VLAN Filter fields.

Table 16 Bridge, VLAN, Filter fields

Field	Description
MacAddress	The MAC address of this entry. This address is used to match the destination address of incoming packets.
Port	Port on which this MAC address is found.
VlanId	The ID of the VLAN.
SrcDiscard	Specify a set of ports. Traffic arriving on any of the specified ports is not forwarded to this MAC address.
DestDiscard	Specify a set of ports. Traffic arriving on any of the specified ports from this MAC address is discarded.

Table 16 Bridge, VLAN, Filter fields (continued)

Field	Description
Status	Displays the status of the VLAN. Values include: • self—one of the bridge's addresses • learned—a learned entry that is being used • mgmt—a static entry
Pcap	Enable or disable the packet capture tool (PCAP) for the MAC address (fdb filter). For more information about PCAP, see the publication *Using the Packet Capture Tool*, part number 315023.

Configuring directed broadcast on a VLAN

You can enable or disable directed broadcast traffic forwarding for an IP-interface on the Direct Broadcast tab.

To configure IP-directed broadcast for a VLAN:

1. From the Device Manager menu bar, choose VLAN > VLANs.

   The VLAN dialog box opens with the Basic tab displayed (see Figure 27 on page 99).

2. Select a VLAN.

   The VLAN is highlighted.

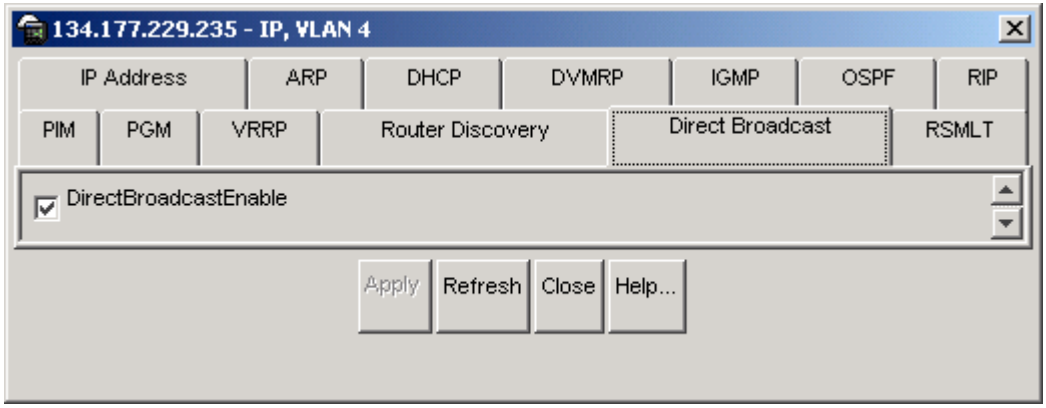
3. Click IP.

   The IP, VLAN dialog box opens with the IP Address tab displayed.

4. Click the Direct Broadcast tab.

   The Direct Broadcast tab opens (Figure 59).

Figure 59 IP, VLAN dialog box—Direct Broadcast tab



5 Click DirectBroadcastEnable.

- If checked, IP-directed broadcasts are enabled.
- If unchecked, IP-directed broadcasts are suppressed.

Note: Multiple VLANs/IRPs in the same subnet but in different switches must be configured simultaneously.

6 Click Apply and then click Close.

Directed broadcast is configured for the VLAN.

Table 17 describes the Direct Broadcast tab.

Table 17 IP, VLAN Direct Broadcast tab

Field	Description
DirectBroadcastEnable	If enabled, an Isolated Routing Port (IRP) can forward directed broadcast traffic. A directed broadcast is a frame sent to the subnet broadcast address on a remote IP subnet. By disabling or suppressing directed broadcast on an interface, all frames sent to the subnet broadcast address for a local router interface are dropped. Disabling this function protects a host from possible denial of service (DOS) attacks. **Note**: This feature is enabled by default. With the feature enabled, the CPU does not receive a copy of the directed broadcast. As a result, the switch does not respond to a subnet broadcast ping sent from a remote subnet.

Configuring Enhanced Operation mode

For more information about Enhanced Operation, see “MultiLink trunking and VLAN scalability” on page 45.

To enable Enhanced Operation mode:

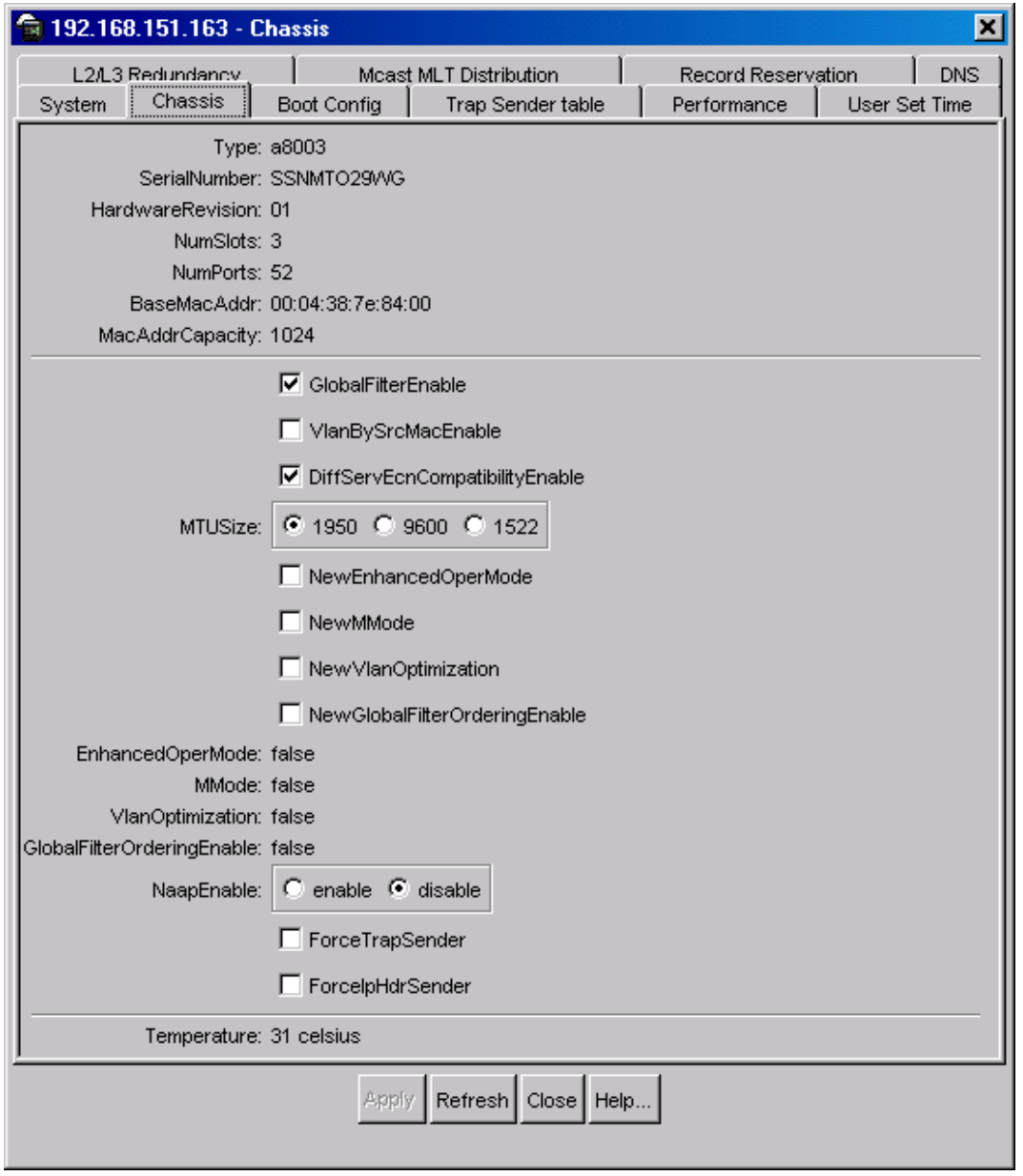
1. From the Device Manager menu bar, choose Edit > Chassis.

   The Chassis dialog box opens with the System tab displayed.

2. Click the Chassis tab.

   The Chassis tab opens (Figure 60).

Figure 60 Chassis dialog box — Chassis tab



3 Click the NewEnhancedOperMode field.

4 Click Apply.

The system notifies you that the setting will take effect after save and reboot.

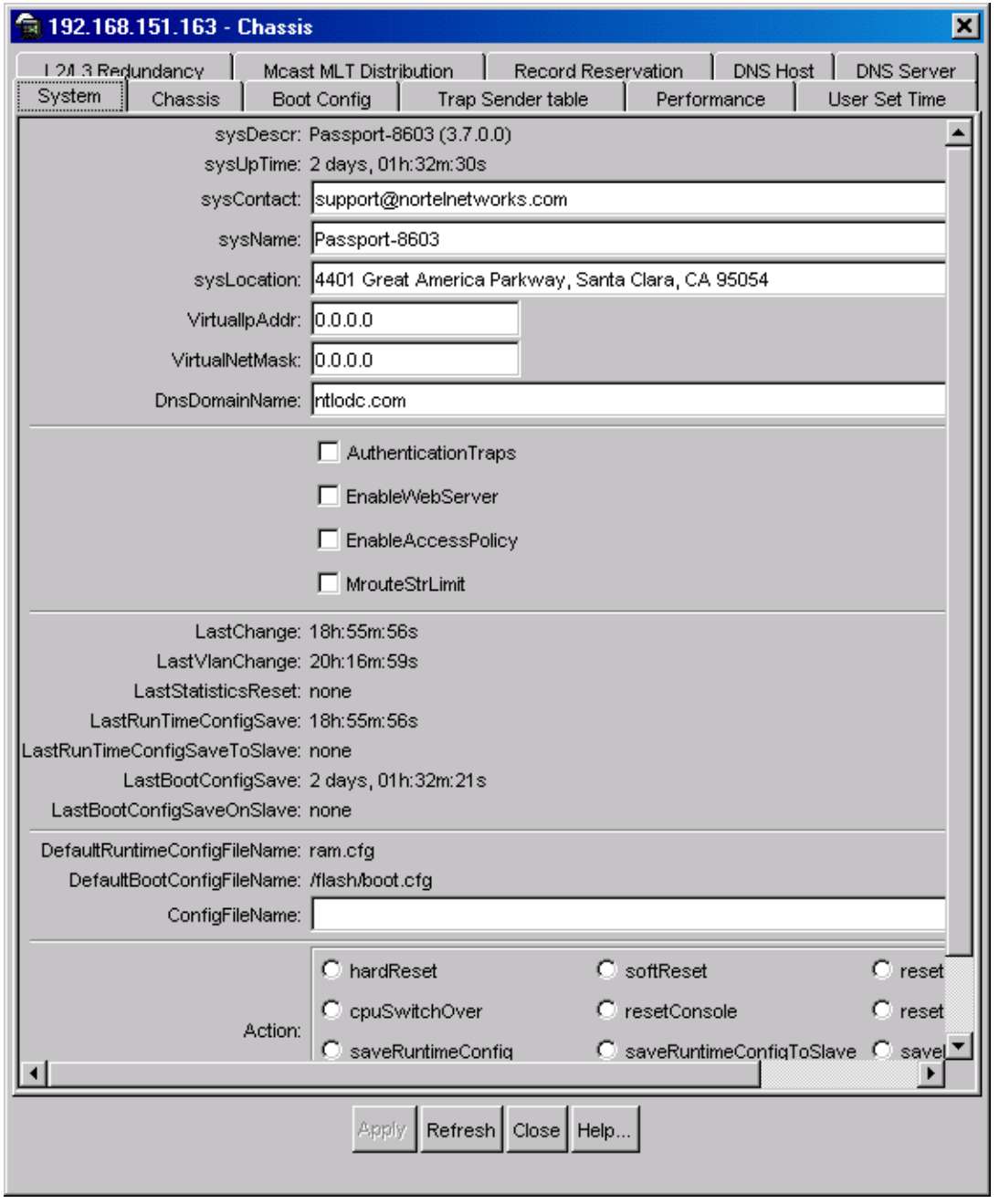
Figure 61 Chassis configuration change notification

5 Click OK.

6 Click the System tab.

The System tab opens (Figure 62).

Figure 62 Chassis—System tab



7 In the Action field, click saveRuntimeConfig.

8 Click Apply > Close.

Enhanced mode is configured.

Caution: When enhanced operation mode is enabled, only 8600 E-modules are initialized (non E-modules are placed offline). To avoid losing modules and network connectivity, either replace any non-E-modules or move the network connections to an E-module.

Chapter 3
Configuring sVLAN using Device Manager

This section describes using Device Manager to configure sVLAN on an 8600 module or an 8100 module and includes the following topics:

This chapter includes the following topics:

Stacked VLAN configuration overview

The stacked VLAN (sVLAN) protocol transparently transports packets through an sVLAN domain by adding an additional 4-byte header to each packet. For more information, see “Stacked VLANs” on page 47.

Follow these steps to configure an sVLAN using Device Manager:

Note: You must follow these steps in sequence to configure an sVLAN.

1 Change the Ether type and set the switch level to a 1 or above.

For more information, see “Setting the sVLAN Ethertype and switch level.”

2 Configure UNI and NNI ports.

For more information, see “Setting the sVLAN port type”

3 Create a STG of type sVLAN.

For more information, see “Creating an sVLAN STG.”

4 Create a VLAN of type sVLAN within the STG created in Step 3 and add ports to it.

For more information, see “Creating an sVLAN.”

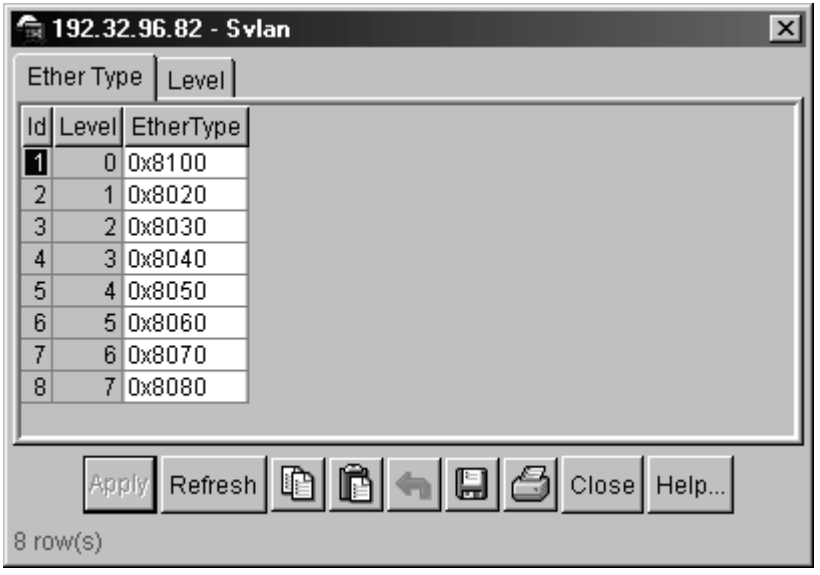
Setting the sVLAN Ethertype and switch level

To configure the sVLAN Ethertype and switch level for the switch:

1 From the Device Manager menu bar choose VLAN > sVLAN.

The sVLAN dialog box opens to the Ether Type tab (Figure 63), displaying the ether types used for sVLAN tagging.

Figure 63 sVLAN dialog box- Ether Type tab



2 Do one of the following:

- Use the default Ether Type-Switch Level mapping and continue to Step 3.
- To modify an Ethertype, double-click an EtherType field, enter a new value, and click Apply.

  The Ethertype is changed.

3 Click the Level tab.

The Level tab opens (Figure 64).

Figure 64 sVLAN dialog box- Level tab

4 In the Active Level field, enter an active switch level (1 - 7).

Note: The switch level default of 0 must be changed to a value of 1 through 7 before configuring UNI or NNI ports.

5 Click Apply.

The Ethertype and active switch level are configured.

Table 18 describes the sVLAN Ether Type tab.

Table 18 sVLAN—Ether Type tab

Field	Description
Id	Index ID for this row in the table of switch levels.

Table 18 sVLAN—Ether Type tab (continued)

Field	Description
Level	The switch level associated with this entry.
EtherType	Specifies the Ether type used for sVLAN tagging. The following are the default Ether types and switch levels: • Level 0 — 0x8100 (Ethertype defined by IEEE for 802.1Q tagged frames) • Level 1 — 0x8020 • Level 2 — 0x8030 • Level 3 — 0x8040 • Level 4 — 0x8050 • Level 5 — 0x8060 • Level 6 — 0x8070 • Level 7 — 0x8080

Table 19 describes the sVLAN Level tab.

Table 19 sVLAN—Level tab

Field	Description
Active Level	Specify the active level (0 - 7) for the switch. The default is Level 0. **Note**: You must configure the switch level to 1 or above before configuring UNI or NNI ports.

Setting the sVLAN port type

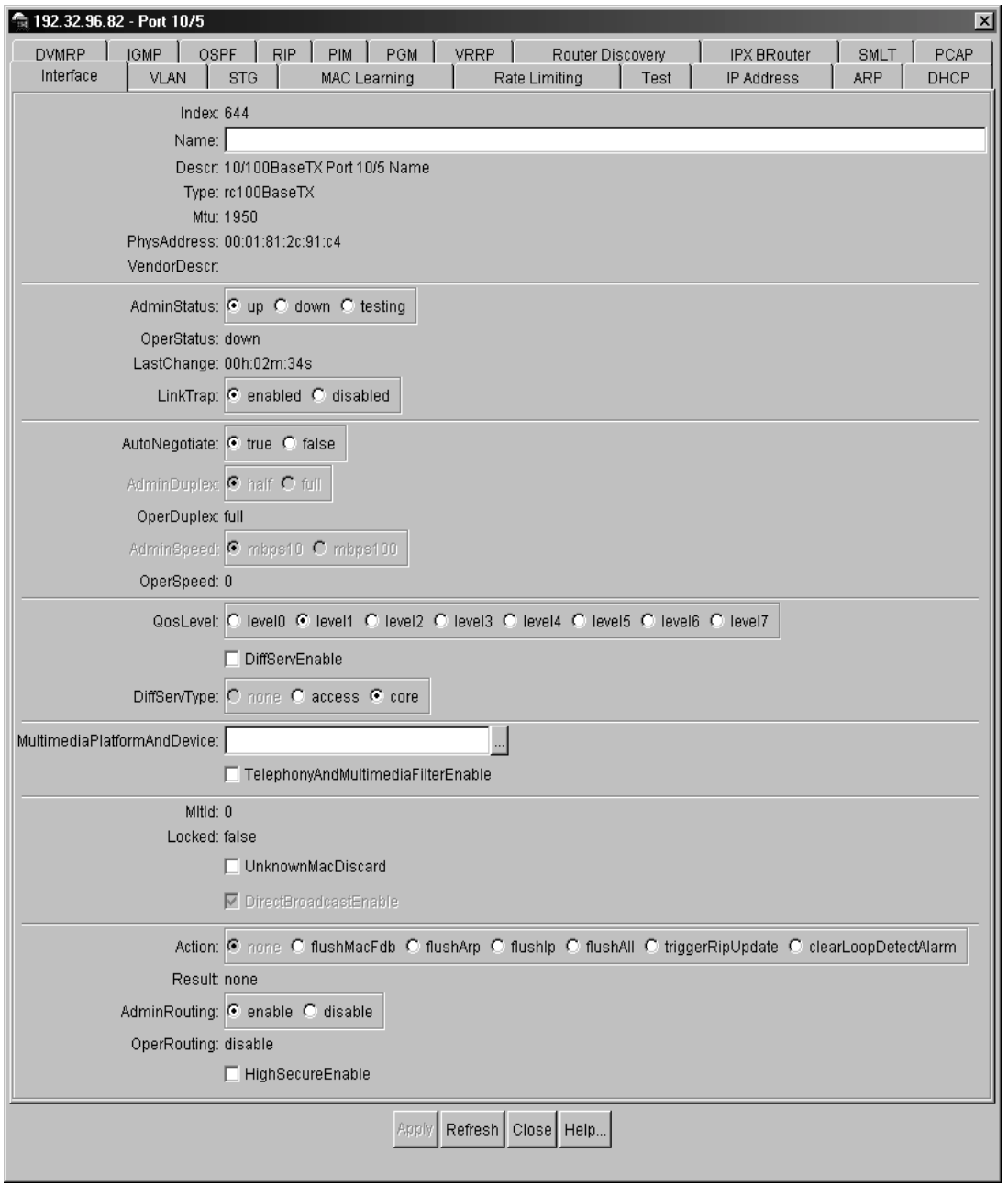
Note: You must change the switch level to 1 or above before you configure UNI or NNI ports. See "Setting the sVLAN Ethertype and switch level" on page 158."

To set the sVLAN port type:

1. From the device view, select the port.
2. From the Device Manager menu bar, choose Edit > Port.

The Port dialog box opens to the Interface tab (Figure 65).

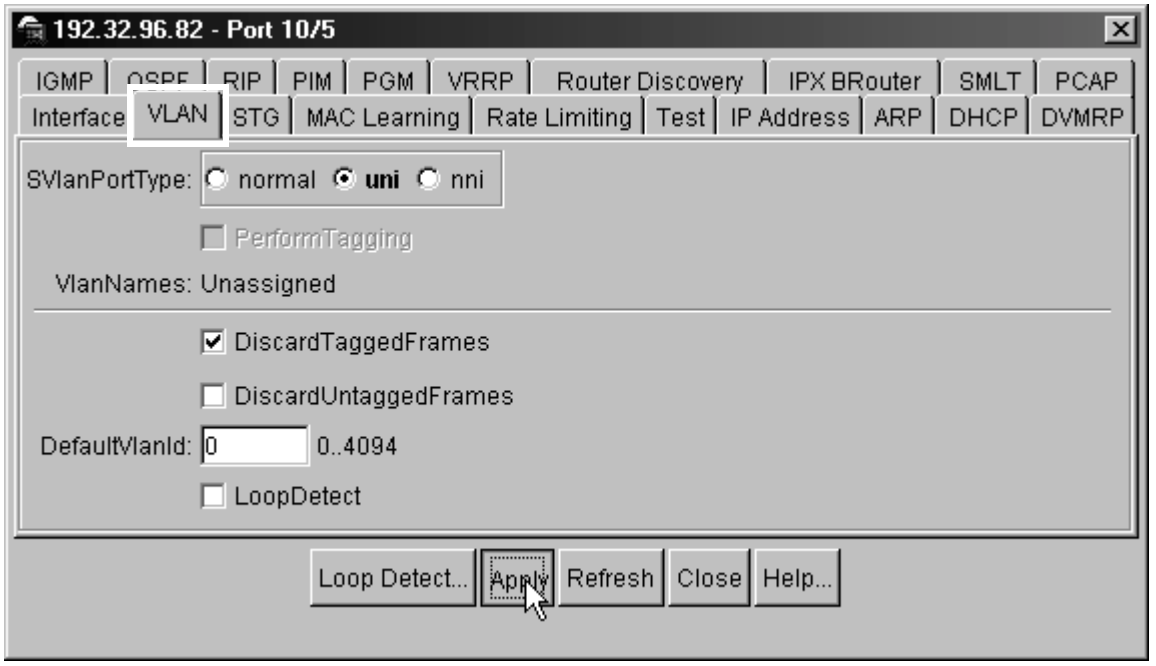
Figure 65 Port dialog box -- Interface tab



3 Click the VLAN tab.

The VLAN tab opens (Figure 66).

Figure 66 Port dialog box-- VLAN tab



4 In the sVLANPortType field, click one of the following:

- uni—User-to-Network interface.

  You must configure ports for which you want to provide VLAN transparency as UNI ports. UNI ports can only belong to one sVLAN. When you designate a port as a UNI port, the DiscardTaggedFrames parameter is automatically enabled. This prevents traffic from leaking to other VLANs.

- nni—Network-to-Network interface.

NNI ports interconnect the switches in the core network, drop untagged frames on ingress, and insert the sVLAN tag at the egress. When you configure an NNI port, the DiscardUnTaggedFrames parameter is automatically enabled.

Note: All ports within the same OctaPID have the same designation that is, all eight ports are either Normal, or all eight ports are UNI/NNI. When you change a port from normal to UNI/NNI, the other seven ports are changed automatically, and vice versa. See "Tap and OctaPID assignment" on page 349 for more details.

5 Click Apply.

The system warns you that by changing the port type, all ports in the OctaPID may be removed from all VLANs and STGs (Figure 67). This message displays the port range for the OctaPID. If you have changed a port from Normal to UNI/NNI, the other seven ports in the OctaPID are changed automatically.

Figure 67 sVLAN configuration warning

6 To continue applying the configuration, click Yes.

The sVLAN port type is configured.

7 Click Close.

The Port dialog box closes.

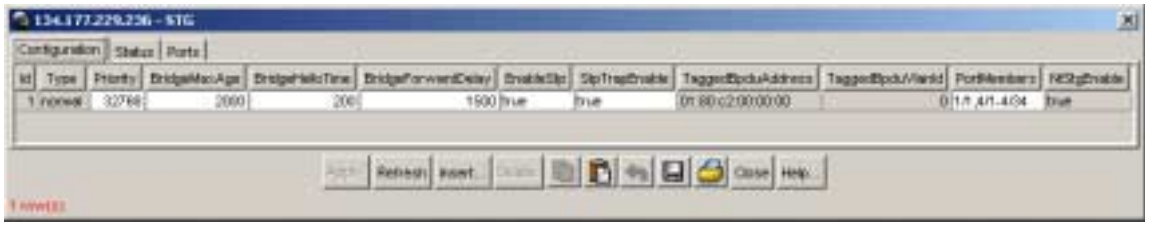
Creating an sVLAN STG

To create an sVLAN STG:

1 From the Device Manager menu bar, choose VLAN > STG.

The STG dialog box opens to the Configuration tab (Figure 68).

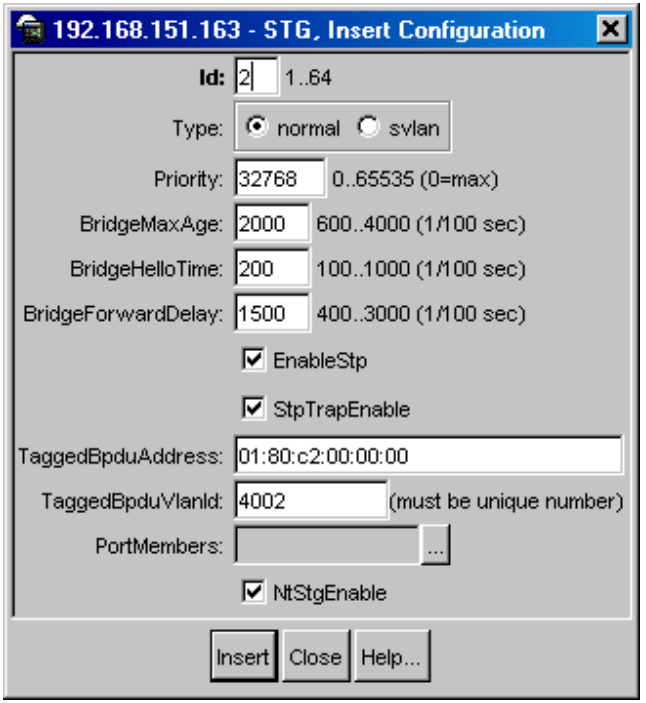
Figure 68 STG dialog box



2 Click Insert.

The STG, Insert Configuration dialog box opens (Figure 69).

Figure 69 STG, Insert Configuration dialog box



3 In the ID field, enter an STG ID, or use the displayed ID.

4 In the Type field, click svlan.

5 In the TaggedBpduAddress field, enter a MAC address to be assigned to the destination MAC address field in tagged BPDUs.

Note: The MAC address you enter must be different from the standardized BPDU MAC address.

6 In the PortMembers field, click the ellipsis (...).

The STG Port Members dialog box opens, displaying available ports.

7 Click the ports to include in the sVLAN STG, and click OK.

The STG Port Members dialog box closes, and the ports appear in the STG, Insert Configuration dialog box.

8 Click Insert.

The STG appears in the Configuration tab.

9 From the Configuration tab, click Close.

The STG is configured and the STG dialog box closes.

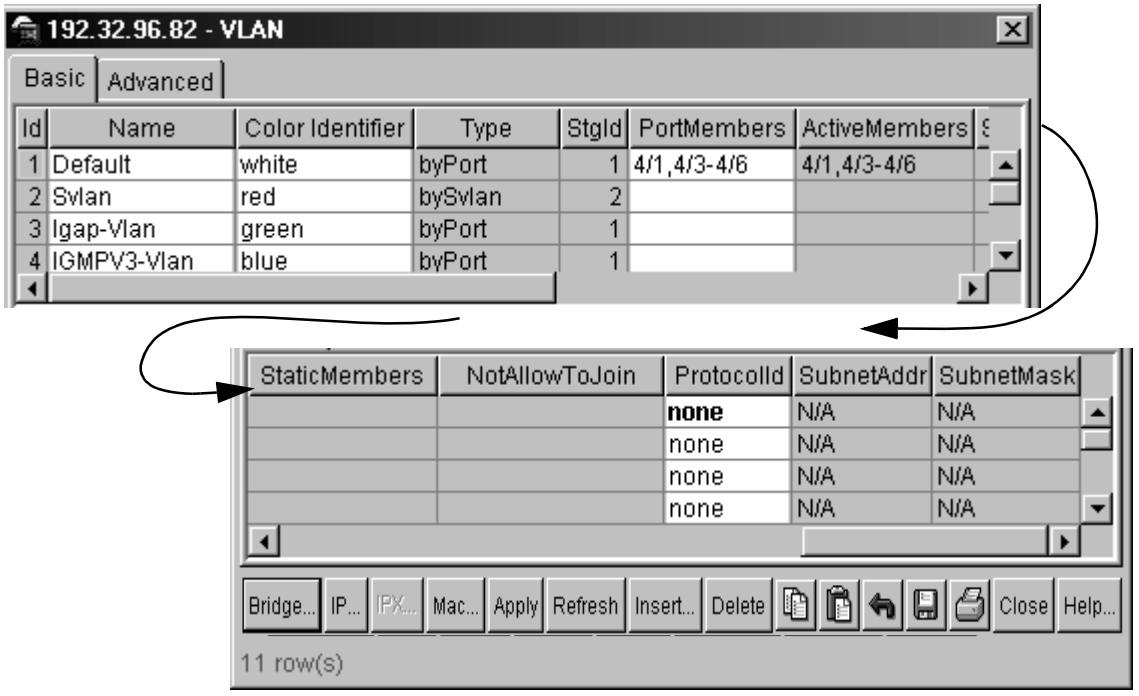
Creating an sVLAN

To create an sVLAN:

1 From the Device Manager menu bar, choose VLAN > VLANs.

The VLAN dialog box opens to the Basic tab (Figure 70).

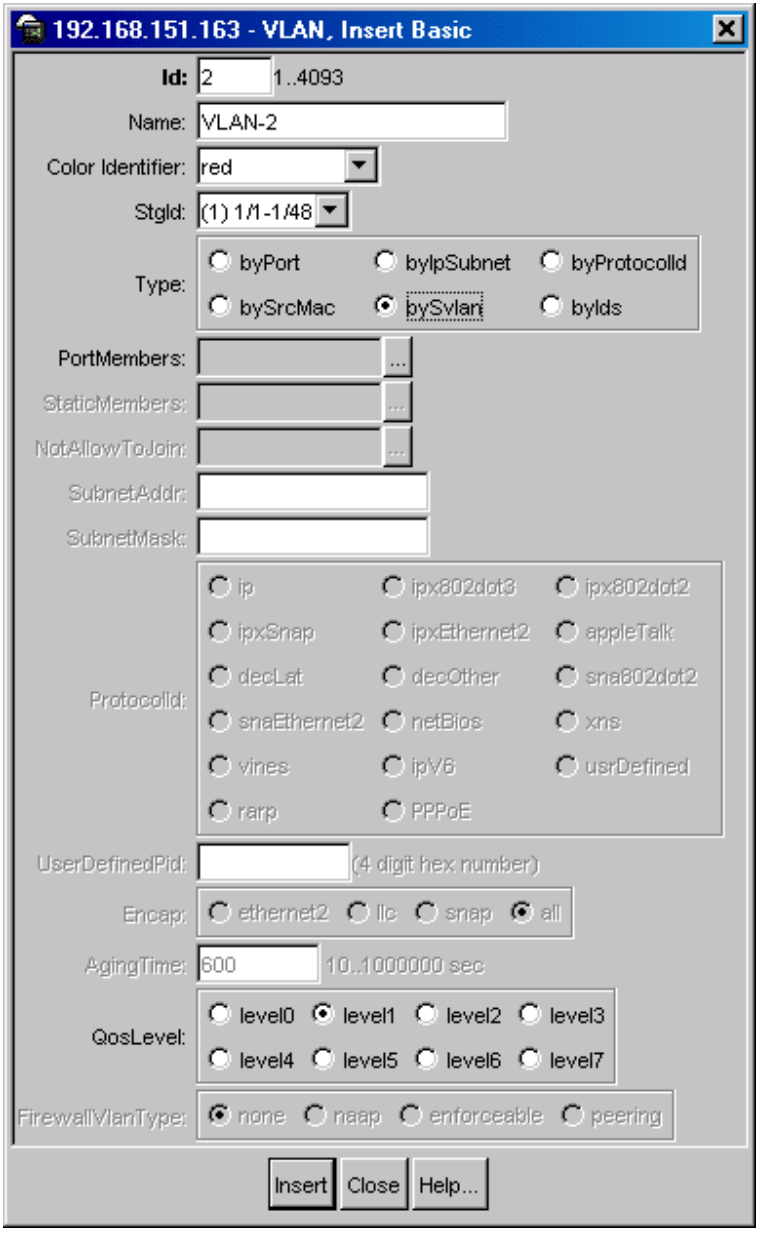
Figure 70 VLAN dialog box-- Basic tab



2 Click Insert.

The VLAN, Insert Basic dialog box opens (Figure 71).

Figure 71 Insert Basic dialog box—for stacked VLANs



3 In the ID field, enter an unused VLAN ID (1 - 4094) or use the ID provided. The default VLAN is VLAN ID 1.

4 (Optional) In the Name field, type the VLAN name, or use the name provided.

5 (Optional) In the Color Identifier field, click the down arrow and choose a color from the dropdown list, or use the color provided.

Device Manager suggests a color, but you can change it.This color is used by VLAN Manager to display the different VLANs in a network.

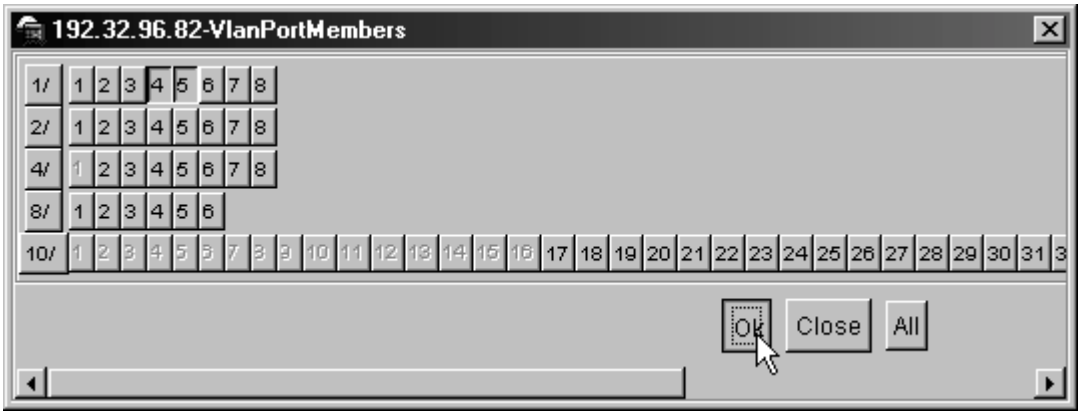
6 In the StgId field, type or select the spanning tree group ID for the VLAN.

7 In the Type field, click bySvlan.

8 In the PortMembers field, click the ellipsis (...).

The VlanPortMembers dialog box opens (Figure 72).

Figure 72 VlanPortMembers dialog box



9 Click the ports to include in the new VLAN.

10 Click OK.

The Port Membership dialog box closes and the port members appear in the Insert Basic dialog box.

11 (Optional) In the QoS field, click a quality of service level.

12 On the VLAN, Insert Basic dialog box, click Insert.

The Insert dialog box closes and the VLAN appears in the Basic tab.

13 In the VLAN, Basic tab, click Close.

The VLAN is configured and the VLAN dialog box closes.

Chapter 4
Configuring STGs using Device Manager

This section discusses using Device Manager to create, manage, and monitor spanning tree groups (STGs), and includes the following topics:

This chapter includes the following topics:

Creating an STG

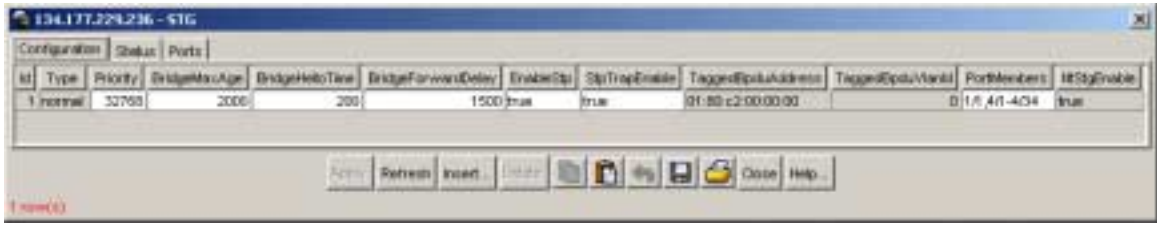
Note: This information applies to Passport 8600 modules only. Spanning Tree Protocol is not currently supported on SMLT or IST ports.

To create an STG:

1 From the Device Manager menu bar, choose VLAN > STG.

The STG dialog box opens to the Configuration tab (Figure 73).

Figure 73 STG dialog box

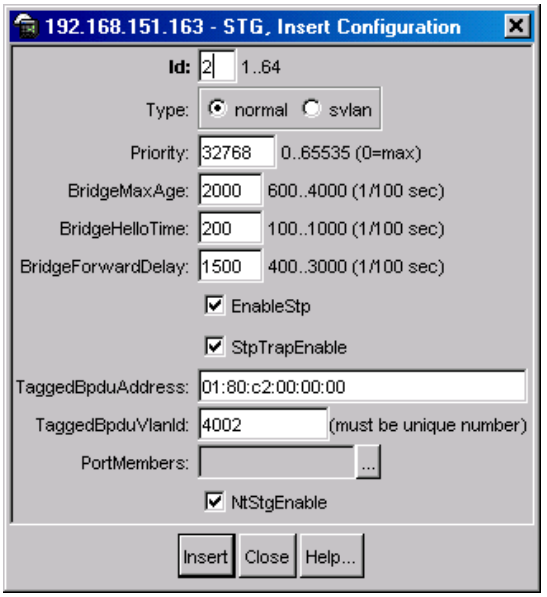


2 From the Configuration tab, click Insert.

The STG, Insert Configuration dialog box opens (see Figure 74 on page 172).

For field descriptions, see Table 20 on page 174.

Figure 74 STG, Insert Configuration dialog box



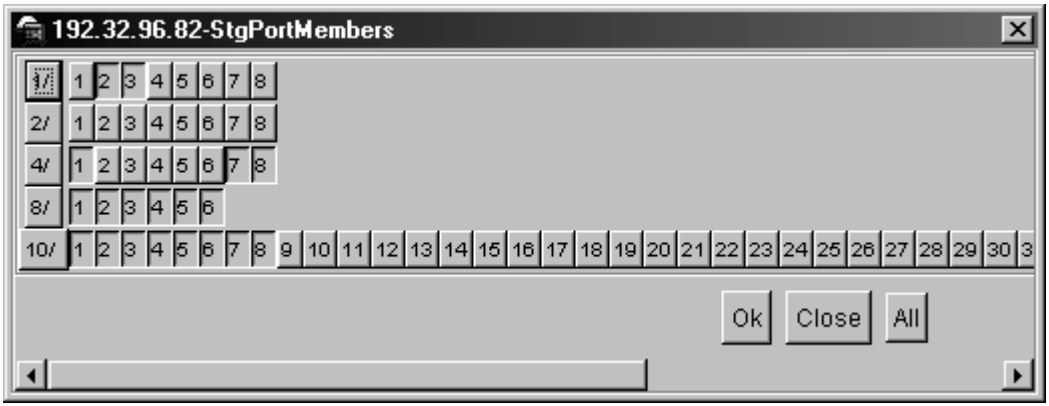
3 Use the fields in the STG, Insert Configuration dialog box to configure the STG.

Note: In the STG table, the STG ID and TaggedBpduVlanId must be unique. If you change the STG ID without updating TaggedBpduVlandId, the insertion may fail because of a duplicate TaggedBpduVlanId.

4 To add ports to the STG, click the ellipses (...) in the PortMembers field.

The Port Members dialog box (Figure 75)opens.

Figure 75 STG Port Members dialog box



5 Click the ports you want to add to the STG, and click OK.

The Port Members dialog box closes, and the ports are added to the Port Members field in the Insert Configuration dialog box.

Note: Spanning Tree protocol is not supported on SMLT or IST ports.

6 Click Insert.

The Insert Configuration dialog box closes, and the STG appears in the Configuration tab.

7 Click Close.

The STG is configured.

Table 20 describes the STG Configuration fields.

Table 20 STG configuration fields

Field	Description
Id	The ID number for the STG. Note: The STG ID and TaggedBpduVlanId must be unique in the STG table. If you change the STG ID without updating TaggedBpduVlanId, the insertion may fail because of a duplicate TaggedBpduVlanId.
Type	Specifies the type of STG. • normal = normal STG • svlan = stacked VLAN STG
Priority	Sets the STP bridge priority, in decimal. The range is 0 (highest priority) to 65535 (lowest priority). The default is 32768.
BridgeMaxAge	The value in hundredths of a second that all bridges use for MaxAge when this bridge is acting as the root. **Note:** The 802.1D-1990 standard specifies that the BridgeMaxAge range is related to the value of dot1dStpBridgeHelloTime. The default is 2000 (20 seconds).
BridgeHelloTime	The value in hundredths of a second that all bridges use for HelloTime when this bridge is acting as the root. The granularity of this timer is specified by the IEEE 802.1D-1990 standard to be in increments of 1/100 of a second. The default is 200 (2 seconds).
BridgeForwardDelay	The value in hundredths of a second that all bridges use for Forward Delay when this bridge is acting as the root. The default is 1500 (15 seconds).
EnableSTP	Enables or disables the spanning tree algorithm for the STG.
StpTrapEnable	Enables SNMP traps to be sent to trace receiver every time an STP topology occurs.
TaggedBpduAddress	Represents a MAC address; specifically for tagged BPDUs.

Table 20 STG configuration fields (continued)

Field	Description
TaggedBpduVlanId	Represents the VLAN tag associated with the STG. This ID is used to tag BPDUs through a non-IEEE tagging bridge to another 8000 Series switch. Note: By default, the TaggedBpduVlanId is an address calculated based on the STG ID by Device Manager. Accepting the default value calculated by Device Manager makes it much simpler to coordinate STGs across multiple switches. If you enter a custom value for this field, you must manually coordinate it across all switches. Note: The STG ID and TaggedBpduVlanId must be unique in the STG table. If you change the STG ID without updating TaggedBpduVlanId, the insertion may fail because of a duplicate TaggedBpduVlanId.
Port Members	The ports you want to become members of the new STG. Ports are not selectable if: • configured as single port SMLT, MLT-base SMLT, or IST • configured as members of any other STG
NtStgEnable	Indicates whether this STG is operating in Nortel mode or Cisco mode. true=Nortel mode; false=Cisco mode.

Note: Nontagged ports can only belong to one STG.

Editing an STG

Note: This information applies to 8600 modules only.

To edit an STG:

1 From the Device Manager menu bar, choose VLAN > STG.

The STG dialog box opens to the Configuration tab (Figure 73).

2 Double-click the field for the STG you want to edit.

The field becomes editable.

3 Enter a new value in the field or select a new setting from the dropdown menu.

4 Click Apply.

The changes are applied to the STG.

Adding ports to an STG

To add ports to a spanning tree group:

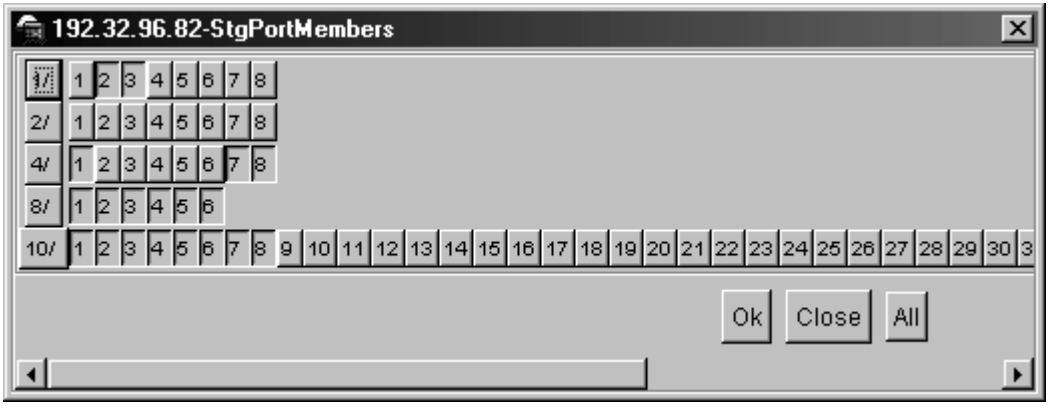
1 From the Device Manager menu bar, choose VLAN > STG.

The STG dialog box opens to the Configuration tab (Figure 73 on page 172).

2 Double-click the Port Members field for the STG.

The Port Members dialog box (Figure 76)opens, indicating the port members assigned to this STG.

Figure 76 STG Port Members dialog box



3 Click the ports you want to add to the STG, and click OK.

The Port Members dialog box closes, and the ports are added to the Port Members field in the Configuration tab.

Note: Spanning Tree protocol is not supported on SMLT or IST ports.

4 Click Apply.

The ports are added to the STG.

Viewing STG status

The STG Status tab allows you to view the status of the spanning tree for each STG that is associated with the network.

To view STG status:

1 From the Device Manager menu bar, choose VLAN > STG.

The STG dialog box opens to the Configuration tab (Figure 73).

2 Click the Status tab.

The Status tab opens (Figure 77), displaying STG status.

Figure 77 STG dialog box—Status tab

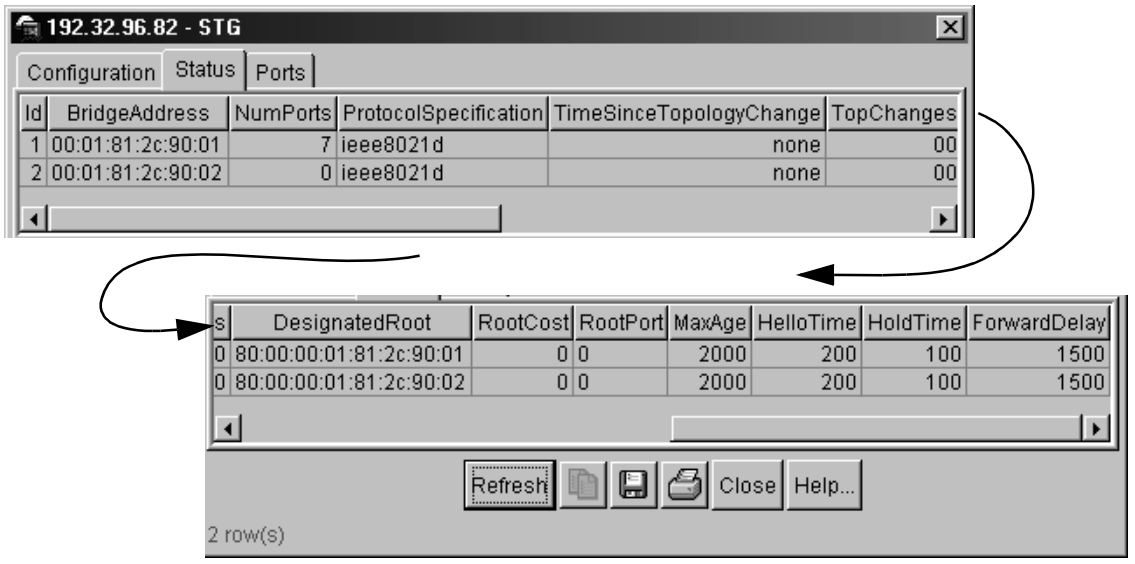


Table 21 describes the STG status fields.

Table 21 STG status fields

Field	Description
BridgeAddress	The MAC address used by this bridge when it must be referred to in a unique fashion.
NumPorts	The number of ports controlled by this bridging entity.
ProtocolSpecification	An indication of what version of the Spanning Tree Protocol is being run. The IEEE 802.1d implementations will return ieee8021d.
TimeSinceTopologyChange	The time in hundredths of a second since the last time a topology change was detected by the bridge entity or STG.
TopChanges	A topology change trap is sent by a bridge when any of its configured ports transitions from the Learning state to the Forwarding state, or from the Forwarding state to the Blocking state. The trap is not sent if a new root trap is sent for the same transition. Implementation of this trap is optional.

Table 21 STG status fields (continued)

Field	Description
DesignatedRoot	The bridge identifier of the root of the spanning tree as determined by the Spanning Tree Protocol as executed by this node. This value is used as the Root Identifier parameter in all Configuration Bridge PDUs originated by this node.
RootCost	The cost of the path to the root as seen from this bridge.
RootPort	The port number of the port that offers the lowest cost path from this bridge to the root bridge.
MaxAge	The maximum age of Spanning Tree Protocol information learned from the network on any port before it is discarded, in units of hundredths of a second. This is the actual value that this bridge is currently using.
HelloTime	The amount of time in hundredths of a second between transmission of config BPDUs by this node on any port when it is the root of the spanning tree. The default value is 200 (2 seconds).
HoldTime	The time interval in hundredths of a second during which no more than two Configuration bridge PDUs shall be transmitted by this node. The default value is 100 (1 second).
ForwardDelay	The time interval in hundredths of a second that controls how fast a port changes its spanning state when moving toward the Forwarding state. The value determines how long the port stays in each of the Listening and Learning states, which precede the Forwarding state. This value is also used when a topology change has been detected and is under way, to age all dynamic entries in the Forwarding Database. [Note that this value is the one this bridge is currently using, in contrast to rcStgBridgeForwardDelay, which is the value that this bridge and all others would start using if/when this bridge were to become the root.] The default value is 1500 (15 seconds).

Viewing STG ports

The Ports tab allows you to view the status of ports for each STG that is associated with the network.

To view STG ports:

1. From the Device Manager menu bar, choose VLAN > STG.

   The STG dialog box opens to the Configuration tab (Figure 73 on page 172).

2. Click the Ports tab.

   The Ports tab opens (Figure 78). For field definitions, see "STG Ports tab fields" on page 180.

Figure 78 STG dialog box—Ports tab

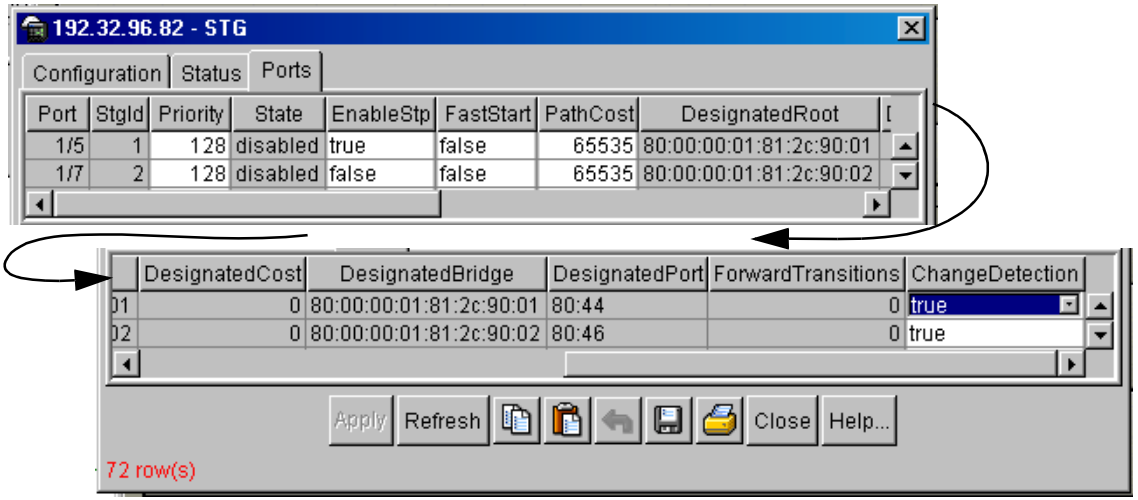


Table 22 describes the Ports tab fields.

Table 22 STG Ports tab fields

Field	Description
Port	The port number of the port for which this entry contains Spanning Tree Protocol management information.
StgId	The STG identifier assigned to this port.
Priority	The value of the priority field which is contained in the first octet of the (2 octet long) Port ID. The other octet of the Port ID is given by the value of rcStgPort. Note: Although port priority values can range from 0-255, on the 8600 Series switch, only the following values are used: 0, 16, 32, 48, 64, 80, 96, 112, 128, 144, 160, 176, 192, 208, 224, 240.

Table 22 STG Ports tab fields (continued)

Field	Description
State	The port's current state as defined by the application of the Spanning Tree Protocol. • disabled(1), • blocking(2), • listening(3), • learning(4), • forwarding(5), • broken(6) This state controls what action a port takes on reception of the frame. If the bridge has detected a port that is malfunctioning, it will place that port into the Broken (6) state. For ports that are disabled, this object will have a value of disable.
EnableStp	The STP state of the port. • Enabled—BPDUs are processed in accordance with STP. • Disabled—The port stays in a forwarding state, received BPDUs are dropped and not processed, and no BPDU is generated.
FastStart	When this flag is set, the port is moved straight to the Forwarding (5) state upon being enabled. • true (enables FastStart for the port) • false (default, disables FastStart for the port) Note: This setting is contrary to that specified in the IEEE 802.1D standard for Spanning Tree Protocol (STP), in which a port enters the blocking state following the initialization of the bridging device or from the disabled state when the port is enabled through configuration.
PathCost	The contribution of this port to the path cost of paths toward the spanning tree root that includes this port. The 802.1D-1990 protocol recommends that the default value of this parameter be in inverse proportion to the speed of the attached LAN.
DesignatedRoot	The unique Bridge Identifier of the Bridge recorded as the Root in the Configuration BPDUs transmitted by the Designated Bridge for the segment to which the port is attached.
DesignatedCost	The path cost of the Designated Port of the segment connected to this port. This value is compared to the Root Path Cost field in received bridge PDUs.
DesignatedBridge	The Bridge Identifier of the bridge that this port considers to be the Designated Bridge for this port's segment.
DesignatedPort	The Port Identifier of the port on the Designated Bridge for this port's segment.

Table 22 STG Ports tab fields (continued)

Field	Description
ForwardTransitions	The number of times this port has transitioned from the Learning state to the Forwarding state.
ChangeDetection	The change detection setting (true or false) for this port. Can only be configured on Access ports. If you enable change detection on an MLT with access ports, the setting is automatically applied to all ports in the MLT. See "Spanning tree protocol topology change detection" on page 55.

Enabling STP on a port

To enable STP for a port:

1. From the Device Manager menu bar, choose VLAN > STG.

   The STG dialog box opens to the Configuration tab (Figure 73 on page 172).

2. Click the Ports tab.

   The Ports tab opens (Figure 78).

3. Click in the EnableStp field for the port you want to enable.

   The dropdown menu opens.

4. From the dropdown menu, choose true.

   The EnableStp setting changes.

5. Click Apply.

   STP is enabled for the port.

Deleting an STG

Note: The following procedure applies to 8600 modules only.

To delete an STG:

1. From the Device Manager menu bar, choose VLAN > STG.

   The STG dialog box opens to the Configuration tab (Figure 73 on page 172).
2. Click the STG that you want to delete.
3. Click Delete.

Note: All VLANs must be deleted from an STG before you can remove it.

Configuring topology change detection

To configure topology change detection on a port:

1. From the Device Manager menu bar, choose VLAN > STG.

   The STG dialog box opens to the Configuration tab (Figure 73 on page 172).
2. Click the Ports tab.

   The Ports tab opens (Figure 78).
3. Double-click the ChangeDetection field.

   The dropdown menu of change detection settings opens.
4. From the dropdown menu, choose one of the following:
   - To enable change detection on the port, choose True.
   - To disable change detection on the port, choose False.
5. Click Apply.

   Change detection is configured for the port.

For more information about change detection, see “Spanning tree protocol topology change detection” on page 55.

Chapter 5
Configuring Link Aggregation using Device Manager

This chapter describes how to configure Link Aggregation in your network, and includes the following topics:

Configuring link aggregation

This section describes how to configure and manage a link aggregation (LAG), and includes the following topics:

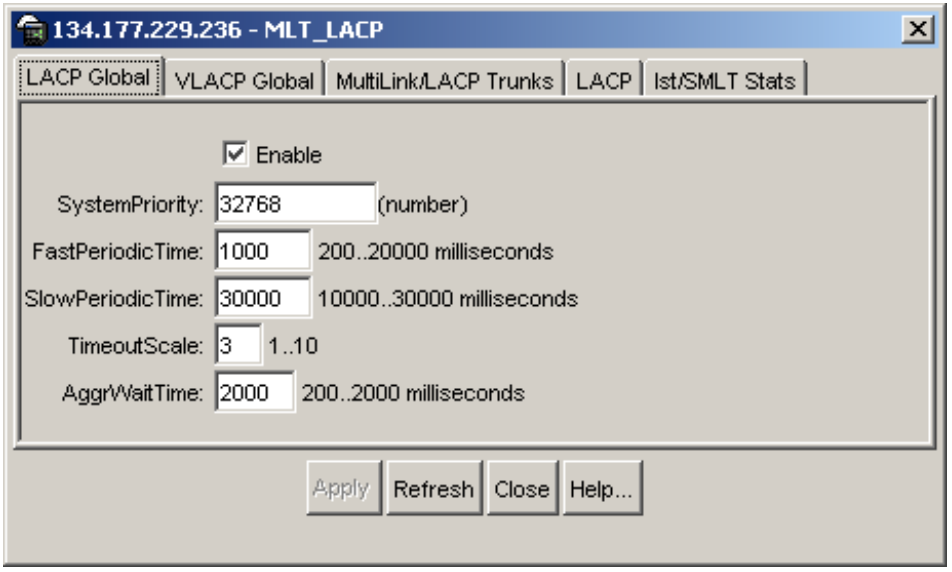
Adding an LACP

To add a MultiLink Trunk:

1 From the Device Manager menu bar, choose VLAN > MLT/LACP.

The MLT_LACP dialog box (Figure 79) opens, displaying LACP global information.

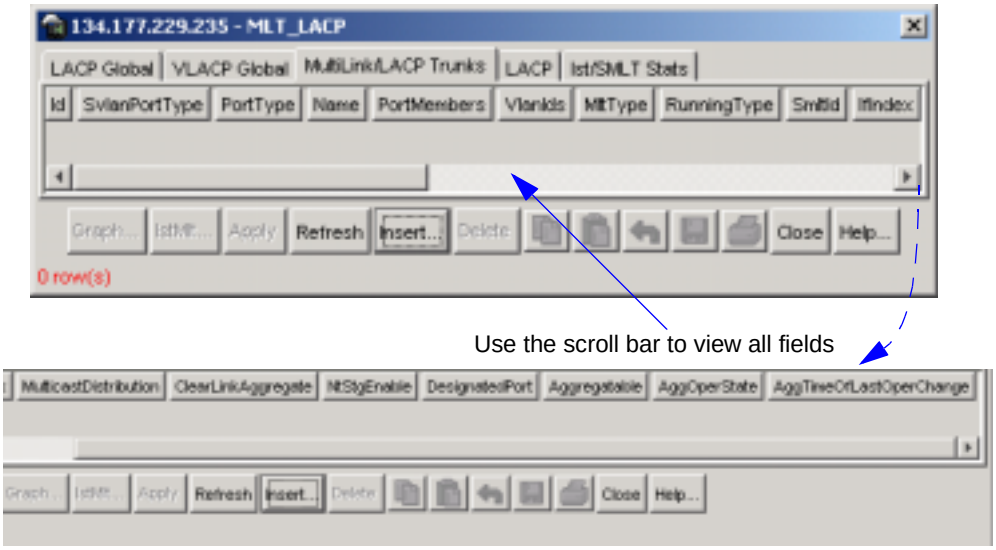
Figure 79 MLT_LACP dialog box



2 Select the MultiLink/LACP Trunks tab.

The MultiLink/LACP Trunks tab displays (Figure 80). For information on its fields, see Table 23 on page 190.

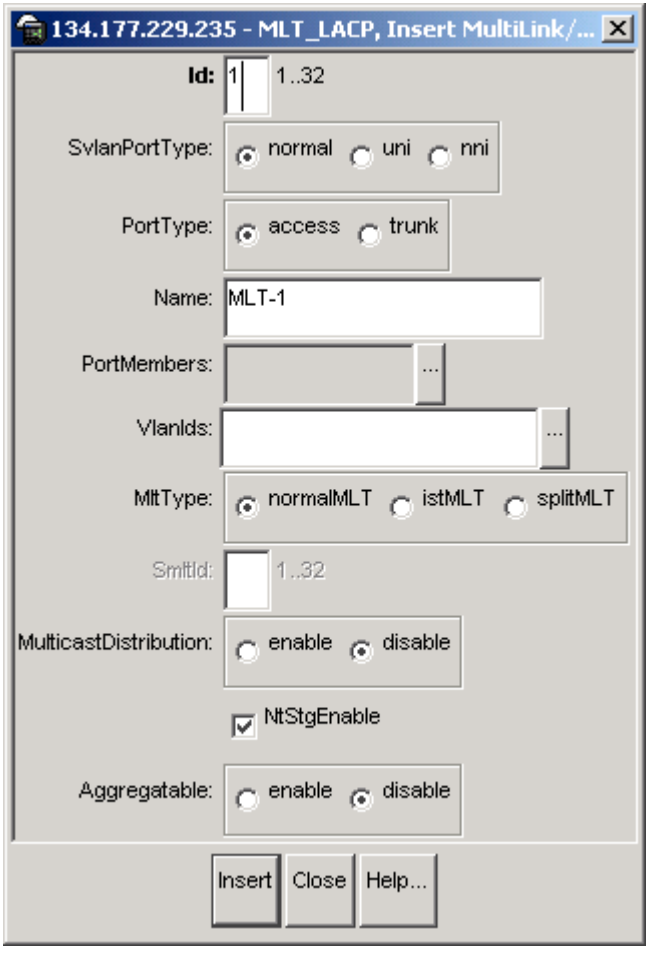
Figure 80 MLT_LACP dialog box—MultiLink/LACP Trunks tab



3 In the MLT_LACP Trunks dialog box, click Insert.

The MLT, Insert Multilink Trunks dialog box (Figure 81) opens.

Figure 81 MLT_LACP, Insert MultiLink/LACP Trunks dialog box



4 In the ID field, type the ID number for the MultiLink/LACP Trunk.

5 In the SvlanPortType field, click normal, UNI, or NNI.

6 In the PortType field, click Access.

7 In the Name field, type a name for the MultiLink/LACP Trunk port.

8 In the MltType field, click normalMLT or splitMLT.

For information about configuring SMLT, see "Adding a LAG-based SMLT" on page 199.

9 In the Multicast Distribution field, click Enable or Disable.

Note: Multicast distribution over MLT is supported only on 8000 Series E-modules. For detailed information about configuring multicast distribution over MLT, see *Configuring IP Multicast Routing Protocols.*

10 Uncheck NtStgEnable.

11 In the aggregatable field, click enable.

12 Click Insert.

The MLT is added to the MultiLink/LACP Trunks tab in the MLT dialog box.

13 In the MLT dialog box, click Close.

The MLT is added.

Table 23 defines the MultiLink/LACP Trunks tab fields.

Table 23 MLT MLT_LACP Trunks tab fields

Field	Description
Id	A value that uniquely identifies the MultiLink/LACP Trunk. • For 8600 modules, up to 32 MLTs (IDs 1-32) are supported. • For 8100 modules, up to 6 MLTs (IDs 1-6) are supported.
SvlanPortType	Sets MLT/LACP port type: • normal (default) • uni (User-to-Network Interface) You must configure ports to which you want to provide VLAN transparency as UNI ports. UNI ports can only belong to one SVLAN. When you designate a port as a UNI port, the DiscardTaggedFrames parameter is automatically configured (Edit>Port>VLAN). This prevents traffic from leaking to other VLANs. • nni (Network-to-Network Interface) NNI ports interconnect the switches in the core network, drop untagged frames on ingress, and insert the SVLAN tag at the egress. When you configure an NNI port, the DiscardUnTaggedFrames parameter is automatically configured (Edit>Port> VLAN). Before configuring a port as uni or nni, you must change the switch level to 1 or above (Edit>VLAN> SVLAN>Level).
PortType	Sets Access or trunk port. **Note:** When the Aggregatable field is set to enable, this field becomes read-only.
Name	The name given to the MLT/LACP.
PortMembers	The ports assigned to the MLT/LACP. MLT/LACP is supported on 10BASE-T, 100BASE-TX, 100BASE-FX, and Gigabit Ethernet ports. All ports in an MLT/LACP must be of the same media type (copper or fiber), and have the same settings for speed and duplex. All untagged ports must belong to the same spanning tree group. For 8600 modules, up to 8 same-type ports can belong to a single MLT/LACP. For 8100 modules, up to 4 same-type ports can belong to a single MLT/LACP. **Note:** When the Aggregatable field is set to enable, this field becomes read-only.

Table 23 MLT MLT_LACP Trunks tab fields (continued)

Field	Description
VlanIds	The VLAN(s) to which the ports belong. **Note:** When the Aggregatable field is set to enable, this field becomes read-only.
MltType	Editable field for specifying the type of MLT: • normalMLT • istMLT • splitMLT
Running Type	Read only field displaying the MLT operational type: • normalMLT • istMLT • splitMLT
SmltId	The split MLT ID (1-32) assigned to both ends of the split trunk. Note: The corresponding SMLTs between aggregation switches must have the same SMLT ID.
IfIndex	The interface index of the MLT
Multicast Distribution	The multicast distribution state on MLT/LACP ports: • Enabled • Disabled (default) Multicast distribution must also be configured on the chassis (Edit > Chassis> Mcast MLT Distribution). For more information, see the publication, *Configuring IP Routing Multicast Protocols*. **Note**: Multicast distribution over MLT is supported only on 8000 Series E-modules.
Clear Link Aggregate	The clear link aggregate for the specific MLT.
NtStgEnable	Indicates whether this STG is operating in Nortel mode or Cisco mode. true=Nortel mode; false=Cisco mode.
Designated Port	Ports designated.
Aggregatable	Enables or disables IEEE 802.3ad link aggregation.

Adding VLACP

To add VLACP:

1 From the Device Manager menu bar, choose VLAN > MLT/LACP.

The MLT_LACP dialog box (Figure 79 on page 186) opens.

2 Click the VLACP Global tab.

Figure 82 VLACP Global

3 Check VlacpEnable to add the Vlacp Global id.

Adding ports to a LAG

To add ports to an existing LAG:

1 From the Device Manager menu bar, choose VLAN > MLT/LACP.

The MLT_LACP dialog box opens with the LACP Global tab (Figure 79 on page 186).

2 Select the Multilink/LACP Trunks tab.

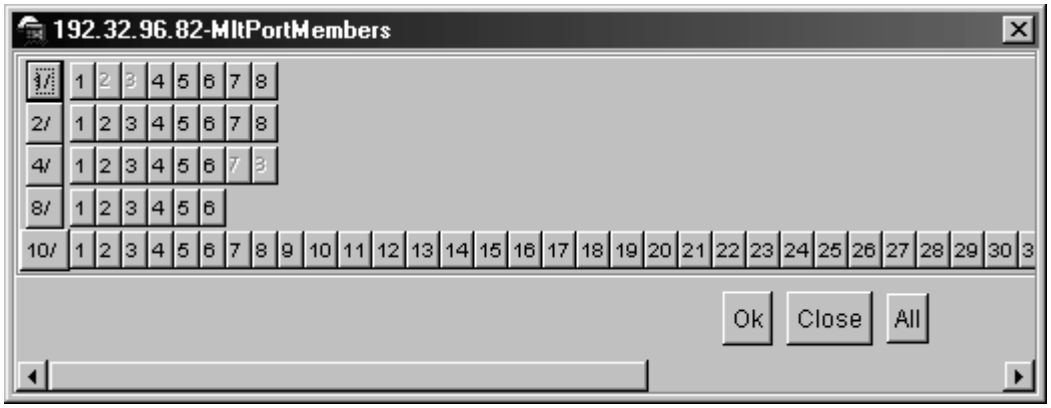
The Multilink/LACP Trunk tab (Figure 80 on page 187) opens with the active MLTs displayed. For field definitions, see Table 23 on page 190.

3 Click Insert and the MLT_LACP, Insert Multilink/LACP Trunks dialog box (Figure 81 on page 188) appears.

4 Double-click in the PortMembers field for the MLT/LACP to which you are adding ports.

The PortMembers dialog box (Figure 83) opens, showing the ports currently assigned for the selected MLT. Available ports are editable.

Figure 83 MltPortMembers dialog box



5 In the PortMembers dialog box, click the port numbers to be added, or click All to add all ports to the MLT.

- For 8600 modules, up to 8 same-type ports can belong to a single MLT.
- For 8100 modules, up to 4 same-type ports can belong to a single MLT.

6 Click OK.

The PortMembers dialog box closes. The port numbers are added to the selected MLT on the MultiLink Trunks tab in the MLT dialog box.

7 From the MLT dialog box, click Apply.

The ports are added to the MLT.

Viewing LAG interface statistics

To view MLT/LACP Trunk interface statistics:

1 From the Device Manager menu bar, choose VLAN > MLT/LACP.

The MLT_LACP dialog box opens with the LACP Global tab (Figure 79 on page 186).

2 Select the Multilink/LACP Trunks tab.

The Multilink/LACP Trunks tab (Figure 80 on page 187) opens with the active MLTs displayed.

3 Select an MLT.

The Graph tool is activated.

4 Click Graph.

The Statistics, MLT dialog box opens to the Interface tab (Figure 84), displaying interface statistics (Table 24) for the selected MLT.

Figure 84 Statistics, MLT dialog box—Interface tab

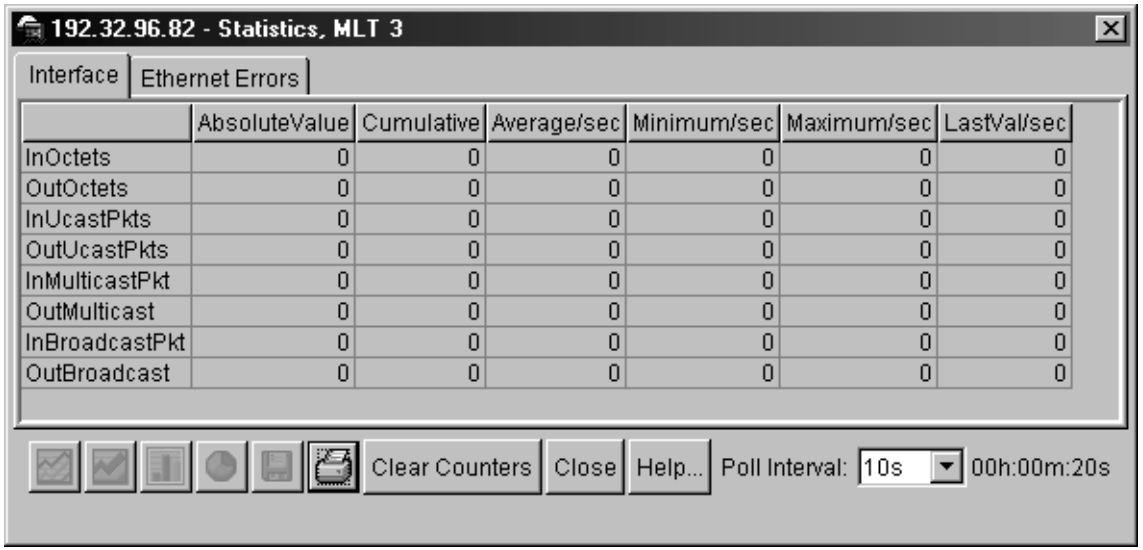


Table 24 defines the fields on the Interface tab.

Table 24 Statistics, MLT dialog box—Interface tab fields

Field	Description
InOctets	The total number of octets received on the MLT interface, including framing characters.
OutOctets	The total number of octets transmitted out of the MLT interface, including framing characters.
InUcastPkts	The number of packets delivered by this MLT to higher level protocols that were not addressed to a multicast or broadcast address at this sublayer.
OutUcastPkts	The number of packets that higher-level protocols requested be transmitted that were not addressed to a multicast address at this MLT.This total number includes those packets discarded or unsent.

Table 24 Statistics, MLT dialog box—Interface tab fields (continued)

Field	Description
InMulticastPkt	The number of packets delivered to this MLT that were addressed to a multicast address at this sublayer. For a MAC layer protocol, this number includes both Group and Functional addresses.
OutMulticast	The total number of packets that higher-level protocols requested be transmitted, and that were addressed to a multicast address at this MLT, including those that were discarded or not sent. For a MAC layer protocol, this number includes both Group and Functional addresses.
InBroadcastPkt	The number of packets delivered to this MLT that were addressed to a broadcast address at this sublayer.
OutBroadcast	The total number of packets that higher-level protocols requested be transmitted, and that were addressed to a broadcast address at this MLT, including those that were discarded or not sent.

Viewing LAG Ethernet error statistics

To view MLT/LACP Trunk Ethernet error statistics:

1. From the Device Manager menu bar, choose VLAN > MLT/LACP.

   The MLT_LACP dialog box opens with the LACP Global tab (Figure 79 on page 186).

2. Select the Multilink/LACP Trunks tab.

   The Multilink/LACP Trunks tab (Figure 80 on page 187) opens with the active MLTs displayed.

3. Select an MLT.

   The Graph tool is activated.

4. Click Graph.

   The Statistics, MLT dialog box opens to the Interface tab (Figure 84 on page 194).

5. Click the Ethernet Errors tab.

   The Ethernet Errors tab (Figure 85) opens, displaying statistics.

Figure 85 Statistics, MLT dialog box—Ethernet Errors tab

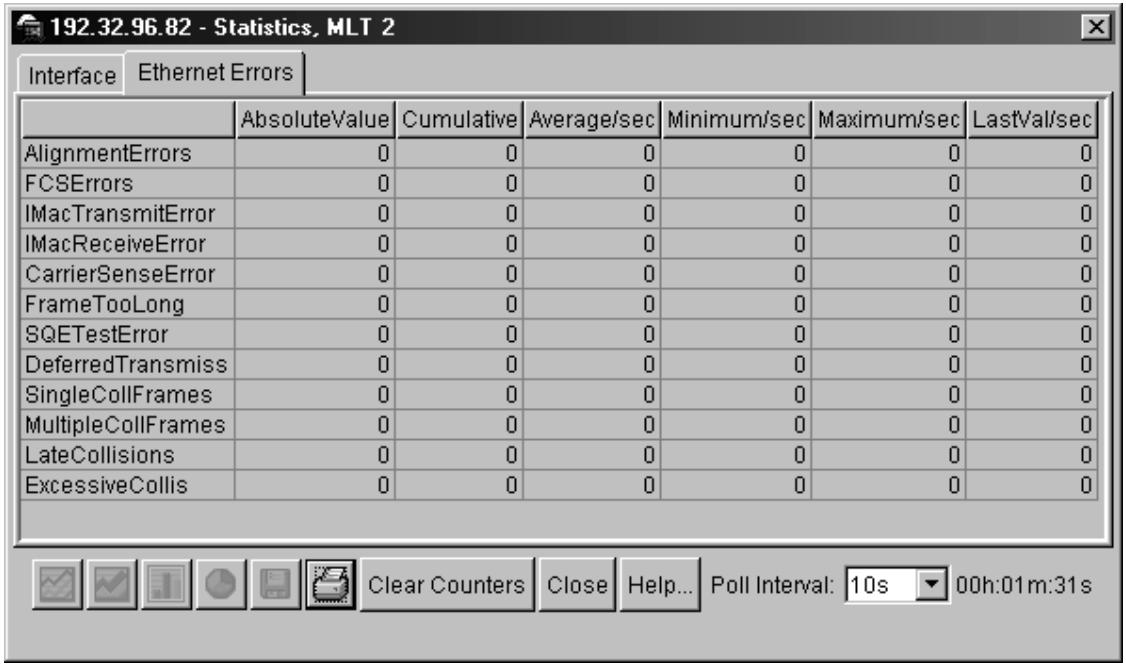


Table 25 lists and defines the fields on the Ethernet Errors tab.

Table 25 Statistics, MLT dialog box—Ethernet Errors tab fields

Field	Description
AlignmentErrors	A count of frames received on a particular MLT that are not an integral number of octets in length and do not pass the FCS check. The count represented by an instance of this object is incremented when the alignmentError status is returned by the MAC service to the LLC (or other MAC user). Received frames for which multiple error conditions occur are, according to the conventions of IEEE 802.3 Layer Management, counted exclusively according to the error status presented to the LLC.
FCSErrors	A count of frames received on an MLT that are an integral number of octets in length but do not pass the FCS check. The count represented by an instance of this object is incremented when the frameCheckError status is returned by the MAC service to the LLC (or other MAC user). Received frames for which multiple error conditions occur are, according to the conventions of IEEE 802.3 Layer Management, counted exclusively according to the error status presented to the LLC.
IMacTransmitError	A count of frames for which transmission on a particular MLT fails due to an internal MAC sublayer transmit error. A frame is only counted by an instance of this object if it is not counted by the corresponding instance of either the LateCollisions object, the ExcessiveCollisions object, or the CarrierSenseErrors object.
IMacReceiveError	A count of frames for which reception on a particular MLT fails due to an internal MAC sublayer receive error. A frame is only counted by an instance of this object if it is not counted by the corresponding instance of either the FrameTooLongs object, the AlignmentErrors object, or the FCSErrors object. The precise meaning of the count represented by an instance of this object is implementation specific. In particular, an instance of this object may represent a count of receive errors on a particular interface that are not otherwise counted.
CarrierSenseError	The number of times that the carrier sense condition was lost or never asserted when attempting to transmit a frame on a particular MLT. The count represented by an instance of this object is incremented at most once per transmission attempt, even if the carrier sense condition fluctuates during a transmission attempt.

Table 25 Statistics, MLT dialog box—Ethernet Errors tab fields (continued)

Field	Description
FrameTooLong	A count of frames received on a particular MLT that exceed the maximum permitted frame size. The count represented by an instance of this object is incremented when the frameTooLong status is returned by the MAC service to the LLC (or other MAC user). Received frames for which multiple error conditions occur are, according to the conventions of IEEE 802.3 Layer Management, counted exclusively according to the error status presented to the LLC.
SQETestError	A count of times that the SQE TEST ERROR message is generated by the PLS sublayer for a particular MLT. The SQE TEST ERROR message is defined in section 7.2.2.2.4 of ANSI/IEEE 802.3-1985 and its generation is described in section 7.2.4.6 of the same document.
DeferredTransmiss	A count of frames for which the first transmission attempt on a particular MLT is delayed because the medium is busy. The count represented by an instance of this object does not include frames involved in collisions.
SingleCollFrames	A count of successfully transmitted frames on a particular MLT for which transmission is inhibited by exactly one collision. A frame that is counted by an instance of this object is also counted by the corresponding instance of either the ifOutUcastPkts object, the ifOutMulticastPkts object, or the ifOutBroadcastPkts object, and is not counted by the corresponding instance of the MultipleCollisionFrames object.
MultipleCollFrames	A count of successfully transmitted frames on a particular MLT for which transmission is inhibited by more than one collision. A frame that is counted by an instance of this object is also counted by the corresponding instance of either the ifOutUcastPkts object, the ifOutMulticastPkts object, or the ifOutBroadcastPkts object, and is not counted by the corresponding instance of the SingleCollisionFrames object.
LateCollisions	The number of times that a collision is detected on a particular MLT later than 512 bit-times into the transmission of a packet; 512 corresponds to 51.2 microseconds on a 10 Mb/s system. A (late) collision included in a count represented by an instance of this object is also considered as a (generic) collision for purposes of other collision-related statistics.
ExcessiveCollis	A count of frames for which transmission on a particular MLT fails due to excessive collisions.

Configuring an SMLT

This section describes how to use Device Manager (DM) to configure Split MultiLink Trunking (SMLT) and includes the following topics:

Adding a LAG-based SMLT

If you are configuring SMLT, you do not need to create an MLT before creating an SMLT. You can create an SMLT by selecting the MLT type as SMLT and then specifying an SMLT ID.

To add an MLT-based SMLT:

1. From the Device Manager menu bar, choose VLAN > MLT/LACP.

   The MLT_LACP dialog box opens with the LACP Global tab (Figure 79 on page 186).

2. Select the Multilink/LACP Trunks tab.

   The Multilink/LACP Trunks tab (Figure 80 on page 187) opens with the active MLTs displayed. For field definitions, see Table 23 on page 190.

3. Click Insert and the MLT_LACP, Insert Multilink/LACP Trunks dialog box (Figure 81 on page 188) appears.
4. In the ID field, the next available MLT ID is displayed. You can use this ID or type an available MLT ID number (1-32).
5. In the SvlanPortType field, click normal.
6. In the PortType field, click Access or Trunk.

7 In the Name field, type a name to identify the MLT-based SMLT port.

8 In the PortMembers field, click the ellipsis (...).

The MltPortMembers dialog box opens, displaying the available ports.

9 Click the ports to include in the MLT-based SMLT.

- For 8600 modules, up to 8 same-type ports can belong to a single MLT.
- For 8100 modules, up to 4 same-type ports can belong to a single MLT.

10 Click OK.

The MltPortMembers dialog box closes and the ports are added to the PortMembers field on the Insert MultiLink Trunks tab.

11 In the VlanIds field, click the ellipsis (...).

The VlanIds dialog box opens, displaying the available VLANs.

12 Select the VLAN IDs for the MLT-based SMLT port, and click OK.

The VlanIds dialog box closes and the VLANs are added to the VlanIds field in the MLT, Insert Trunks dialog box.

13 In the MltType field, click splitMLT.

The SmltId field becomes editable.

14 In the SmltId field, type an unused SMLT ID (1 - 32).

Note: The corresponding SMLTs between aggregation switches must have matching SMLT IDs. The same ID number must be used on both sides.

To view the SMLT IDs currently in use on the switch, see "Viewing single port SMLTs configured on your switch" on page 201.

15 Click Insert.

The Insert MultiLink Trunks dialog box closes, and the new MLT-based SMLT appears in the MultiLink Trunks tab.

16 From the MultiLink Trunks tab, click Close.

The MLT-based SMLT is added.

Viewing single port SMLTs configured on your switch

To view the single port SMLTs configured on your switch:

➡ From the menu bar, choose VLAN > SMLT.

The SMLT dialog box opens to the Single Port SMLT tab, which displays the single port SMLTs currently configured on your switch (Figure 86).

Figure 86 Single Port SMLT tab

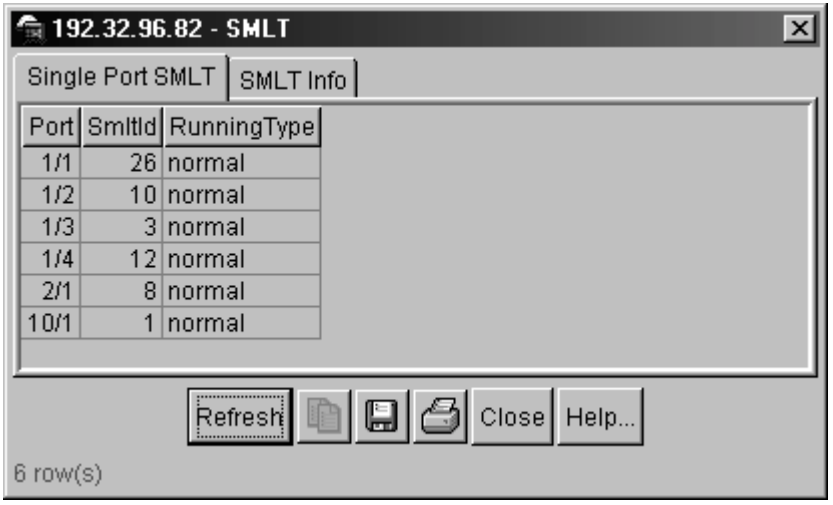


Table 26 describes the fields on the Single Port SMLT tab.

Table 26 Single Port SMLT fields

Field	Description
Port	Read only field that displays the port's interface index number.
SmltId	The ID number of the single port Split MLT (1 - 512).
OperType	Read only field that displays the port's operational type: • normal • smlt (single port Split MLT)

Viewing MLT-based SMLTs configured on your switch

To view the MLT-based SMLTs configured on your switch:

1. From the menu bar, choose VLAN > SMLT.

   The SMLT dialog box opens to the Single Port SMLT tab (Figure 86 on page 201).

2. Click the SMLT Info tab.

   The SMLT Info tab opens with all the configured MLT-based SMLTs displayed (Figure 87).

Figure 87 SMLT Info tab

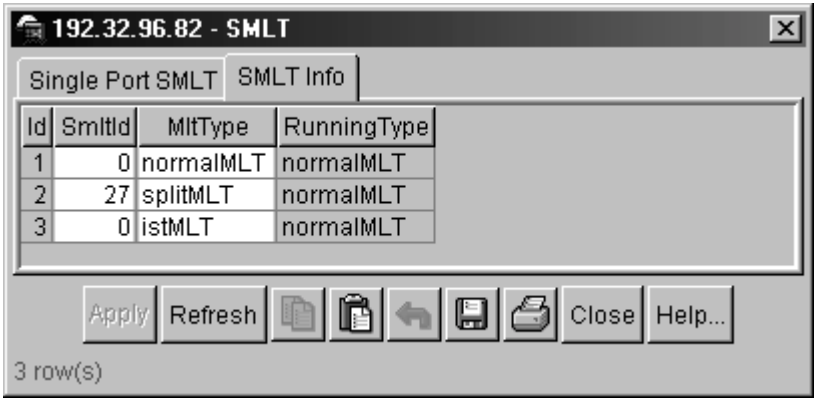


Table 27 describes the fields on the SMLT Info tab.

Table 27 SMLT Info tab fields

Field	Description
Id	Read only field, displaying the MLT ID (1 - 32) for this Split MultiLink Trunk.
SmltId	The MLT-based Split MultiLink Trunk ID number (1 - 32).

Table 27 SMLT Info tab fields (continued)

Field	Description
MltType	Editable field for specifying the type of MLT: • normalMLT • istMLT • splitMLT
RunningType	Read only field displaying the MLT operational type: • normalMLT • istMLT • splitMLT

Adding ports to an MLT-based SMLT

To add ports to an existing MLT-based SMLT:

1. From the Device Manager menu bar, choose VLAN > MLT/LACP.

   The MLT_LACP dialog box opens with the LACP Global tab (Figure 79 on page 186).

2. Select the Multilink/LACP Trunks tab.

   The Multilink/LACP Trunks tab (Figure 80 on page 187) opens with the active MLTs displayed. For field definitions, see Table 23 on page 190.

3. Double-click the Port Members field for the MLT-based SMLT to which you are adding ports.

   The MltPortMembers dialog box (Figure 83 on page 193) opens for the specified SMLT ID. Available ports are editable.

4. Select the port numbers to be added, or click All to select all ports.

   - For 8600 modules, up to 8 same-type ports can belong to a single MLT.
   - For 8100 modules, up to 4 same-type ports can belong to a single MLT.

5. Click OK.

   The MltPortMembers dialog box closes and the ports are added to the Port Members field on the MultiLink Trunks tab.

6. From the MultiLink Trunks tab, click Apply.

The ports are added to the MLT-based SMLT.

Configuring an IST MLT

To configure an IST MLT:

1. From the Device Manager menu bar, choose VLAN > MLT/LACP.

   The MLT_LACP dialog box opens with the LACP Global tab (Figure 79 on page 186).

2. Select the Multilink/LACP Trunks tab.

   The Multilink/LACP Trunks tab (Figure 80 on page 187) opens with the active MLTs displayed. For field definitions, see Table 23 on page 190.

3. Click Insert and the MLT_LACP, Insert Multilink/LACP Trunks dialog box (Figure 81 on page 188) appears.

4. In the PortMembers field for the IST MLT, click the ellipsis (...).

   The MltPortMembers dialog box opens, displaying the available ports.

5. Click the port(s) to include in the IST MLT.

6. Click OK.

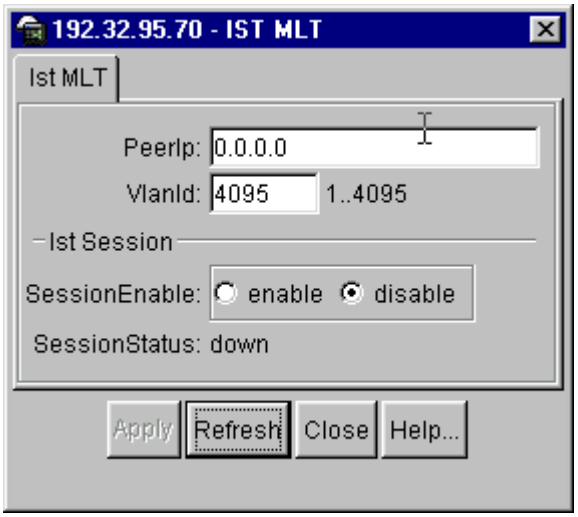
   The MltPortMembers dialog box closes and the ports are added to the PortMembers field for the IST MLT in the Insert MultiLink Trunks tab.

7. Select an istMLT in the MltType field.

8. Click IstMlt.

   The Ist MLT dialog box (Figure 88) opens. For field definitions, see Table 28 on page 205.

Figure 88 Ist MLT dialog box



9 In the PeerIp field, enter a peer IP address.

10 In the VlanId field, enter a VLAN ID.

11 In the Session Enable field, click either Enable or Disable.

12 Click Apply.

The IST MLT dialog box closes and the changes are applied.

13 Disable CP-Limit on the port using the CLI command:

```
config ethernet <slot/port> cp-limit disable
```

The IST MLT is configured. For more information, see "About CP-Limit and SMLT IST" on page 64 and "Disabling CP-Limit for an IST" on page 244.

Table 28 describes the IST MLT fields.

Table 28 IST MLT fields

Field	Description
Peerip	IST MLT peer IP address.
VlanId	An IST VLAN ID number from 1 to 4095.
SessionEnable	Enable/disable IST functionality.

Viewing IST statistics

To view IST statistics on an interface:

1 From the Device Manager menu bar, choose VLAN > MLT/LACP.

The MLT_LACP dialog box opens with the LACP Global tab(Figure 79 on page 186).

2 Click the Ist/SMLT Stats tab.

The Ist protocol packet statistics (Figure 89) are displayed.

Figure 89 Ist/SMLT Stats tab

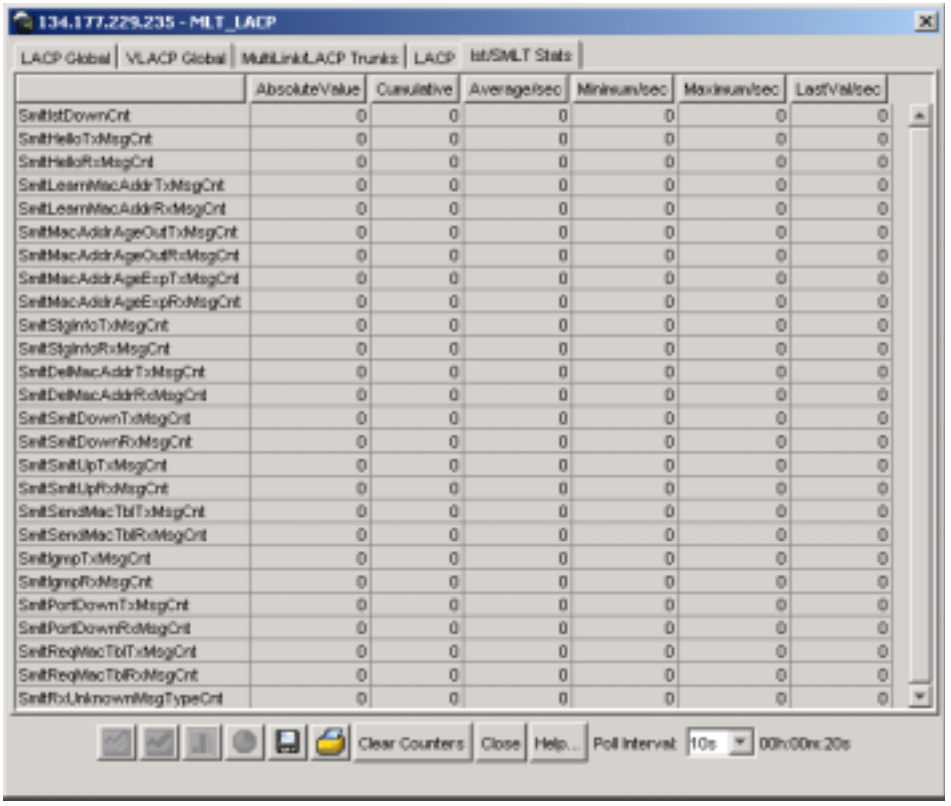


Table 29 describes the Ist/SMLT statistics.

Table 29 Ist/SMLT Stats tab fields

Field	Description
SmltIstDownCnt	The number of IST down messages.
SmltHelloTxMsgCnt	The number of hello messages transmitted.
SmltHelloRxMsgCnt	The number of hello messages received.
SmltLearnMacAddrTxMsgCnt	The number of learn MAC address messages transmitted.
SmltLearnMacAddrRxMsgCnt	The number of learn MAC address messages received.
SmltMacAddrAgeOutTxMsgCnt	The number of MAC address aging out messages transmitted.
SmltMacAddrAgeOutRxMsgCnt	The number of MAC address aging out messages received.
SmltMacAddrAgeExpTxMsgCnt	The number of MAC address age expired messages transmitted.
SmltMacAddrAgeExpRxMsgCnt	The number of MAC address age expired messages received.
SmltStgInfoTxMsgCnt	The number of SMLT STG info messages transmitted.
SmltStgInfoRxMsgCnt	The number of SMLT STG info messages received.
SmltDelMacAddrTxMsgCnt	The number of deleted MAC address messages transmitted.
SmltDelMacAddrRxMsgCnt	The number of deleted MAC address messages received.
SmltSmltDownTxMsgCnt	The number of SMLT down messages transmitted.
SmltSmltDownRxMsgCnt	The number of SMLT down messages received.
SmltSmltUpTxMsgCnt	The number of SMLT up messages transmitted.
SmltSmltUpRxMsgCnt	The number of SMLT up messages received.
SmltSendMacTblTxMsgCnt	The number of send MAC table messages transmitted.
SmltSendMacTblRxMsgCnt	The number of send MAC table messages received.
SmltIgmpTxMsgCnt	The number of IGMP messages transmitted.
SmltIgmpRxMsgCnt	The number of IGMP messages received.
SmltPortDownTxMsgCnt	The number of port down messages transmitted.
SmltPortDownRxMsgCnt	The number of port down messages received.

Table 29 Ist/SMLT Stats tab fields (continued)

Field	Description
SmltReqMacTblTxMsgCnt	The number of request MAC table messages transmitted.
SmltReqMacTblRx MsgCnt	The number of request MAC table messages received.
SmltRxUnknownMsgTypeCnt	The number unknown SMLT messages received.

Configuring a single port SMLT

Ports that are already configured as MLT or MLT-based SMLT cannot be configured as single port SMLT. You must first remove the split trunk and then reconfigure the ports as a single port SMLT.

To configure a single port SMLT:

1. From the Device Manager Main window, select the port.

   The port is highlighted.

2. From the menu bar, choose Edit > Port.

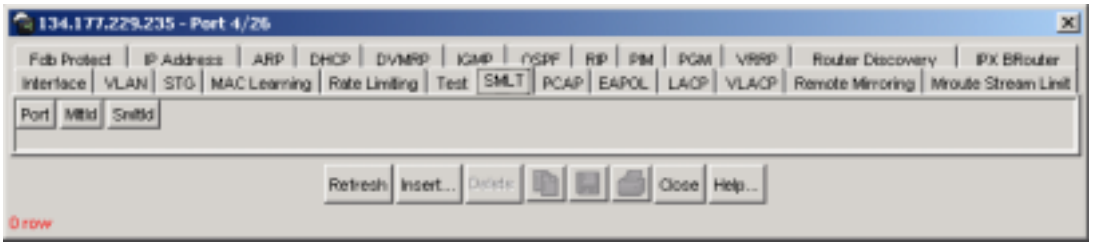
   The Port dialog box opens to the Interface tab.

3. Click the SMLT tab.

   The port's SMLT tab (Figure 90) opens.

Note: This tab indicates if this port is already configured as MLT or MLT-based SMLT. If so, you cannot configure single port SMLT.

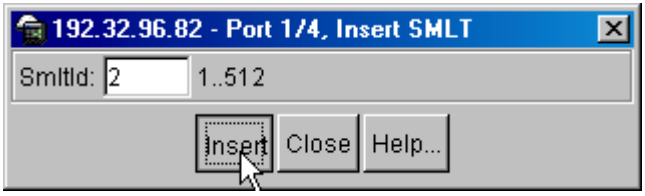
Figure 90 Port SMLT tab



4 Click Insert.

The Insert SMLT dialog box (Figure 91) opens.

Figure 91 Port, Insert SMLT dialog box



5 In the SmltId field, enter an unused SMLT ID number from 1 to 512.

To view the SMLT IDs that are already in use on your switch, see "Viewing single port SMLTs configured on your switch" on page 201.

6 Click Insert.

The Insert SMLT dialog box closes and the ID is entered into the SMLT tab.

Table 30 describes the fields on the Port SMLT tab.

Table 30 Port SMLT tab fields

Field	Description
Port	The slot/port number for the port.

Table 30 Port SMLT tab fields (continued)

Field	Description
MltId	Read only field, displaying one of the following: • A value of 1 - 32 indicates that the port is part of an MLT, and single port SMLT cannot be configured on this port. • A value of 0 indicates that no MLT is assigned, and the port can be configured for single port SMLT.
SmltId	The Split MLT ID, an integer from 1 to 512. • A read-only field with a value of 1-512 indicates the port's single port SMLT ID assignment. • A blank field indicates the port is not configured for single port SMLT. Find an unused SMLT ID by viewing the currently-used IDs. See "Viewing single port SMLTs configured on your switch" on page 201.

Deleting a single port SMLT

To delete a single port SMLT:

1. From the Device Manager Main window, select the port.

   The port is highlighted.

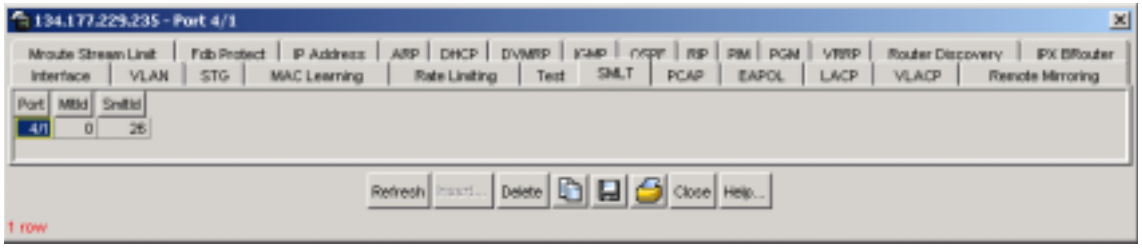
2. From the menu bar, choose Edit > Port.

   The Port dialog box opens to the Interface tab.

3. Click the SMLT tab.

   The port's SMLT tab (Figure 92) opens, displaying the single port SMLT ID.

Figure 92 Deleting a single port SMLT



4. Select the single port SMLT.

The single port SMLT is highlighted.

5 Click Delete >Close.

The single port SMLT is deleted.

Configuring the Global MAC filter

To configure the Global MAC filter:

1 From the Device Manager window select Vlan>Global Mac Filtering. The GlobalMacFiltering tab opens (Figure 93).

Figure 93 GlobalMacFiltering tab

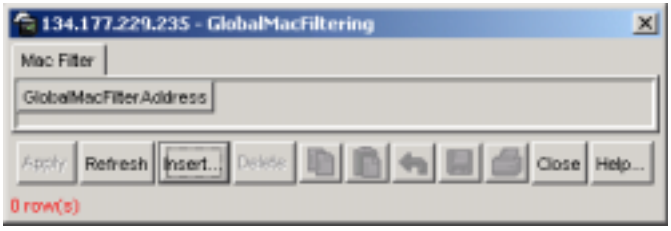


Table 31 describes the fields on the GlobalMacFiltering tab.

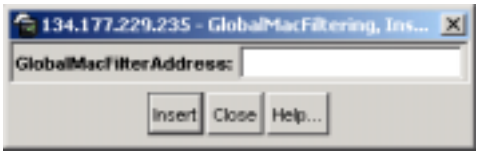
Table 31 GlobalMacFiltering tab fields

Field	Description
GlobalMacFilterAddress	A mac address which will be discarded globally by the switch.

2 Click Insert.

The GlobalMacFiltering, Insert Mac Filter dialog box opens (Figure 94).

Figure 94 GlobalMacFiltering, Insert Mac Filter dialog box



3 Type in the GlobalMacFilterAddress and then click Insert.

The address you entered then appears in the GlobalMacFiltering tab.

Chapter 6
Configuring multiple DSAP and SSAP per VLAN using Device Manager

The Passport 8000 Series switch allows you to configure multiple DSAPs or SSAPs for SNA or user-defined VLAN types. The base implementation of the SNA VLAN allows SNA 802.2 traffic to be classified into a SNA VLAN based on a 0x04 destination SAP or 0x04 source SAP. Some applications require changing these classifications to DSAP and to SSAP.

You can support any user-defined VLANs with multiple SSAPs and DSAPs. For example, you can add 31 additional protocol IDs or DSAP/SSAP values, for a total of 32, when you create a sna802dot2 VLAN or a user-defined VLAN, or when you reconfigure a sna802dot2 VLAN or a user-defined VLAN.

Note: Hardware record usage increases considerably when you configure multiple DSAPs or SSAPs for SNA or user-defined VLAN types. For more information, see “Design aspects” on page 214).

This chapter describes how to configure multiple DSAPs and SSAPs per VLAN and includes the following topics:

Design aspects

You can configure multiple DSAPs or SSAPs for SNA or user-defined VLAN types using the CLI or Device Manager. Regardless of your configuration tool, you must first create the SNA or user-defined VLAN, and then add the DSAPs or SSAPs for this VLAN.

For user-defined VLANs, DSAP/SSAP additions can only be applied to VLANs created without any specific encapsulation type or to VLANs with an encapsulation type of LLC. The addition of DSAP/SSAP is not allowed on user-defined VLANs created with an encapsulation type of Ethernet-ii or SNAP.

For each SNA802dot2 VLAN, including 31 additional DSAP/SSAP values, 256 records are created, including:

- 8 IEEE VLAN records
- 31 * 8 = 248 protocol ID records.

In this case the default 0x04 records is always created on the switch.

For each user defined VLAN created with no encapsulation specified, a total of 280 records are created, including:

- 8 IEEE VLAN records
- 3 * 8 = 24 protocol ID records for the base protocol ID (specified during VLAN creation). One record of each type - LLC, Ethernet-ii and SNAP is created in this case.
- 31 * 8 = 248 protocol ID records for the additional DSAP/SSAP added

For each user-defined VLAN created with encapsulation set to LLC, 264 HW records are created, including:

- 8 IEEE VLAN records
- 1 * 8 = 8 protocol ID records for the base protocol ID (specified during VLAN creation). Only the LLC record is created in this case
- 31 * 8 = 248 protocol ID records for the additional DSAP/SSAP added

Nortel Networks does not recommend using more than 10 of the UserDefined VLANs including 32 DSAP/SSAP values due to the extensive hardware record usage which could affect overall system scalability.

You can check for hardware record availability by executing the CLI command **`show/sys/record-reservation`**.

There is only one SNA VLAN allowed on an individual port. The switch does not allow configuring user-defined VLANs with DSAP/SSAP of xx04 or 04xx. Other values can be configured provided they are not the same as the reserved values listed (Table 32).

An exception is 0x0800 which can be configured with the encapsulation set to LLC.

Table 32 Reserved values for configuring SNA or user-defined VLANs

Protocol name	Etype	DSAP	SSAP	OUI	PID
IP_ii	0x0800				
ARP_ii	0x0806				
RARP_ii	0x8035				
IPX(old)_ii IPX_ii	0x8137 0x8138				
IPX(old)_SNAP IPX_SNAP				0x000000 0x000000	0x8137 0x8138
IPX_802.3		0xE0	0xE0		
IPX_802.3		0xFF	0xFF		
APPLE_ii APPLE_SNAP	0x809B 0X80F3			0x080007	0x809B 0x80F3
DEC_LAT	0x6004				

Table 32 Reserved values for configuring SNA or user-defined VLANs

Protocol name	Etype	DSAP	SSAP	OUI	PID
DEC_ELSE	0x6000 - 0x6003 0x6005 - 0x6009				
DEC_BPDU	0x8038				
SNA_ii	0x80D5				
SNA_LLC		0x04 XX	XX 0x04		
NetBIOS		0xF0 XX	XX 0xF0		
XNS XNS_comp	0x0600 0x0807				

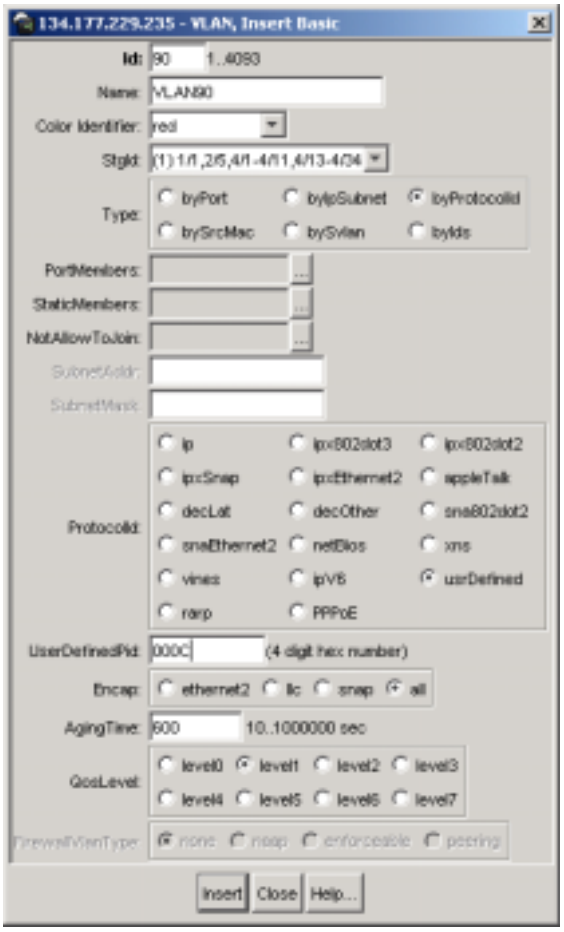
Configuring multiple DSAPs and SSAPs per VLAN

To configure this feature:

1. Use the VLAN > VLAN > Basic menu and create a user-defined VLAN or a SNA VLAN.

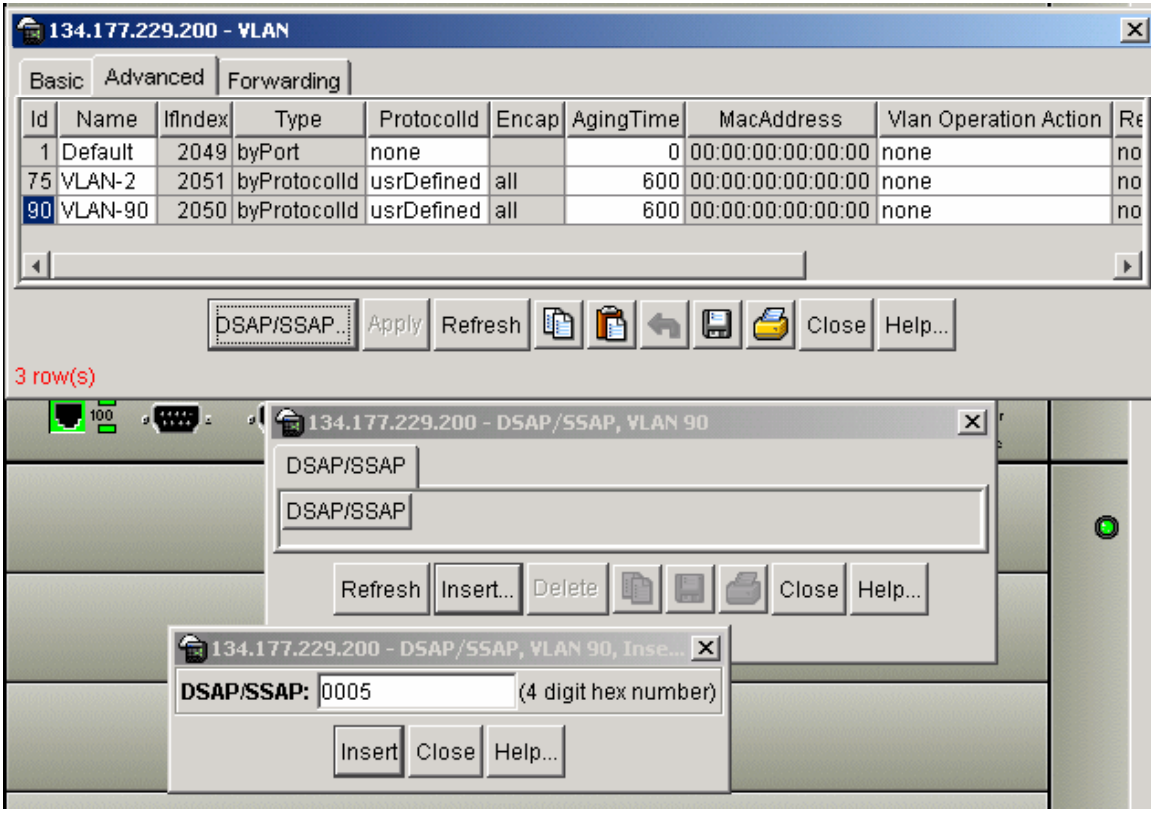
   Figure 95 shows an example of how to configure a user-defined VLAN with DSAP 000C using Device Manager.

Figure 95 Example of configuring a user-defined VLAN with DSAP 000C



2 After you have created the VLAN, select the Advanced tab and then add other DSAPs or SSAPs for the created VLAN (Figure 96).

Figure 96 Adding DSAPs or SSAPs in the VLAN Advanced tab



Chapter 7
Configuring and managing VLANs using the CLI

This chapter describes how to configure and manage VLANs using the CLI, and includes the following topics:

For conceptual information about VLANs, see “VLANs” on page 27.

Roadmap of VLAN commands

The following roadmap lists the VLAN commands and their parameters. Use this list as a quick reference or click on any entry for more information.

Command	Parameter
config vlan <vid> create	info byipsubnet <sid> <ipaddr/mask> [name <value>] [color <value>] byport <sid> [name <value>] [color <value>] [naap-vlan] [firewall-vlan] [firewall-peering-vlan]

Command	Parameter
	byprotocol <sid> <ip|ipx802dot3|ipx802dot2|ipxSnap|ipxEthernet2|appleTalk|decLat|decOther|sna802dot2|snaEthernet2|netBios|xns|vines|ipV6|usrDefined|rarp|PPPoE> [<pid>] [name <value>] [color <value>] [encap <value>]
	bysrcmac <sid> [name <value>] [color <value>]
	bysvlan <sid> [name <value>] [color <value>]
	forIDS <sid> [name <value>] [color <value>]
config vlan <vid>	info
	action <action choice>
	add-mlt <integer>
	addDsapSsap <DSAP/SSAP values>
	removeDsapSsap <DSAP/SSAP values>
	agetime <10..1000000>
	delete
	qos-level <integer>
	name <vname>
config vlan <vid> fdb-entry	info
	aging-time <seconds>
	flush
	monitor <mac> status <value> <true|false>
	qos-level <mac> status <value> <0..7>
	sync

Command	Parameter
config vlan <vid> fdb-filter	info
	add <mac> port <value> [qos <value>]
	pcap <mac> <enable|disable>
	remove <mac>
config vlan <vid> fdb-filter notallowfrom	info
	add <mac> port <value> [<srcOnly|dstOnly|Both>]
	remove <mac> port <value> [<srcOnly|dstOnly|Both>]
config vlan <vid> fdb-static	info
	add <mac> port <value> [qos <value>]
	remove <mac>
config vlan <vid> ports	info
	add <ports> [member <value>]
	remove <ports> [member <value>]
config vlan <vid> srcmac	info
	add <macaddr>
	remove <macaddr>
config vlan <vid> ip rsmlt	info
	enable
	disable
	holddown-timer <seconds>
	holdup-timer <seconds>

Command	Parameter
config vlan <vid> ipx rsmlt	info
	enable
	disable
	holddown-timer <seconds>
	holdup-timer <seconds>
show vlan info all [<vid>] [by <value>]	
show vlan info fdb-entry <vid>	
show vlan info fdb-filter <vid>	
show vlan info fdb-static <vid>	
show vlan info advance [<vid>]	
show vlan info arp [<vid>]	
show vlan info basic [<vid>]	
show vlan info brouter-port [<vid>]	
show vlan info igmp [<vid>]	
show vlan info ports [<vid>]	
show vlan info srcmac [<vid>]	
config vlan <vid> ip	info
	create <ipaddr/mask> [mac_offset <value>]
	delete <ipaddr>
show vlan info ip [<vid>]	
config sys set flag enhanced-operational-mode	true
	false

Configuring a VLAN

To create VLANs, add or remove ports in the VLAN, set priority, change a VLAN name, and perform other operation, use the VLAN configuration commands. In all VLAN commands, *vid* is the VLAN ID (from 1 to 4094).

This section includes the following procedures:

Creating a VLAN

To create a VLAN, use the following command:

```
config vlan <vid> create
```

You can specify the type of VLAN and assign an IP address to the VLAN using this command. The required parameter *vid* is the VLAN ID (from 1 to 4094). VLAN 1 is the default VLAN.

This command includes the following parameters:

config vlan <*vid*> create followed by:	
`info`	Displays information about the type of the specified VLAN.
`byipsubnet <sid> <ipaddr/mask> [name <value>] [color <value>]`	Creates an IP subnet-based VLAN. • *sid* is a spanning tree group ID from 1 to 64 characters. • *ipaddr/mask* is the IP address and mask {a.b.c.d/x | a.b.c.d/x.x.x.x | default}. • name <*value*> is the name of the VLAN from 0 to 20 characters. • color <*value*> is the color of the VLAN (0 to 32). The color attribute is used by Optivity software to display the VLAN. This command is available only for Passport 8600 switches.
`byport <sid> [name <value>] [color <value>] [naap-vlan] [firewall-vlan] [firewall-peering-vlan]`	Creates a port-based VLAN. • *sid* is the spanning tree group ID from 1 to 64 characters. • name <*value*> is the name of the VLAN. from 0 to 20 characters. • color <*value*> is the color of the VLAN {0..32}. The color attribute is used by Optivity software to display the VLAN.
`byprotocol <sid> <ip|ipx802dot3|ipx802dot2|ipxSnap|ipxEthernet2|appleTalk|decLat|decOther|sna802dot2|snaEthernet2|netBios|xns|vines|ipV6|usrDefined|rarp|PPPoE> [<pid>] [name <value>] [color <value>] [encap <value>]`	Creates a protocol-based VLAN. • *sid* is spanning tree ID 1 to 64. • *ip|ipx802dot3|ipx802dot2|ipxSnap|ipxEthernet2|appleTalk|decLat|decOther|sna802dot2|snaEthernet2|netBios|xns|vines|ipV6|usrDefined|rarp*|PPPoE specifies the protocol. • *pid* is a user-defined protocol ID number in hexadecimal (0 to 65535). • name <*value*> is the name of the VLAN from 0 to 20 characters. • color <*value*> is the color of the VLAN (0 to 32). The color attribute is used by Optivity software to display the VLAN. • encap <*value*> is the frame encapsulation method.

config vlan <*vid*> create followed by:	
bysrcmac <*sid*> [name <*value*>] [color <*value*>]	Creates a VLAN by source MAC address. • *sid* is spanning tree ID 1 to 64. • name <*value*> is the name of the VLAN from 0 to 20 characters. • color <*value*> is the color of the VLAN (0 to 32). The color attribute is used by Optivity software to display the VLAN. This command is available only for Passport 8600 switches.
bysvlan <*sid*> [name <*value*>] [color <*value*>]	Creates an sVLAN. • *sid* is spanning tree ID 1 to 64. • name <*value*> is the name of the VLAN from 0 to 20 characters. • color <*value*> is the color of the VLAN (0 to 32). The color attribute is used by Optivity software to display the VLAN.
forIDS <*sid*> [name <*value*>] [color <*value*>]	Creates a VLAN for IDS. • *sid* is spanning tree ID 1 to 64. • name <*value*> is the name of the VLAN from 0 to 20 characters. • color <*value*> is the color of the VLAN (0 to 32). The color attribute is used by Optivity software to display the VLAN.

Figure 97 shows sample output for the **config vlan create info** command.

Figure 97 config vlan create info command output

```
Passport-8603:3# config vlan 1 create info

Sub-Context: clear config dump monitor show test trace wsm asfm sam
Current Context:

                     byport :
                                 sid - 1
                                name - Default
                               color - 0 (white)
```

Performing general VLAN operations

To perform general VLAN operations, such a setting a QoS level for the VLAN or adding or changing the name of a VLAN, use the following command:

`config vlan <vid>`

In all VLAN commands, *vid* is the VLAN ID (from 1 to 4094).

This command includes the following options:

config vlan <*vid*> followed by:	
`info`	Displays characteristics of the specified VLAN (Figure 98).
`action <action choice>`	Flushes a table or triggers an RIP update. • *action choice* is {none|flushMacFdb|flushArp|flushIp|flushDynMemb|all|flushSnoopMemb|triggerRipUpdate|flushSenders|flushSnoopMRtr}. To flush all tables, use all.
`add-mlt <integer>`	Adds an MLT to a VLAN. *integer* is the MLT ID (1 to 32).
`addDsapSsap <DSAP/SSAP values>`	Adds DSAP/SSAP to SNA/USR defined VLANs. *DSAP/SSAP values* for SNA and user defined VLANs. (0x0..0xffff)
`removeDsapSsap <DSAP/SSAP values>`	Removes DSAP/SSAP to SNA/USR defined VLANs. *DSAP/SSAP values* for SNA and user defined VLANs. (0x0..0xffff)
`agetime <10..1000000>`	Sets the VLAN aging time in seconds (10 to 1000000).
`delete`	Deletes a VLAN.
`qos-level <integer>`	Sets a Quality of Service (QoS) level for a VLAN. *integer* is the QOS level (0 to 7).
`name <vname>`	Changes the name of a VLAN. *vname* is a string of length 0 to 20 characters.

Figure 98 shows sample output for the **`config vlan info`** command.

Figure 98 config vlan info command output

```
Passport-8603:3# config vlan 1 info

Sub-Context: clear config dump monitor show test trace wsm asfm sam
Current Context:

                     action : N/A
                    add-mlt : 32
                addDsapSsap :
             removeDsapSsap : N/A
                    agetime : N/A
                     delete : N/A
                   qoslevel : 1
                       name : Default
```

Configuration Example

The following configuration example uses the above command to:

- Add a DSAP to SNA /USR Vlans
- Delete a Vlan

After configuring the parameters, use the info command to show a summary of the results.

Passport-8600:5/config/vlan/10# addDsapSsap 0x0808

Passport-8600:5/config/vlan/10# info

Sub-Context: create fdb-entry fdb-filter fdb-static ip ipx ports srcmac static-mcastmac

Current Context:

action : N/A

add-mlt :

addDsapSsap : 0x000c,0x0808

```
removeDsapSsap : N/A

ageTime : 600

delete : N/A

qosLevel : 1

name : VLAN-1000

Passport-8600:5/config/vlan/10# removeDsapSsap 0x0808

Passport-8600:5/config/vlan/10# info

Sub-Context: create fdb-entry fdb-filter fdb-static ip ipx ports srcmac
static-mcastmac

Current Context:

action : N/A

add-mlt :

addDsapSsap : 0x000c

removeDsapSsap : N/A

ageTime : 600

delete : N/A

qosLevel : 1

name : VLAN-1000
```

Configuring VLAN parameters in the forwarding database

This section includes the following topics:

Configuring or modifying VLAN entries in the forwarding database

To configure or modify VLAN entries in the forwarding database, enter the following command:

```
config vlan <vid> fdb-entry
```

This command includes the following options:

config vlan <*vid*> fdb-entry followed by:	
`info`	Displays current level parameter settings and next level directories.
`aging-time <seconds>`	Sets the forwarding database aging timer. • *seconds* indicates the time out period in seconds {10..1000000}
`flush`	Flushes forwarding database.
`monitor <mac> status <value> <true|false>`	Sets forwarding database monitor parameters. • *mac* indicates the MAC address • `status <value>` allows you to view the current status of the forwarding database according to one of the following choices: {other|invalid|learned|self|mgmt} • `true|false` enables or disables the monitor.

config vlan <*vid*> fdb-entry followed by:	
qos-level <*mac*> status <*value*> <*0..7*>	Sets a QoS Level for a VLAN. • *mac* indicates the MAC address • status <*value*> is the forwarding database status according to one of the following choices: {other|invalid|learned|self|mgmt} • 0..7 set the QoS level from 0 through 7.
sync	Allows you to synchronize the switch's forwarding database with the forwarding database of the other aggregation switch.

Configuring VLAN filter members

To configure VLAN filter members, enter the following command:

```
config vlan <vid> fdb-filter
```

The **config vlan <vid> fdb-filter** command includes the following options:

config vlan <*vid*> fdb-filter followed by:	
info	Displays current level parameter settings and next level directories.
add <*mac*> port <*value*> [qos <*value*>]	Allows you to add a filter member to a VLAN bridge. • <*mac*> indicates the MAC address • port <*value*> indicates the port (slot/port) number. • qos <*value*> is the QoS level.
pcap <mac> <enable|disable>	Allows to you enable or disable the packet capture tool (PCAP). • <*mac*> indicates the MAC address For more information about PCAP, see the publication *Using the Packet Capture Tool*, part number 315023.
remove <*mac*>	Allows you to remove a filter member from a VLAN bridge. • <*mac*> indicates the MAC address

Configuration Example

The following configuration example uses the above command to:

- Add a filter member to the VLAN bridge
- Remove a filter member from a VLAN bridge

After configuring the parameters, use the info command to show a summary of the results:

Passport-8600:5/config/vlan/10/fdb-filter# add 2:2:2:2:2:2 port 1/1

Passport-8600:5/config/vlan/10/fdb-filter# info

Sub-Context: notallowfrom

Current Context:

add :

mac - 02:02:02:02:02:02

port - 1/1

Pcap - Disable

remove : N/A

Passport-8600:5/config/vlan/10/fdb-filter# remove 2:2:2:2:2:2

Passport-8600:5/config/vlan/10/fdb-filter# info

Sub-Context: notallowfrom

Current Context:

add :

remove : N/A

Setting or modifying parameters of VLAN not allowed filter member

To set or modify VLAN not allowed filter member parameters, enter the following command:

```
config vlan <vid> fdb-filter notallowfrom
```

This command includes the following options:

config vlan <*vid*> fdb-filter notallowfrom followed by:	
`info`	Displays current level parameter settings and next level directories.
`add <mac> port <value> [<srcOnly|dstOnly|Both>]`	Allows you to add a not allowed filter member to a VLAN bridge. • *<mac>* indicates the MAC address • *<value>* indicates the port (slot/port) number. • *<srcOnly}dstOnly|Both>* is optional to set a mask.
`remove <mac> port <value> [<srcOnly|dstOnly|Both>]`	Allows you to remove a not allowed filter member from a VLAN bridge. • *<mac>* indicates the MAC address • *<value>* indicates the port (slot/port) number. • *<srcOnly}dstOnly|Both>* is optional to set a mask.

Configuration Example

The following configuration example uses the above command to:

- Add a not allowed filter member to a VLAN bridge.

- Remove a not allowed filter member to a VLAN bridge.

After configuring the parameters, use the info command to show a summary of the results.

Passport-8600:5/config/vlan/10/fdb-filter# notallowfrom

Passport-8600:5/config/vlan/10/fdb-filter/notallowfrom# add 2:2:2:2:2:2 port 1/2 Both

Passport-8600:5/config/vlan/1000/fdb-filter/notallowfrom# info

Sub-Context:

Current Context:

add :

mac - 02:02:02:02:02:02

Dest Discard set - 1/2

Src Discard set - 1/2

remove : N/A

Passport-8600:5/config/vlan/10/fdb-filter/notallowfrom# remove 2:2:2:2:2:2 port 1/2 srcOnly

Passport-8600:5/config/vlan/10/fdb-filter/notallowfrom# info

Sub-Context:

Current Context:

add :

mac - 02:02:02:02:02:02

Dest Discard set - 1/2

Src Discard set -

remove : N/A

Configuring VLAN static member parameters

To configure VLAN static member parameters, enter the following command:

`config vlan <vid> fdb-static`

This command includes the following options:

`config vlan <vid>` fdb-static followed by:	
`info`	Displays current level parameter settings and next level directories.
`add <mac> port <value> [qos <value>]`	Allows you to add a static member to a vlan bridge. • `<mac>` indicates the MAC address • `<value>` indicates the port (slot/port) number. • `qos <value>` is the QoS level.
`remove <mac>`	Allows you to remove a static member from a VLAN bridge. • `<mac>` indicates the MAC address

Adding or removing VLAN ports

To add or remove ports in the VLAN, enter the following command:

`config vlan <vid> ports`

This command includes the following options:

config vlan <*vid*> ports followed by:	
info	Displays member status of the ports in the VLAN (Figure 99 on page 235).
add <*ports*> [member <*value*>]	Adds one or more ports to an existing VLAN. • *ports* is the port list. • member <*value*> is the port member type. It can be portmember (always a member), static (sometimes a member), or notallowed (never a member).
remove <*ports*> [member <*value*>]	Removes ports from a VLAN but does not delete the VLAN. • *ports* is the port list. • member <*value*> is the port member type. It can be portmember (always a member), static (sometimes a member), or notallowed (never a member).

Figure 99 shows sample output for the **config vlan ports info** command.

Figure 99 config vlan ports info command output

```
Passport-8603:3# config vlan 1 ports info

Sub-Context: clear config dump monitor show test trace wsm asfm sam
Current Context:

                        add :
                           portmember - 1/1-1/48,2/3-2/4
                         activemember - 1/1-1/48,2/3-2/4
                         staticmember -
                       notallowtojoin -
                    remove : N/A
```

Adding or removing VLAN source MAC addresses

To add or remove VLAN source MAC addresses, enter the following command:

```
config vlan <vid> srcmac
```

This command includes the following options:

config vlan <*vid*> srcmac followed by:	
`info`	Displays current level parameter settings and next level directories.
`add <macaddr>`	Adds a source MAC address to a VLAN. • *macaddr* is the MAC address to be added.
`remove <macaddr>`	Removes a source MAC address from a VLAN. • *macaddr* is the MAC address to be removed.

Configuring RSMLT on an IP interface

The RSMLT holdup timer should be configured to the infinite on both RSMLT features if used as Gateway address for the client.

To configure RSMLT on an IP interface, enter the following command:

```
config vlan <vid> ip rsmlt
```

where:
<vid> is the ID of the VLAN.

This command includes the following options:

config vlan <vid> ip rsmlt followed by:	
`info`	Displays current level parameter settings and next level directories.
`enable`	Enables RSMLT.
`disable`	Disables RSMLT.

config vlan <vid> ip rsmlt followed by:	
holddown-timer <*seconds*>	Sets the RSMLT hold-down timer. *seconds* is the hold-down timer value with range of 0 to 3600.
holdup-timer <*seconds*>	Sets the RSMLT hold-up timer. *seconds* is the hold-up timer value with range of 0 to 9999.

Configuring RSMLT on an IPX interface

To configure RMSLT on an IP interface, enter the following command:

```
config vlan <vid> ipx rsmlt
```

where:
<*vid*> is the ID of the VLAN.

This command includes the following options:

config vlan <vid> ipx rsmlt followed by:	
info	Displays current level parameter settings and next level directories.
enable	Enables RSMLT.
disable	Disables RSMLT.
holddown-timer <*seconds*>	Sets the RSMLT hold-down timer. *seconds* is the hold-down timer value with range of 0 to 3600.
holdup-timer <*seconds*>	Sets the RSMLT hold-up timer. *seconds* is the hold-up timer value with range of 0 to 9999.

Using the VLAN show commands

To obtain configuration information about all VLANs on the switch or specified VLANs, use the **show vlan** commands.

This section includes the following topics:

Displaying general VLAN information

To display all general information about the VLANs on the switch or a specified VLAN, enter the following command:

```
show vlan info all [<vid>] [by <value>]
```

where:
`<vid>` is the VLAN id (1..4094)
`by <value>` groups the information by ID number or by each feature.

Displaying information for specified VLANs

To display information for the specified VLANs, use the show commands. This section provides the following show command procedures:

Displaying forwarding database information

To display forwarding database information for the specified VLAN, enter the following command:

```
show vlan info fdb-entry <vid>
```

Figure 100 shows sample output for the **show vlan info fdb-entry** command.

Figure 100 show vlan info fdb-entry command output

```
Passport-8603:3# show vlan info fdb-entry 1

================================================================================
===
                                      Vlan Fdb
================================================================================
===
VLAN            MAC                                      QOS    SMLT
ID   STATUS     ADDRESS            INTERFACE  MONITOR LEVEL  REMOTE
--------------------------------------------------------------------------------
---

0 out of 2 entries in all fdb(s) displayed.
```

Displaying forwarding database filters

To display the forwarding database filters for the specified VLAN, enter the following command:

```
show vlan info fdb-filter <vid>
```

The display includes the VLAN ID, the status, the VLAN MAC address, and the ports from which the VLAN is not allowed to receive frames.

This command is available only for the Passport 8600 Switch.

Figure 101 shows sample output for the **show vlan info fdb-filter** command.

Figure 101 show vlan info fdb-filter command output

```
Passport-8603:3# show vlan info fdb-filter 1

================================================================================
===
                                        Vlan Filter
================================================================================
===
VLAN           MAC                        QOS          DEST_DISCARD
SRC_DISCARD
ID   STATUS    ADDRESS            PORT    LEVEL PCAP    SET
SET
--------------------------------------------------------------------------------
```

Displaying database status, MAC address, and QoS levels

To display the static forwarding database status, the VLAN MAC address, and the QoS level for the specified VLAN, enter the following command:

`show vlan info fdb-static <vid>`

Figure 102 shows sample output for the **show vlan info fdb-static** command.

Figure 102 show vlan info fdb-static command output

```
TOKYO>5:# show vlan info fdb-static 1

================================================================================
                                        Vlan Static
================================================================================
VLAN                 MAC                                QOS
ID   STATUS          ADDRESS             PORT    MONITOR LEVEL
--------------------------------------------------------------------------------
1    learned         08:12:20:38:4e:76  1/1     1/2     7

TOKYO>5:#
```

Displaying additional parameters

To display additional parameters for the specified VLAN or all VLANs, enter the following command:

```
show vlan info advance [<vid>]
```

All zeros in the MAC ADDRESS column indicate that there is no IP address associated with that VLAN.

Figure 103 shows sample output for the **`show vlan info advance`** command.

Figure 103 show vlan info advance command output

```
Passport-8603:3# show vlan info advance

================================================================================
==
                                        Vlan Advance
================================================================================
==
VLAN        IF    QOS AGING MAC                              USER
ID  NAME    INDEX LVL TIME  ADDRESS           ACTION RESULT  DEFINEPID ENCAP
--------------------------------------------------------------------------------
--
1   Default 2049  1   0     00:00:00:00:00:00  none   none    0x0000

VLAN
ID  DSAP/SSAP
--------------------------------------------------------------------------------
```

Displaying ARP configuration

To display the ARP configuration for all VLANs or the specified VLAN, enter the following command:

```
show vlan info arp [<vid>]
```

Figure 104 shows sample output for the **show vlan info arp** command.

Figure 104 show vlan info arp command output

```
Passport-8603:3# show vlan info arp

================================================================
==================
                                              Vlan Arp
================================================================
==================
VLAN ID  DOPROXY    DORESP
----------------------------------------------------------------
------------------
1        false      true
4093     false      true
```

Displaying basic configuration

To display the basic configuration for all VLANs or the specified VLAN, enter the following command:

`show vlan info basic [<vid>]`

Figure 105 shows sample output for the **show vlan info basic** command.

Figure 105 show vlan info basic command output

```
Passport-8603:3# show vlan info basic

================================================================================
==
                                      Vlan Basic
================================================================================
==
VLAN                               STG
ID  NAME            TYPE         ID  PROTOCOLID SUBNETADDR      SUBNETMASK
--------------------------------------------------------------------------------
--
1   Default         byPort       1   none       N/A             N/A
4093 VLAN-4093        byPort       64  none       N/A             N/A
```

Displaying brouter port status

To display the brouter port status for all VLANs on the switch or for the specified VLAN, enter the following command:

```
show vlan info brouter-port [<vid>]
```

This command is available only for Passport 8600 switches.

Figure 106 shows sample output for the **show vlan info brouter-port** command.

Figure 106 show vlan info brouter-port command output

```
TOKYO>:5# show vlan info brouter-port 1

        Vlan Id          Port
        =======          ====
        1                1/3

TOKYO>:5#
```

Displaying IGMP switch operation information

To display information about the IGMP operation in the switch, enter the following command:

```
show vlan info igmp [<vid>]
```

Figure 107 shows sample output for the **show vlan info igmp** command.

Figure 107 show vlan info igmp command output

```
Passport-8603:3# show vlan info igmp 1

================================================================================
                                      Vlan Ip Igmp
================================================================================
VLAN QUERY QUERY ROBUST VERSION LAST  PROXY  SNOOP  SSM    FAST   FAST
ID   INTVL MAX                  MEMB  SNOOP  ENABLE SNOOP  LEAVE  LEAVE
           RESP                 QUERY ENABLE        ENABLE ENABLE PORTS
--------------------------------------------------------------------------------
1    125   100   2      2       10    false  false  false  false

Passport-8603:3#
```

Displaying port member status

To display the port member status for all VLANs on the switch or for the specified VLAN, enter the following command:

```
show vlan info ports [<vid>]
```

A port can be an active member, a static member, or a not-allowed member.

Figure 108 shows sample output for the **show vlan info ports** command.

Figure 108 show vlan info ports command output

```
TOKYO>:5# show vlan info ports

================================================================================
                                      Vlan Port
================================================================================
VLAN PORT              ACTIVE            STATIC            NOT_ALLOW
ID   MEMBER            MEMBER            MEMBER            MEMBER
--------------------------------------------------------------------------------
1    9/1-9/48          9/1-9/48
2    9/3               9/3
3    9/2               9/2               9/2

================================================================================
                                      Vlan ATM VPort
================================================================================
VLAN ID    PORT NUM      PVC LIST

TOKYO>:5#
```

Displaying source MAC addresses

To display the source MAC address for any source MAC-based VLANs on the switch, or for the specified VLAN, if it is source MAC-based, enter the following command:

`show vlan info srcmac [<vid>]`

This command is available only for the Passport 8600 switch.

Figure 109 shows sample output for the **show vlan info srcmac** command.

Figure 109 show vlan info srcmac command output

```
TOKYO>:5# show vlan info srcmac

================================================================================
                                        Vlan Srcmac
================================================================================
VLAN_ID    MAC_ADDRESS
1          00:00:00:00:00:00
2          00:00:00:00:00:00

TOKYO>:5#
```

Displaying RSMLT information

To display RSMLT boot flags, enter the following command:

```
show ip rsmlt info [<local|peer>]
```

Using the VLAN IP commands

The VLAN IP commands described in this section are general routing commands for the VLAN. Other VLAN commands are included in the sections of this manual that describe commands used with a specific protocol or feature (for example, DHCP).

Assigning an IP address to a VLAN

To assign an IP address to a VLAN, use the following command:

```
config vlan <vid> ip
```

This command requires a VLAN ID *vid* from 1 to 4094.

On 8100 switches, only VLAN ID 1 can be configured with an IP address.

This command includes the following options:

config vlan <*vid*> ip followed by:	
`info`	Displays current level parameter settings and next level directories.
`create <ipaddr/mask> [mac_offset <value>]`	Assigns an IP address and subnet mask to the VLAN. • *ipaddr/mask* is the IP address and mask {a.b.c.d}. • `mac_offset <value>` is a user-assigned MAC address. This MAC address is in place of the default MAC address.
`delete <ipaddr>`	Deletes the specified VLAN address.

Figure 110 shows sample output for the **`config vlan ip info`** command.

Figure 110 config vlan ip info command output

```
Passport-8603:3/config/vlan/1/ip# info
Sub-Context: arp-response dhcp-relay directed-broadcast dvmrp igmp ospf pim
pgm proxy rip route-discovery rsmlt vrrp

urrent Context:
             create : 10.1.1.1/255.255.255.0 mac_offset 1
                          delete : N/A
```

Displaying routing (IP) configuration

To display the routing (IP) configuration for all VLANs on the switch or for the specified VLAN, enter the following command:

`show vlan info ip [<vid>]`

Figure 111 shows sample output for the **show vlan info ip** command.

Figure 111 show vlan info ip command output

```
TOKYO>:5# show vlan info ip

================================================================================
                                      Vlan Ip
================================================================================
VLAN IP              NET              BCASTADDR REASM    ADVERTISE  DIRECTED
ID   ADDRESS         MASK             FORMAT    MAXSIZE  WHEN_DOWN  BROADCAST
--------------------------------------------------------------------------------
1    192.32.253.1    255.255.255.0    ones      1500     disable    enable

TOKYO>:5#
```

Configuring Enhanced Operation mode

Enhanced operation mode enables the Passport 8000 Series switch to support more VLANs. With MLT, you can create a maximum of 1980 VLANs. With SMLT, the limit is 989 VLANs. For more information on enhanced operation concepts, see “MultiLink trunking and VLAN scalability” on page 45.

To configure enhanced operation for 1980 VLANs on the Passport 8000 Series switch, use the following command:

```
config sys set flag enhanced-operational-mode
```

The command includes the following parameters:

You must save the configuration and reset the chassis before the change takes effect.

The **config sys set flag enhanced-operational-mode** command includes the following options:

config sys set flag enhanced-operational-mode followed by:	
true	Enables enhanced operation mode to support 1980 VLANs for the system.
false	Disables enhanced operation mode for the system.

Configuration example: configuring support for 1980 VLANs

This configuration example uses the above commands to configure support for 1,980 VLANs.

- Enable enhanced-operational mode.
- View a summary of the results.

Figure 112 shows sample output for this configuration commands.

Figure 112 configuration example for supporting 1980 VLANs command output

```
Passport-8603:3# config sys set flag info

Sub-Context: clear config dump monitor show test trace wsm asfm sam
Current Context:

                                m-mode: (false) -> false
             enhanced-operational-mode: (false) -> false
                vlan-optimization-mode: (false) -> false
                global-filter-ordering: (false) -> false

Passport-8603:3#
```

Chapter 8
Configuring sVLANs using the CLI

The stacked VLAN (sVLAN) protocol transparently transports packets through an sVLAN domain by adding an additional 4-byte header to each packet.

This section describes how to configure sVLANs using the CLI and includes the following topics:

For conceptual information about sVLANs, see “Stacked VLANs” on page 47.

Roadmap of VLAN commands

The following roadmap lists the VLAN commands and their parameters. Use this list as a quick reference or click on any entry for more information.

Command	Parameter
config svlan	info
	ether-type level <value> <ethertype>
	level <level>
show svlan info ether-type	
show svlan info active-level	
config ethernet <ports> svlan-porttype <uni|nni>	info
	svlan-porttype <normal|uni|nni>
config stg <sid>	info
	add ports <value>
	create [<ports>] [vlan <value>] [mac <value>] [type <value>] [ntstg <value>]
	delete
	forward-delay <timeval>
	group-stp <enable|disable>
	hello-interval <timeval>
	max-age <timeval>
	priority <number>
	remove ports <value>
	trap-stp <enable|disable>
config stg <sid> add ports <ports>	add ports <ports>
config vlan <vid> create bysvlan <sid>	bysvlan <sid> [name <value>] [color <value>]

Overview of sVLAN CLI configuration

Follow these steps to create an sVLAN using the CLI:

Note: You must follow these steps in sequence to configure an sVLAN.

1. Set the sVLAN switch level to 1 or above.

   For more information, see "Setting the ether-type and switch level" on page 253.

2. Configure UNI and NNI ports.

   For more information, see "Setting the sVLAN port type" on page 257.

3. Create a STG of type sVLAN and set the tagged BPDU address as different from the standardized BPDU.

   For more information, see "Creating an sVLAN STG" on page 259.

4. Add UNI or NNI ports to the STG.

   For more information, see "Adding UNI or NNI ports to the STG" on page 261.

5. Create VLAN of type sVLAN within the STG created in Step 3 and add ports to it.

   For more information, see "Creating an sVLAN" on page 263.

Setting the ether-type and switch level

To set the ether-type and switch level, use the following commands:

```
config svlan
```

For sVLAN configurations, you must set the switch level to 1 or above.

The **`config svlan`** command includes the following parameters:

`config svlan` followed by:	
`info`	Displays current configuration information for an sVLAN (Figure 113).
`ether-type level <value> <ethertype>`	Sets an sVLAN tag for a switch level. <*value*> is an integer value in the range of 1 to 7. <*ethertype*> hex value in the range of 0x5dd to 0xffff.
`level <level>`	Allows you to specify the switch level associated with this sVLAN. • <*level*> is an integer value in the range of 0 to 7. Level 0 (normal port): 802.1Q frames are classified into port-based VLANs. Level 1-7: any frame type is transparently switched and an additional Ether type 4 bytes is added. The default level is 0.

Figure 113 shows the **config svlan info** command output.

Figure 113 config svlan info command output

```
Passport-8603:3# config svlan info

Sub-Context: clear config dump monitor show test trace wsm asfm sam
Current Context:

        LEVEL ETHER-TYPE
        0     0x8100
        1     0x8020
        2     0x8030
        3     0x8040
        4     0x8050
        5     0x8060
        6     0x8070
        7     0x8080

        Active-Level = 0
Passport-8603:3#
```

Showing ether-type and switch level information

To display sVLAN ether-type and level information, use the following commands:

```
show svlan info ether-type
show svlan info active-level
```

Figure 114 shows sample output for the **show svlan info ether-type** command, while Figure 115 shows output for the **show svlan info active-level** command.

Figure 114 show svlan info ether-type command output

```
Passport-8603:3# show svlan info ether-type

================================================================================
                                        Stacked Vlan Ether Type
================================================================================
LEVEL ETHER-TYPE
--------------------------------------------------------------------------------
0     0x8100
1     0x8020
2     0x8030
3     0x8040
4     0x8050
5     0x8060
6     0x8070
7     0x8080

Passport-8603:3#
```

Figure 115 show svlan info level command output

```
Passport-8606:5# config svlan info active-level

Sub-Context: clear config dump monitor show test trace wsm asfm sam
Current Context:

        LEVEL ETHER-TYPE
        0     0x8100
        1     0x8022
        2     0x8030
        3     0x8040
        4     0x8050
        5     0x8060
        6     0x8070
        7     0x8080

        Active-Level = 1
Passport-8606:5#
```

Setting the sVLAN port type

You must set the sVLAN port type to sVLAN UNI or sVLAN NNI.

To set the sVLAN port type, use the following command:

```
config ethernet <ports> svlan-porttype <uni|nni>
```

Note: Since each OctaPID can support up to eight ports, you must designate all ports within an OctaPID as either normal or sVLAN (that is, the ports can be all Normal or a combination of UNI/NNI within the Octapid, which could be up to 8 ports). See Appendix A, “Tap and OctaPID assignment“Configuring sVLANs using the CLI” on page 251. CHECK REFERENCE

You will see the warning shown in Figure 116.

Figure 116 sVLAN-porttype warning

```
Passport-8606:5# config svlan level 1
Passport-8606:5# config ethernet 10/12 svlan-porttype uni
warning: Ports 10/9-10/16 may be removed from all the Vlans and
Stgs. Do you want to continue? (y/n) ? y
Passport-8606:5#
```

When you configure a UNI port in the CLI, the tagged-frames-discard parameter is automatically enabled. Similarly, when you configure an NNI port in the CLI, the untagged-frames-discard parameter is automatically enabled.

The **`config ethernet <ports>`** command includes the following parameters:

`config ethernet <ports>` followed by:	
`info`	Displays the current port settings (Figure 117).
`svlan-porttype <normal|uni|nni>`	Sets the port type for the sVLAN to normal, user-to-network interface (UNI), or network-to-network interface (NNI). The default is normal.

Figure 117 shows sample output for the **`config ethernet <ports> info`** command.

Figure 117 config ethernet <ports> info command output

```
Passport-8606:5/config/ethernet/1/2#
Passport-8606:5/config/ethernet/1/2# info

Sub-Context: ip ipx multimedia stg unknown-mac-discard
Current Context:

Port 1/2 :
                         lock : false
                         name :
              auto-negotiate : true
             enable-diffserv : false
             access-diffserv : false
                   qos-level : 1
         unknown-mac-discard : disable
             default-vlan-id : 0
       tagged-frames-discard : enable
             perform-tagging : disable
              svlan-porttype : uni
     untagged-frames-discard : disable
                 loop-detect : disable
                       state : up
                    linktrap : enable
        multicast rate-limit : disabled
        broadcast rate-limit : disabled
                     cp limit : enabled multicast limit 15000
                                broadcast limit 10000

Passport-8606:5#
```

Creating an sVLAN STG

To set a tagged BPDU address different from the standardized BPDU address and create an sVLAN STG, use the following command:

```
config stg <sid>
```

The **`config stg <sid>`** command configures parameters for a specified spanning tree group. The required parameter **`<sid>`** (spanning tree group ID) is from 1 to 64.

The **`config stg <sid>`** command includes the following parameters:

`config stg <sid>` followed by:	
`info`	Displays current configuration information
`add ports <value>`	Adds ports for the STG. • *`value`* is the port list.
`create [<ports>] [vlan <value>] [mac <value>] [type <value>] [ntstg <value>]`	Creates a new STG. • `<ports>` specifies one or more ports. • `vlan <value>` is the tagged BPDU VLAN ID. If a VLAN spans multiple switches, it must be within the same STG across all switches. Range is from 1 to 4094. • `mac <value>` is the tagged BPDU MAC address. • `type <value>` sets the STG to normal or sVLAN. `Choices are stgsvlan or stgnormal.` • ntstg <value> enables or disables NTSTG. Choices are enable or disable.
`delete`	Deletes a STG.
`forward-delay <timeval>`	Bridges forward delay time for the STG. • *`timeval`* is the number in 1/100 seconds. Range is 400 to 3000.
`group-stp <enable|disable>`	Enables or disables STP for a specific STG.
`hello-interval <timeval>`	Bridges hello time for the STG. • *`timeval`* is the number in 1/100 seconds. Range is 100 to 1000.
`max-age <timeval>`	Bridges maximum age time for the STG. • *`timeval`* is the number in 1/100 seconds. Range is 600 to 4000.
`priority <number>`	Bridges priority for the STG. • *`number`* is the prioity number. Range is 0 to 65535.

config stg <*sid*> followed by:	
remove ports <value>	Removes ports for the STG. • *value* is the port list.
trap-stp <enable|disable>	Enables or disables STP traps for a specific STG.

Figure 118 shows sample output for the **config stg info** command

Figure 118 config stg info command output

```
Passport-8606:5# config stg 2 create mac 01:23:45:67:89:01 type stgsvlan
Passport-8606:5# config stg 2 info

Sub-Context: clear config dump monitor show test trace wsm asfm sam
Current Context:

                  add ports :
                     create : 2
                     delete : N/A
               forward-delay : 1500
                   group-stp : true
              hello-interval : 200
                     max-age : 2000
                    priority : 32768
                remove ports : N/A
                    trap-stp : true
                        type : stgsvlan
                     nt-stg : enable

Passport-8606:5#
```

Adding UNI or NNI ports to the STG

To add UNI or NNI ports to the STG, use the following command:

```
config stg <sid> add ports <ports>
```

The **config stg <*sid*>** command configures parameters for a specified spanning tree group. The required parameter **<*sid*>** (spanning tree group ID) is from 1 to 64.

The **config stg <*sid*>** command includes the following options:

config stg <*sid*> followed by:	
add ports <*ports*>	Adds ports to a STG. *ports* specifies one or more ports.

Figure 119 shows sample output for the **config stg <sid> info** command.

Figure 119 config stg <sid> info command output

```
Passport-8606:5# config stg 2 add ports 1/1
Passport-8606:5# config stg 2 info

Sub-Context: clear config dump monitor show test trace wsm asfm sam
Current Context:

                  add ports : 1/1
                     create : 2
                     delete : N/A
              forward-delay : 1500
                  group-stp : true
             hello-interval : 200
                    max-age : 2000
                   priority : 32768
               remove ports : N/A
                  trap-stp : true
                       type : stgsvlan
                     nt-stg : enable

Passport-8606:5#
```

Creating an sVLAN

To create a VLAN of type sVLAN, use the following command:

```
config vlan <vid> create bysvlan <sid>
```

This command allows you to specify the type of VLAN. The required parameter *vid* is the VLAN ID (from 1 to 4094). VLAN 1 is the default VLAN.

This command includes the following parameters:

config vlan <*vid*> create followed by:	
bysvlan <*sid*> [name <*value*>] [color <*value*>]	Creates an sVLAN. • *sid* is spanning tree ID 1 to 64. • name <*value*> is the name of the VLAN from 0 to 20 characters. • color <*value*> is the color of the VLAN (0 to 32). The color attribute is used by Optivity software to display the VLAN. This command is available only for the Passport 8600.

Figure 120 shows sample output for the **config vlan info** command

Figure 120 config vlan info command output

```
Passport-8610:5/config/vlan/2# create bysvlan 2 name SVLAN2
color 11
Passport-8610:5/config/vlan/2# info

Sub-Context: create-fdb-entry fdb-filter fdb-static ip ipx
ports scrmac static-mcastmac
Current Context:

                action     : N/A
                add-mlt    :
                agetime    : 0
                delete     : N/A
                qoslevel   : 1
                name       : SVLAN2
```

Configuration example

Figure 121 uses all the commands required to create an sVLAN.

Note: You must enter the commands in sequence.

Figure 121 sample command output for creating an sVLAN

```
Passport-8606:5# config svlan level 3
Passport-8606:5# config ethernet 10/12 svlan-porttype uni
warning: Ports 10/9-10/16 may be removed from all the Vlans and Stgs. Do you
want to continue? (y/n) ? y
Passport-8606:5# config stg 9 create mac 01:90:c2:00:00:00 type stgsvlan
Passport-8606:5# config vlan 1476 create bysvlan 9 name matt color 11
Passport-8606:5# config stg 9 add ports 10/9-10/16
Passport-8606:5#
```

Chapter 9
Configuring STGs using the CLI

You can set up spanning tree groups (STGs) by using the spanning tree group commands. You can set parameters for a group and for ports in that group. You can also enable or disable the Spanning Tree Protocol in an STG.

The Passport 8600 modules support up to 25 STGs in a switch.

The Passport 8100 modules support only one STG (STG 1) in a switch.

This section includes information about configuring STG and its parameters by using the appropriate commands and includes the following topics:

Roadmap of STG commands

The following roadmap lists all STG commands and their parameters. Use this list as a quick reference or click on any entry for more information:

Command	Parameter
config stg <sid>	info
	add ports <ports>

Command	Parameter
	create [<ports>] [vlan <value>] [mac <value>] [type <value>] [ntstg <value>]
	delete
	forward-delay <timeval>
	group-stp <enable|disable>
	hello-interval <timeval>
	max-age <timeval>
	priority <number>
	remove ports <value>
	trap-stp <enable|disable>
config ethernet <ports> stg <sid>	info
	faststart <enable|disable>
	change-detection <enable|disable>
	pathcost <intval>
	priority <intval>
	stp <enable|disable>
show stg show-all	
show stg info config	
show stg info status [<sid>]	
show ports info stg main [<ports>]	
show ports info stg extended [<ports>]	
show ports stats stg [<ports>]	

Configuring STG parameters

To configure parameters for a specified spanning tree group, enter the following command:

```
config stg <sid>
```

where:
sid (spanning tree group ID) is a value from 1 to 25.

This command includes the following options:

config stg <*sid*> followed by:	
`info`	Displays characteristics of the spanning tree group.
`add ports <ports>`	Adds port(s) to a spanning tree group. *ports* specifies one or more slot/port numbers. Ports can not be added to the STG if: • configured as single port SMLT • configured as members of another STG
`create [<ports>] [vlan <value>] [mac <value>] [type <value>] [ntstg <value>]`	Creates a new spanning tree group. • <*ports*> specifies one or more slot/port numbers. (Note: ports cannot be added to the STG if configured as single port SMLT, or as a member of another STG.) • `vlan <value>` is the VLAN ID. If a VLAN spans multiple switches, it must be within the same STG across all switches. • `mac <value>` is the MAC address. • `type <value>` is the type of STG. Choices are *stgnormal* or *stgsvlan*. • `ntstg <value>` enables or disables ntstg. By default, ntstg is enabled providing the default group STP operation. By setting the ntstg parameter to disable, this enables PVST+ for this particular VLAN.
`delete`	Deletes the specified spanning tree group.

config stg <*sid*> followed by:	
`forward-delay <timeval>`	Sets the bridge forward delay time in 1/100 seconds. `<timeval>` is between 400 and 3000. The default is 1500 (15 seconds).
`group-stp <enable|disable>`	Enables or disables the Spanning Tree Protocol on the specified spanning tree group.
`hello-interval <timeval>`	Sets the bridge hello time in 1/100 seconds. `<timeval>` is between 100 and 1000. The default is 200 (2 seconds).
`max-age <timeval>`	Sets the bridge maximum age time in 1/100 seconds. `<timeval>` is between 600 and 4000. The default is 2000 (20 seconds).
`priority <number>`	Sets the bridge priority number. `<number>` is between 0 and 65535.
`remove ports <value>`	Removes ports from a spanning tree group. `<value>` is the specified port.
`trap-stp <enable|disable>`	Enables or disables the Spanning Tree Protocol trap for the specified spanning tree group.

Note: Disabling the Spanning Tree Protocol can reduce CPU overhead slightly. However, unless you are using the switch in a simple network with little possibility of having loops, Nortel Networks recommends that you leave the Spanning Tree Protocol enabled.

Figure 122 shows sample output for the **config stg info** command.

Figure 122 config stg info command output

```
Passport-8603:3# config stg 1 info

Sub-Context: clear config dump monitor show test trace wsm asfm sam
Current Context:

                    add ports : 1/1-1/48,2/3-2/4
                       create : 1
                       delete : N/A
                forward-delay : 1500
                    group-stp : true
               hello-interval : 200
                      max-age : 2000
                     priority : 32768
                 remove ports : N/A
                     trap-stp : true
                         type : normal
                       nt-stg : enable

Passport-8603:3#
```

Configuring STG port parameters

Ports must have tagging enabled to belong to multiple spanning tree groups.

Note: Nortel Networks recommends that you enable FastStart as an alternative to disabling Spanning Tree Protocol on an individual port.
Note: The Spanning Tree protocol is currently not supported on SMLT/IST ports.

To configure spanning tree group port parameters, enter the following command:

```
config ethernet <ports> stg <sid>
```

where:
ports = the slot/port(s) you want to add to the STG.
sid = the spanning tree group ID. The valid values are 1 to 64.

This command includes the following options:

config ethernet <*ports*> stg <*sid*> followed by:	
info	Displays current settings for the port spanning tree group.
faststart <enable|disable>	Enables or disables the FastStart feature. When FastStart is enabled, the port goes through the normal listening and learning states before forwarding, but the hold time for these states is the bridge hello timer (2 seconds by default) instead of the bridge forward delay timer (15 seconds by default).
change-detection <enable|disable>	Enables or disables topology change detection for the specified spanning tree. The default is enable.
pathcost <*intval*>	Sets the contribution of this port to the path cost. <*intval*> is the cost (1 to 65535).
priority <*intval*>	Sets the priority of this port. <*intval*> is the priority (0 to 255).
stp <enable|disable>	Enables or disables the Spanning Tree Protocol. Note: Spanning Tree protocol is not supported on SMLT or IST ports.

To display the current settings for the spanning tree group, use the following command:

```
config ethernet <ports> stg <sid> info
```

Figure 123 shows sample output for this command.

Figure 123 config ethernet <slot/port> stg <sid> info command output

```
8610# config ethernet 2/1 stg 1 info

Sub-Context:
Current Context:

Port 2/1 :
              change-detection : enable
                    faststart : disable
                     pathcost : 100
                     priority : 128
                          stp : enable
```

Configuring topology change detection

Change detection is enabled by default. With change detection enabled, when a topology change occurs, a trap is sent containing the MAC address of the STG sending the topology change notification (TCN), the port number, and the STG ID. You can use this information to identify the device. For more information about change detection, see "Spanning tree protocol topology change detection" on page 55.

To configure topology change detection, use the following command:

```
config ethernet <ports> stg <sid> change-detection <enable|disable>
```

where:

ports =	the port on which you want to configure spanning tree topology change detection. If you enable change detection on an MLT with access ports, the setting is automatically applied to all ports in the MLT.
sid =	the spanning tree (1 - 64) for which you want to enable or disable topology change detection.
enable|*disable* =	enables or disables topology change detection for the specified spanning tree. The default is `enabled`.

Querying the change-detection setting

To query the change detection setting, use the following command:

```
config ethernet <ports> stg <sid> info
```

Figure 123 on page 271 shows sample output for this command.

The **`show ports info stg main`** command (Figure 124) also displays the change detection setting.

Figure 124 show ports info stg main command output

```
Passport 8606:5# show ports info stg main

================================================================================
                                        Port Stg
================================================================================
                              ENABLE                        FORWARD    CHANGE
SID PORT_NUM PRIO STATE        STP   FASTSTART PATHCOST TRANSITION DETECTION
--------------------------------------------------------------------------------
1   4/1      128  disabled   false  false     100      0          true
1   4/2      128  disabled   true   false     100      0          true
1   4/3      128  disabled   true   false     100      0          true
1   4/4      128  disabled   true   false     100      0          true
1   4/5      128  disabled   true   false     100      0          true
1   4/6      128  disabled   true   false     100      0          true
1   4/7      128  disabled   true   false     65535    0          true
1   4/8      128  disabled   true   false     65535    0          true

Passport 8606:5#
```

Using the STG show commands

To display the status of spanning tree on the switch or on a port, use the **`show stg`** commands.

This section includes information on show commands that allow you to display:

- “Displaying all STG information” on page 273

Displaying all STG information

To display all Spanning Tree Group information enter the following command:

```
show stg show-all
```

The command uses the syntax:

```
show stg show-all [file <value>]
```

where <*value*> is the filename to which the output will be redirected. Figure 125 shows sample output for this command.

Figure 125 show stg show-all sample output

```
Passport-8603:3# show stg show-all

# show stg info config

================================================================================
                                    Stg Config
================================================================================
STG           BRIDGE  BRIDGE     FORWARD ENABLE STPTRAP
ID   PRIORITY MAX_AGE HELLO_TIME DELAY   STP    TRAP    NT-STG
--------------------------------------------------------------------------------
1    32768    2000    200        1500    true   true    enable
64   32768    2000    200        1500    false  true    enable

STG  TAGGBPDU           TAGGBPDU STG     PORT
ID   ADDRESS            VLAN_ID   TYPE MEMBER
--------------------------------------------------------------------------------
1    01:80:c2:00:00:00  0       normal 1/1-1/48,2/3-2/4
64   01:80:c2:00:00:00  4093    normal 2/3-2/4

Total number of STGs :  2



# show stg info status


================================================================================
                                    Stg Status
================================================================================
STG  BRIDGE            NUM   PROTOCOL      TOP
ID   ADDRESS           PORTS SPECIFICATION CHANGES
--------------------------------------------------------------------------------
1    00:04:38:7e:84:01 50    ieee8021d     1
64   00:04:38:7e:84:40 2     ieee8021d     0

STG  DESIGNATED              ROOT  ROOT  MAX  HELLO  HOLD  FORWARD
ID   ROOT                    COST  PORT  AGE  TIME   TIME  DELAY
--------------------------------------------------------------------------------
1    80:00:00:04:38:7e:84:01 0     cpp   2000 200    100   1500
64   80:00:00:04:38:7e:84:40 0     cpp   2000 200    100   1500

Total number of STGs :  2
Passport-8603:3#
```

Displaying STG configuration

To display the spanning tree group configuration for the switch or for the specified spanning tree group, enter the following command:

```
show stg info config
```

The command syntax is:

```
show stg info config [<sid>]
```

Figure 126 shows sample output for the **`show stg info config`** command.

Figure 126 show stg info config command output

```
Passport-8603:3# show stg info config

================================================================================
                                    Stg Config
================================================================================
STG           BRIDGE  BRIDGE     FORWARD ENABLE STPTRAP
ID   PRIORITY MAX_AGE HELLO_TIME DELAY   STP    TRAP    NT-STG
--------------------------------------------------------------------------------
1    32768    2000    200        1500    true   true    enable
64   32768    2000    200        1500    false  true    enable

STG  TAGGBPDU           TAGGBPDU STG     PORT
ID   ADDRESS            VLAN_ID   TYPE MEMBER
--------------------------------------------------------------------------------
1    01:80:c2:00:00:00  0       normal 1/1-1/48,2/3-2/4
64   01:80:c2:00:00:00  4093    normal 2/3-2/4

Total number of STGs :  2
Passport-8603:3#
```

Displaying STG status

To display the spanning tree group status for the specified spanning tree group or all STGs, enter the following command:

```
show stg info status [<sid>]
```

Figure 127 shows sample output for the **show stg info status** command.

Figure 127 show stg info status command output

```
Passport-8603:3# show stg info status

================================================================================
                                      Stg Status
================================================================================
STG  BRIDGE            NUM   PROTOCOL      TOP
ID   ADDRESS           PORTS SPECIFICATION CHANGES
--------------------------------------------------------------------------------
1    00:04:38:7e:84:01 50    ieee8021d     1
64   00:04:38:7e:84:40 2     ieee8021d     0

STG  DESIGNATED              ROOT  ROOT  MAX  HELLO  HOLD  FORWARD
ID   ROOT                    COST  PORT  AGE  TIME   TIME  DELAY
--------------------------------------------------------------------------------
1    80:00:00:04:38:7e:84:01 0     cpp   2000 200    100   1500
64   80:00:00:04:38:7e:84:40 0     cpp   2000 200    100   1500

Total number of STGs :  2
Passport-8603:3#
```

Displaying basic STG information

To display basic spanning tree group information about one or more specified ports or about all ports, enter the following command:

```
show ports info stg main [<ports>]
```

(See also "Displaying basic STG information" on page 276 for information on the **show ports info stg extended** command.)

Figure 128 shows sample output for the **show ports info stg main** command.

Figure 128 show ports info stg main command output

```
Passport-8603:3# show ports info stg main 1/1

================================================================================
                                        Port Stg
================================================================================
                              ENABLE                    FORWARD    CHANGE
SID PORT_NUM PRIO STATE        STP   FASTSTART PATHCOST TRANSITION DETECTION
--------------------------------------------------------------------------------
1   1/1      128  disabled    true   false     100      0          true

Passport-8603:3#
```

Displaying additional STG information

To display additional spanning tree group information about the specified port or about all ports, enter the following command:

`show ports info stg extended [<ports>]`

This information is less often used in switch monitoring than the information obtained with the **show ports info stg main** command (page 276).

Figure 129 shows sample output for the **show ports info stg extended** command.

Figure 129 show ports info stg extended command output

```
Passport-8603:3# show port info stg extended

================================================================================
                                    Port Stg Extended
================================================================================

          ----------------------DESIGNATED----------------
SID PORT_NUM   ROOT                     COST       BRIDGE                   PORT
--------------------------------------------------------------------------------
--
1   1/1        80:00:00:04:38:7e:84:01 0          80:00:00:04:38:7e:84:01 80:40
1   1/2        80:00:00:04:38:7e:84:01 0          80:00:00:04:38:7e:84:01 80:41
1   1/3        80:00:00:04:38:7e:84:01 0          80:00:00:04:38:7e:84:01 80:42
1   1/4        80:00:00:04:38:7e:84:01 0          80:00:00:04:38:7e:84:01 80:43
1   1/5        80:00:00:04:38:7e:84:01 0          80:00:00:04:38:7e:84:01 80:44
1   1/6        80:00:00:04:38:7e:84:01 0          80:00:00:04:38:7e:84:01 80:45
1   1/7        80:00:00:04:38:7e:84:01 0          80:00:00:04:38:7e:84:01 80:46
1   1/8        80:00:00:04:38:7e:84:01 0          80:00:00:04:38:7e:84:01 80:47
```

Displaying STG statistics counters

To display statistics counters for spanning tree groups on all ports or the specified port, enter the following command:

`show ports stats stg [<ports>]`

Figure 130 shows sample output for the **`show ports stats stg`** command.

Figure 130 show ports stats stg command (partial output)

```
Passport-8603:3# show ports stats stg
================================================================================
                                      Port Stats Stg
================================================================================
PORT     IN_CONFIG  IN_TCN     IN_BAD     OUT_CONFIG OUT_TCN
NUM      BPDU       BPDU       BPDU       BPDU       BPDU
--------------------------------------------------------------------------------
--
1/1      0          0          0          0          0
1/2      0          0          0          0          0
1/3      0          0          0          0          0
1/4      0          0          0          0          0
1/5      0          0          0          0          0
1/6      0          0          0          0          0
1/7      0          0          0          0          0
1/8      0          0          0          0          0
1/9      0          0          0          0          0
1/10     0          0          0          0          0
1/11     0          0          0          0          0
1/12     0          0          0          0          0
1/13     0          0          0          0          0
1/14     0          0          0          0          0
```

Chapter 10
Configuring Link Aggregation using the CLI

This section describes the 802.3ad link aggregation (link aggregation) commands.

Note: Although the command line for the Passport 8000 Series switch refers to MLT, the feature supported in the Passport 8000 Series switch is 802.3ad link aggregation. For more information, See "Link aggregation (MLT, IEEE 802.3ad, VLACP, SMLT)" on page 58.

This chapter includes the following topics:

Roadmap of link aggregation commands

The following roadmap lists the commands used for configuring link aggregation.

Command	Parameter
`config mlt <mid>`	`info`
	`create`

Command	Parameter
	cp-limit <enable|disable> [multicast-limit <value>] [broadcast-limit <value>]
	delete
	mcast-distribution <enable|disable>
	name <string>
	ntstg <enable|disable>
	perform-tagging <enable|disable>
	svlan-porttype <uni|nni|normal>
config mlt <mid> add	info
	ports <ports>
	vlan <vid>
config mlt <mid> remove	info
	ports <ports>
	vlan <vid>
config mlt <mid> mcast-distribution	enable
	disable
config lacp	info
	enable
	disable
	aggr-wait-time <milliseconds>
	system-priority <integer>
	fast-periodic-time milliseconds
	slow-periodic-time milliseconds
	timeout-scale <integer>
config mlt <mlt id> lacp	info
	enable
	disable

Command	Parameter
	clear-link-aggregate
	key
	system-priority <integer>
config <port-type> <slot|port> lacp	info
	enable
	disable
	aggr-wait-time <milliseconds>
	fast-periodic-time <milliseconds>
	key <integer>
	aggregation <true|false>
	mode <active|passive>
	partner-key <int>
	partner-port <int>
	partner-port-priority <int>
	partner-state <hex>
	partner-system-id <mac>
	partner-system-priority <int>
	port-priority <integer>
	slow-periodic-time <milliseconds>
	system-priority <integer>
	port-priority <integer>
	slow-periodic-time <milliseconds>
	system-priority <integer>
	timeout <long|short>
	timeout-scale <integer>
show lacp info	
show port info lacp[<ports>]	

Command	Parameter
show port stats lacp [<ports>]	
show mlt lacp [<mlt id>]	
config <port-type> <slot|port> vlacp	info
	enable
	disable
	fast-periodic-time <milliseconds>
	slow-periodic-time <milliseconds>
	timeout <long|short>
	timeout-scale <integer>
	ethertype <integer>
	macaddress <mac>
show port info vlacp <slot/port>	
config vlacp	info
	enable
	disable
config mlt <mid> smlt	info
	create smlt-id <value>
	delete
config mlt <mid> ist	info
	create ip <value> vlan-id <value>
	delete
	disable
	enable
config mlt <mlt-id> ist create ip <value> vlan-id <value>	
config mlt <mlt-id> ist <enable|disable>	

Command	Parameter
config ethernet <slot/port> cp-limit disable	<enable|disable>
	multicast-limit <value>
	broadcast-limit <value>
config mlt <mlt-id> ist delete	
config <Ethernet|ATM|POS> <port> smlt <SmltId> <option>	info
	create
	delete
config sys set smlt-on-single-cp <enable/disable> [timer <value>]	
show mlt show-all [file <value>]	
show mlt error collision [<mid>]	
show mlt error main [<mid>]	
show mlt info [<mid>]	
show smlt info [<mid>]	
show port info smlt	
show port info config <port>	
show mlt stats [<mid>]	
config fdb fdb-filter	info
	add <mac>
	remove <mac>

Configuring link aggregation

This section includes configuration commands for the following topics:

Link aggregation commands

To set up MLTs on the switch, enter the following command:

`config mlt <mid>`

The required parameter *mid* specifies the link aggregation ID (1 to 32).

This command includes the following options:

config mlt *<mid>* followed by:	
info	Displays current settings for the specified link aggregation group.
create	Creates a link aggregation group.

config mlt *<mid>* followed by:	
`cp-limit <enable|disable> [multicast-limit <value>] [broadcast-limit <value>]`	Sets the control packet rate limit. • *<enable|disable>* = Enables or disables control packet rate limit. To re-enable the ports, issue the command `config ethernet slot/port state disable` then enable {disable|enable}. • `multicast-limit` *<value>* is the multicast control frame rate with range from 1000 to 100000. • `broadcast-limit` *<value>* is the broadcast frame rate with range from 1000 to 100000.
`delete`	Deletes a link aggregation group.
`mcast-distribution <enable|disable>`	Enables or disables multicast distribution per link aggregation group. Multicast distribution is disabled by default. For detailed information about commands used to configure multicast distribution over link aggregation, see the publication, *Configuring IP Routing Multicast Protocols*.
`name` *<string>*	Names a link aggregation group. • *string* is the name, from 0 to 20 characters.
`ntstg <enable|disable>`	Enables or disable NTSTG.
`perform-tagging <enable|disable>`	Enables or disables tagging on a link aggregation port.
`svlan-porttype <uni|nni|normal>`	Sets the port type to normal, uni, or nni.

Figure 131 shows sample output for the **`config mlt info`** command.

Figure 131 config mlt info command output

```
Passport-8603:3/config/mlt/3# info

Sub-Context: add ist lacp remove smlt
Current Context:

             create : 3
             delete : N/A
          mcast-distribution : disable
               name : MLT-3
             nt-stg : enable
             perform-tagging : disable
          svlan-porttype : normal
              portmember :
                cp-limit : port   status
                MC-limit :
                 BC-limit:
```

Adding ports to a link aggregation group

To add ports to a link aggregation group, and add an existing VLAN to a link aggregation configuration, enter the following command:

`config mlt <`*`mid`*`> add`

This command includes the following options:

config mlt <*mid*> add followed by:	
info	Displays ports and/or VLANs added to the link aggregation group.
ports <*ports*>	Adds ports to the link aggregation group. • *ports* is the port number or a list of ports you want to add to the link aggregation group. Use the following convention when adding one or more vlans to the link aggregation: {vid[-vid] [,...]}. Note: If the port you are configuring already has an SMLT ID on it, you cannot add it to the link aggregation group.
vlan <*vid*>	Adds an existing VLAN to the link aggregation group. *vid* is the VLAN ID or a list of VLAN IDs you want to add to the link aggregation group.The range is 1 to 4094 VLANs. Use the following convention when adding one or more ports to the link aggregation: {vid[-vid][,...]}.

Configuration Example

The following configuration example uses the above command to:

- Add ports to link aggregation group
- Add an existing VLAN to the link aggregation group

After configuring the parameters, use the info command to show a summary of the results.

Passport-8600:5#/config/mlt/1# add po 1/1-1/7,1/9

Passport-8600:5#/config/mlt/1# add vlan 1-8,10

Passport-8600:5#/config/mlt/1# info

Sub-Context:

Current Context:

ports : 1/1-1/7,1/9

vlan : 1-8,10

Passport-8600:5#/config/mlt/1/add# remove

Passport-8600:5#/config/mlt/1/remove# po 1/1-1/7,1/9

Passport-8600:5#/config/mlt/1/remove# vlan 1-8,10

Passport-8600:5#/config/mlt/1/remove# info

Sub-Context:

Current Context:

ports :

vlan :

Removing ports from a link aggregation group

To remove ports from an MLT and remove a VLAN from an MLT configuration, enter the following command:

```
config mlt <mid> remove
```

This command includes the following options:

config mlt <*mid*> remove followed by:	
`info`	Displays the ports and/or VLANs removed from the MLT.
`ports <ports>`	removes ports from the MLT. • *ports* is the port number or a list of ports you want to remove from the MLT. Use the following convention when removing one or more ports from the MLT:{vid[-vid][,...]}.
`vlan <vid>`	Removes a VLAN from the MLT. *vid* is the VLAN ID or a list of VLAN IDs you want to remove from the link aggregation group.The range is 1 to 4094 VLANs. Use the following convention when removing one or more vlans from the link aggregation: {vid[-vid][,...]}. The range is 1 to 4094 VLANs.

Configuring multicast distribution for an MLT

Multicast distribution over MLT is supported only on 8000 Series E-modules.

To configure multicast distribution for an MLT, enter the following command:

```
config mlt <mid> mcast-distribution
```

This command includes the following options:

config mlt <*mid*> mcast-distribution followed by:	
`enable`	Enables multicast distribution for the MLT.
`disable`	Disables multicast distribution for the MLT.

For more information about multicast distribution over MLT, see the *Configuring IP Routing Multicast Protocols* guide.

Global LACP commands

Caution: Changes made at the global-level override and reset all port-level settings.

LACP can be enabled or disabled globally. When LACP is set to system-priority globally, it is applied to all LACP enabled aggregators and ports. When LACP is enabled on an aggregator or a port, it will take the current global system-priority. LACP protocol is described in terms of the operation of aggregation within a single system however, the managed objects provided both for the aggregator and the port allow management of these parameters. The result of this is to permit a single piece of equipment to be configured by management to contain more than one system from the point of view of the operation of link aggregation. The basic command syntax is:

```
config lacp
```

This command includes the following options:

config lacp followed by:	
`info`	Displays current level parameter settings and next level directories.
`enable`	Enables LACP globally.
`disable`	Disables LACP globally.
`aggr-wait-time <milliseconds>`	Sets the aggregator wait-time in milliseconds. The default wait-time is 2,000 ms. The range is 200 to 2,000 ms.
`system-priority <integer>`	Sets LACP system priority globally. *`integer`* is the system priority value with range of 0..65535.
`fast-periodic-time milliseconds`	Sets fast periodic time globally. *`milliseconds`* is the fast periodic time value.
`slow-periodic-time milliseconds`	Sets slow periodic time globally. *`milliseconds`* is the slow periodic time value.
`timeout-scale <integer>`	Sets a timeout scale globally. *`integer`* is the timeout scale value.

Aggregator configuration commands

When LACP is enabled globally on an MLT, that MLT is associated with an aggregator and used for link aggregation. When LACP is disabled on an MLT, this MLT functions as a legacy MLT. Clear-link-aggregate is equivalent to disable and re-enable LACP on the MLT.

You can attach ports to an aggregator only if their system-priorities are the same; otherwise, they are considered to be operating in two different switches. You can attach ports to an aggregator only if their key are the same.

The basic command syntax is:

`config mlt <mlt id> lacp`

where:
<mlt id> is the MLT ID (1..32).

This command includes the following options:

config mlt <mlt id> lacp followed by:	
`info`	Displays current level parameter settings and next level directories.
`enable`	Enables LACP for a specific MLT.
`disable`	Disables LACP for a specific MLT.
`clear-link-aggregate`	Clears link aggregation information for a specific MLT.
`key`	Sets LACP aggregator key for a specific MLT.
`system-priority <integer>`	Sets LACP system-priority for a specific MLT. *integer* is system-priority value with range 0..65535.

Port configuration commands

Caution: Changes made at the global-level override and reset all port-level settings.

LACP can be enabled or disabled on a selected port list. A port can operate in active or passive mode. It can be configured to use long timeout or short timeout. It can be configured as an individual link or aggregatable link. All the timers are configurable, however when timers are changed from their default values, the user has to make sure that the timer values on both sides of the link are consistent. The basic command syntax is:

```
config <port-type> <slot|port> lacp
```

where:

- *port-type* is Ethernet or POS.
- *slot|port* is the slot and port number.

This command includes the following options:

config <port-type> <slot/port> lacp followed by:	
info	Displays current level parameter settings and next level directories.
enable	Enables LACP for a specific port-type.
disable	Disables LACP for a specific port-type.
aggr-wait-time <milliseconds>	Sets the aggregation wait time (in milliseconds) for a specific port-type. • *milliseconds* is the LACP aggregation wait time, an integer value in the range 200 and 2,000 ms
fast-periodic-time <*milliseconds*>	Sets the fast periodic time (in milliseconds) for a specific port-type. The default value is 1,000 ms. • *milliseconds* is the fast periodic time value; an integer value in the range 200 and 20,000 ms. **Note:** The fast periodic time value of 200 ms is not supported for this software release. The minimum supported fast periodic time value is 400 ms.

config <port-type> <slot/port> lacp followed by:	
key <*integer*>	Sets LACP aggregation key for a specific port-type. • *integer* is an integer value in the range 1 and 32 for aggregatable ports. • You can use a default key only for individual ports, an integer value in the range 0 and 65535.
aggregation <true|false>	Sets individual port or aggregatable for a specific port type. • *true* sets port as aggregatable. • *false* sets port as individual.
mode <*active*|*passive*>	Sets the mode as active or passive for a specific port-type.
partner-key <int>	Sets the port partner's administration key value. • *int* is the LACP partner's administrative key; an integer value in the range 0 and 65535.
partner-port <int>	Sets the port partner's administration port value. • *int* is the LACP partner's administrative port; an integer value in the range 0 and 65535.
partner-port-priority <int>	Sets the port partner's administration port priority value. • *int* is the LACP partner's administrative port priority; an integer value in the range 0 and 65535.
partner-state <hex>	Sets the port partner's administration state. • *hex* is the LACP partner's administrative state bitmap; (Exp,Def,Dis,Col,Syn,Agg,Time,Act). **Example:** • Activity = true • Aggregating = true • val = 00000101 (0x05) {0x0..0xff}
partner-system-id <mac>	Sets the port partner's administration system ID. • *mac* is the LACP partner's administrative system ID; Mac address in the format: 0x00:0x00:0x00:0x00:0x00:0x00.
partner-system-priority <int>	Sets the port partner's administration system priority value. • *int* is the LACP partner's administrative system priority; an integer value in the range 0 and 65535.

config <port-type> <slot/port> lacp followed by:	
port-priority <*integer*>	Sets the LACP port priority to specific port type. The default value is 32768. • *integer* is the port priority value; an integer value in the range 0 and 65535.
slow-periodic-time <*milliseconds*>	Sets the slow periodic time (in milliseconds) for a specific port-type. The default value is 1,000 ms • *integer* is the slow periodic time value, an integer value in the range 10,000 and 30,000 ms.
system-priority <*integer*>	Sets system-priority for a specific port-type. *integer* is system-priority value with range 0..65535.
timeout <*long*|*short*>	Sets the timeout value to either long or short for a specific port-type.
timeout-scale <*integer*>	Sets a timeout scale for a specific port-type. The default value is 3. • *integer* is the timeout scale value, an integer value in the range 1 and 10.

LACP show commands

This section describes show commands you can use to display LACP information.

Displaying global LACP configuration information

To display global LACP configuration information, enter the following command:

```
show lacp info
```

Displaying LACP configuration information per port

To display LACP configuration information per port, enter the following command:

```
show port info lacp[<ports>]
```

where:
<*ports*> is the port number.

Displaying LACP statistics information per port

To display LACP statistics information per port, enter the following command:

```
show port stats lacp [<ports>]
```

where:

- *ports* is the port number.

Displaying LACP configuration information per aggregator

To display LACP configuration information per aggregator, enter the following command:

```
show mlt lacp [<mlt id>]
```

where:

- *mlt id* is the MLT ID (1..32).

Configuring VLACP on a port

Caution: Changes made at the global-level override and reset all port-level settings.

Use the following command to configure VLACP on a port:

```
config <port-type> <slot|port> vlacp
```

where:

- *port-type* is Ethernet or POS.
- *slot|port* is the slot and port number.

This command includes the following options:

config <port-type> <slot|port> vlacp followed by:	
`info`	Displays current level parameter settings and next level directories.
`enable`	Enables VLACP for a specific port-type.
`disable`	Disables VLACP for a specific port-type.
`fast-periodic-time <milliseconds>`	Sets the fast periodic time value (in milliseconds) for a specific port-type. The default value is 200 ms • *`milliseconds`* is the fast periodic time value, an integer value in the range 200 and 20,000 ms. **Note:** The fast periodic time value of 200 ms is not supported for this software release. The minimum supported fast periodic time value is 400 ms.
`slow-periodic-time <milliseconds>`	Sets the slow periodic time value (in milliseconds) for a specific port-type. The default value is 30,000 ms • *`milliseconds`* is the slow periodic time value, an integer value in the range 10,000 and 30,000 ms.
`timeout <long|short>`	Sets the port to use the long or short timeout value: • *long* sets the port to use the timeout-scale value * the slow-periodic-time value. • *short* sets the port to use the timeout-scale value * the fast-periodic-time value. For example, if you set the timeout-scale *value* to 3, and the fast-periodic-time *value* to 200 ms, the timer will expire within 400 to 600 ms.
`timeout-scale <integer>`	Sets a timeout scale for a specific port-type (where timeout-scale = periodic-time * timeout-scale). The default value is 3. • *`integer`* is the timeout scale value, an integer value in the range 1 and 10.
`ethertype <integer>`	Sets the VLACP protocol identification for this port. • *integer* is the ethertype value, an integer value in the range 1 and 65535.
`macaddress <mac>`	Sets the Multicast MAC address used for the VLACPDU. Required parameters: *mac* is the MAC address in the following format: 0x00:0x00:0x00:0x00:0x00:0x00

Displaying the VLACP port configuration

Enter the following command to display the port VLACP configuration:

```
show port info vlacp <slot/port>
```

Globally enabling or disabling VLACP

Caution: Changes made at the global-level override and reset all port-level settings.

To globally enable or disable VLACP, use the following command:

```
config vlacp
```

This command includes the following options:

`config vlacp` followed by:	
`info`	Displays current level parameter settings and next level directories.
`enable`	Enables VLACP globally.
`disable`	Disables VLACP globally.

Creating an SMLT from an existing MLT

To create an SMLT from an existing MLT, enter the following command:

```
config mlt <mid> smlt
```

Note: Before you can create an SMLT, you must first create an MLT (see "Link aggregation commands" on page 286).

This command includes the following options:

config mlt <*mid*> smlt followed by:	
`info`	Displays ports and/or VLANs added to the MLT.
`create smlt-id <value>`	Creates an SMLT from an existing MLT. • *value* is an integer value with a range of 1 to 32. The value must match the peer switch's SMLT-ID. Note: If the SMLT ID already exists on a single port SMLT, you cannot assign it to an MLT-based SMLT.
`delete`	Deletes an existing SMLT.

Creating an IST

To create an IST from an existing MLT, enter the following command:

```
config mlt <mid> ist
```

This command includes the following options:

config mlt <*mid*> ist followed by:	
`info`	Displays current level parameter settings and next level directories.
`create ip <value> vlan-id <value>`	Creates an IST from an existing MLT (see "Creating an IST from an existing trunk MLT," next). • IP *value* is a peer IP address • VLAN ID *value* is an integer value with a range of 1 to 4095. Note that the peer IP address is the IP address of the IST VLAN on the other aggregation switch.
`delete`	Deletes an existing IST. **NOTE:** You must disable an IST before you can delete it.
`disable`	Disables an existing IST.
`enable`	Enables an existing IST.

Creating an IST from an existing trunk MLT

To create an IST from an existing MLT, enter the following command:

```
config mlt <mlt-id> ist create ip <value> vlan-id <value>
```

where,

mlt-id =	the multilink trunk ID number
value =	the IP address of the peer switch
value =	a VLAN ID number from 1 to 4095

IST is enabled when you first create it.

The peer IP address is the IP address of the IST VLAN on the peer aggregation switch. A VLAN created on the redundant aggregation switch must also be created on the second aggregation switch. The IST treats two switches as a single switch. To allow the two switches to communicate, you must assign an IP address to both VLANs.

For example:

switch A		switch B
VLAN 20		VLAN 20
10.1.1.1. /24	<--------IST-------->	10.1.1.2 /24 *

* Same subnet, same VLAN.

Figure 132 shows sample output for the **config mlt ist create ip vlan-id** command, followed by the **info** command.

Figure 132 config mlt ist create ip vlan-id command output

```
8610:5/config/mlt/1/ist# create ip 10.1.1.1 vlan-id 1
8610:5/config/mlt/1/ist# info

Sub-Context:
Current Context:

              Enable: false
             vlan-id: 1
                 ip: 10.1.1.1
```

Enabling/disabling an IST

To enable and disable the IST, enter the following command:

```
config mlt <mlt-id> ist <enable|disable>
```

Figure 133 shows sample output for the **`config mlt ist enable`** and **`config mlt ist disable`** commands. It includes the system warning that appears when you attempt to disable the IST.

Figure 133 config mlt ist enable/disable command output

```
8610:5/config/mlt/1/ist# enable
8610:5/config/mlt/1/smlt# disable

WARNING : Disabling IST may cause a loop in the network!
          Do you really want to DISABLE IST? (yes/no?)
```

Disabling CP-Limit for an IST

Nortel Networks recommends disabling CP-Limit on IST links. For more information, see "About CP-Limit and SMLT IST" on page 64.

To disable CP-limit for the IST, enter the following command:

```
config ethernet <slot/port> cp-limit disable
```

This command includes the following options:

`config ethernet <slot/port> cp-limit` followed by:	
`<enable|disable>`	Enables/Disables control packet rate limit (CP-Limit). The default setting is Enabled. If you want to re-enable CP-Limit on a port for which you have disabled it, you must first disable the port and then re-enable it (config ethernet slot/port state <disable | enable)).
`multicast-limit <value>`	Sets the multicast control frame packet per second rate (1000 to 100000).
`broadcast-limit <value>`	Sets the broadcast frame packet per second rate (1000 to 100000).

For information about viewing current CP-Limit status for an IST MLT, see Figure 131, "config mlt info command output" on page 288.

Deleting an IST

To delete the IST, enter the following command:

```
config mlt <mlt-id> ist delete
```

Note that you have to disable the IST before deleting it (see "Enabling/disabling an IST," preceding this section).

Creating a single port SMLT

To create a single port SMLT, enter the following command:

```
config <Ethernet|ATM|POS> <port> smlt <SmltId> <option>
```

This command includes the following options:

`config <Ethernet|ATM|POS> <slot/port> smlt <SmltId>` followed by:	
`info`	Displays the port's smlt info.
`create`	Creates a single port SMLT.
`delete`	Deletes a single port SMLT.

For more information about single port SMLT, see “About single port SMLT” on page 67.

Configuration example: single port SMLT

The configuration example shown in Figure 134 on page 304, uses the commands described above to create a single port SMLT on slot/port 2/2. The switch automatically disables spanning tree protocol on the port after it is configured for SMLT.

After configuring the parameters, use the **`info`** command to show a summary of the results.

Figure 134 Configuration example: single port SMLT

```
8610:5/config/ethernet/2/2# smlt 1
8610:5/config/ethernet/2/2/smlt/1#
8610:5/config/ethernet/2/2/smlt/1# create

INFO : The spanning tree protocol has been disabled on this port
       while configuring the port with SMLT

8610:5/config/ethernet/2/2/smlt/1# info

Sub-Context:
Current Context:

Port 2/2 :
                      create : 1
                      delete : N/A
                  Oper Status : normal

8610:5/config/ethernet/2/2/smlt/1#
```

Configuring SMLT-on-single-CPU

To support SMLT on an aggregation switch with a single CPU, enter the following command:

```
config sys set smlt-on-single-cp <enable/disable> [timer
<value>]
```

Where:

- *enable* enables the SMLT-on-Single-CPU feature
- *disable* disables the SMLT-on-Single-CPU feature
- timer <*value*> this (optional) value can be used to set the SMLT-on-single-CPU feature timeout value.

  The timeout value determines when the I/O modules take their port link status down after the single CPU becomes non-operational. The parameter is a numerical value in the range 1 and 3. If not set, the default value, 3 is used. Timer value of 1 relates to approximately 3 seconds detection and a timer value of 3 relates to approximately 9 seconds duration.

Using the MLT and SMLT show commands

To display information and statistics about MLT operation in the switch, use the **`show mlt`** commands

This section includes information on show commands that allow you to:

Displaying all MLT information

The `show mlt show-all` command displays all MLT information.

The command uses the syntax:

`show mlt show-all [file <value>]`

where <*value*> is the filename to which the output will be redirected.

Figure 135, Figure 136, and Figure 137 show sample output for this command.

Figure 135 show mlt show-all sample output

```
Passport-8603:3# show mlt show-all


# show mlt error collision


================================================================================
                                      Mlt Collision Error
================================================================================
MLT   -----------------COLLISIONS------------
ID    SINGLE   MULTIPLE LATE     EXCESSIVE
--------------------------------------------------------------------------------
31    0        0        0        0
32    0        0        0        0



# show mlt error main


================================================================================
                                      Mlt Ethernet Error
================================================================================
MLT  ALIGN   FCS     IMAC    IMAC    CARRIER FRAMES  SQETEST DEFER

ID   ERROR   ERROR   TRNSMIT RECEIVE SENSE   TOOLONG ERROR   TRNSMSS
--------------------------------------------------------------------------------
31   0       0       0       0       0       0       0       0
32   0       0       0       0       0       0       0       0



# show mlt info


================================================================================
                                      Mlt Info
================================================================================
                        PORT    SVLAN  MLT   MLT        PORT         VLAN
MLTID IFINDEX NAME      TYPE    TYPE  ADMIN CURRENT    MEMBERS      IDS
--------------------------------------------------------------------------------
31  4126  MLT-31       trunk   normal norm   norm     2/1-2/2
32  4127  MLT-32       trunk   normal norm   norm     2/3-2/4           1 4093

              MULTICAST             DESIGNATED   LACP      LACP
MLTID IFINDEX  DISTRIBUTION  NT-STG  PORTS        ADMIN     OPER
--------------------------------------------------------------------------------
31     4126     disable      enable   null       disable   down
```

Figure 136 show mlt show-all sample output (continued)

```
# show mlt ist stat


================================================================================
                                      Mlt IST Message Statistics
================================================================================
PROTOCOL MESSAGE            COUNT
--------------------------------------------------------------------------------

Ist Down                 :  0
Hello Sent               :  0

Hello Recv               :  0
Learn MAC Address Sent   :  0
Learn MAC Address Recv   :  0
MAC Address AgeOut Sent  :  0
MAC Address AgeOut Recv  :  0
MAC Address Expired Sent :  0
MAC Address Expired Sent :  0
Delete Mac Address Sent  :  0
Delete Mac Address Recv  :  0
Smlt Down Sent           :  0
Smlt Down Recv           :  0
Smlt Up Sent             :  0
Smlt Up Recv             :  0
Send MAC Address Sent    :  0
Send MAC Address Recv    :  0
IGMP Sent                :  0
IGMP Recv                :  0
Port Down Sent           :  0
Port Down Recv           :  0
Request MAC Table Sent   :  0
Request MAC Table Recv   :  0
Unknown Msg Type Recv    :  0
```

Figure 137 show mlt show-all sample output (continued)

```
# show mlt smlt info

================================================================================
                                    Mlt SMLT Info
================================================================================
MLT   SMLT     ADMIN    CURRENT
ID    ID       TYPE     TYPE
--------------------------------------------------------------------------------
2     27       smlt     norm

# show mlt stats

================================================================================
                                    Mlt Interface
================================================================================
ID IN-OCTETS          OUT-OCTETS         IN-UNICST          OUT-UNICST
--------------------------------------------------------------------------------

1  0                  0                  0                  0
2  0                  0                  0                  0
3  0                  0                  0                  0

ID IN-MULTICST        OUT-MULTICST       IN-BROADCST        OUT-BROADCST  MT
--------------------------------------------------------------------------------
1  0                  0                  0                  0             E
2  0                  0                  0                  0             E
3  0                  0                  0                  0             E


NOTE 1: MT - MLT Type, P - POS, E - Ethernet, A - ATM
NOTE 2: Broadcast & Multicast values are not applicable for MLT POS ports.
NOTE 3: ATM link out-bound statistics are available in aggregate form only
        as show in OUT UNICST/OUT MULTICST/OUT BROADCST
8610:5#
```

Displaying information about collision errors

To display information about collision errors in the specified MultiLink Trunk or all MLTs, enter the following command:

```
show mlt error collision [<mid>]
```

Figure 138 shows sample output for the **show mlt error collision** command.

Figure 138 show mlt error collision command output

```
Passport-8603:3# show mlt error collision

================================================================================
==============
                                              Mlt Collision Error
================================================================================
==============
MLT   -----------------COLLISIONS------------
ID    SINGLE   MULTIPLE LATE     EXCESSIVE
--------------------------------------------------------------------------------
```

Displaying information about Ethernet errors

To display information about the types of Ethernet errors sent and received by the specified MLT or all MLTs, enter the following command:

```
show mlt error main [<mid>]
```

Figure 139 shows sample output for the **show mlt error main** command. The IMAC columns refer to internal MAC address errors.

Figure 139 show mlt error main command output

```
Passport-8603:3# show mlt error main
================================================================================
                                        Mlt Ethernet Error
================================================================================
MLT  ALIGN   FCS     IMAC    IMAC    CARRIER FRAMES  SQETEST DEFER
ID   ERROR   ERROR   TRNSMIT RECEIVE SENSE   TOOLONG ERROR   TRNSMSS
--------------------------------------------------------------------------------
31   0       0       0       0       0       0       0       0
32   0       0       0       0       0       0       0       0
```

Displaying MLT status

To display the status of MultiLink Trunking for the switch or the specified MLT ID, enter the following command:

`show mlt info` [<*mid*>]

Figure 140 shows sample output for the **`show mlt info`** command.

Figure 140 show mlt info command output

```
Passport-8603:3# show mlt info
================================================================================
                                     Mlt Info
================================================================================
                        PORT    SVLAN  MLT   MLT        PORT         VLAN
MLTID IFINDEX NAME      TYPE    TYPE  ADMIN CURRENT    MEMBERS      IDS
--------------------------------------------------------------------------------
31  4126  MLT-31       trunk   normal norm   norm     2/1-2/2
32  4127  MLT-32       trunk   normal norm   norm     2/3-2/4           1 4093
MULTICAST             DESIGNATED   LACP      LACP
MLTID IFINDEX  DISTRIBUTION  NT-STG  PORTS        ADMIN     OPER
--------------------------------------------------------------------------------
31     4126     disable      enable   null       disable   down
```

Displaying SMLT status

To display SMLT status for the switch or a specific SMLT ID, enter the following command:

`show smlt info` [<*mid*>]

The switch displays both MLT-based SMLT information, and single port SMLT information.

Figure 141 shows output from a sample **`show smlt info`** command.

Figure 141 show smlt info command output

```
Passport-8603:3# show smlt info

================================================================================
                                        Mlt SMLT Info
================================================================================
MLT   SMLT     ADMIN    CURRENT
ID    ID       TYPE     TYPE
--------------------------------------------------------------------------------



================================================================================
                                        SMLT Info
================================================================================
PORT  SMLT     ADMIN    CURRENT
NUM   ID       TYPE     TYPE
--------------------------------------------------------------------------------

Passport-8603:3#
```

Displaying all ports configured for single port SMLT

To view all ports currently configured for single port SMLT, enter the following command:

```
show port info smlt
```

Figure 142 shows the output from a sample `show port info smlt` command.

Figure 142 show port info smlt command output

```
8010:5# show port info smlt


================================================================================
                                      SMLT Info
================================================================================
PORT  SMLT     ADMIN    CURRENT
NUM   ID       TYPE     TYPE
--------------------------------------------------------------------------------
1/2   10       smlt     normal
1/3   3        smlt     normal
1/4   12       smlt     normal
2/1   8        smlt     normal
10/1  1        smlt     normal

8010:5#
```

Displaying a port configured for single port SMLT

To view a port configured for single port SMLT, enter the following command:

`show port info config <port>`

Figure 143 shows output from a sample `show port info config <port>` command.

Figure 143 show port info config <*port*> command output

```
Passport-8603:3# show port info config 1/1

================================================================================
                                      Port Config
================================================================================
PORT              AUTO  SFFD  ADMIN      OPERATE     DIFF-SERV  QOS MLT VENDOR
DUAL SMLT ADMIN   OPERATE
NUM   TYPE         NEG.       DUPLX SPD   DUPLX SPD   EN   TYPE  LVL ID  NAME
CONN ID   ROUTING ROUTING
--------------------------------------------------------------------------------
1/1   100BaseTX    true  false half  10        0    fals  core  1   0
0    Enable  Disable

Passport-8603:3#
```

Displaying MLT statistics

To display MultiLink Trunking statistics for the switch or the specified MLT ID, enter the following command:

`show mlt stats [<mid>]`

Figure 144 shows sample output for the **`show mlt stats`** command.

Figure 144 show mlt stats command output

```
Passport-8603:3# show mlt stats

================================================================================
                                    Mlt Interface
================================================================================
ID IN-OCTETS          OUT-OCTETS         IN-UNICST          OUT-UNICST
--------------------------------------------------------------------------------
31 4411520            1782784            0                  0
32 744762             6946308            7518               7626

ID IN-MULTICST        OUT-MULTICST       IN-BROADCST        OUT-BROADCST      MT
--------------------------------------------------------------------------------
31 68930              27856              0                  0                 E
32 33                 97480              131                1                 E


NOTE 1: MT - MLT Type, P - POS, E - Ethernet, A - ATM
NOTE 2: Broadcast & Multicast values are not applicable for MLT POS ports.
NOTE 3: ATM link out-bound statistics are available in aggregate form only
        as show in OUT UNICST/OUT MULTICST/OUT BROADCST


Passport-8603:3#
```

Troubleshooting SMLT problems

This section provides procedures for troubleshooting IST problems and single-user problems.

The following topics are included:

- Troubleshooting IST problems, next
- Troubleshooting problems with a single user (page 318)

Troubleshooting IST problems

To troubleshoot SMLT IST problems:

1 Enter the **show mlt ist stat** command to display the IST message count. (Figure 145).

Figure 145 show mlt ist stat command output

```
Passport-8603:3# show mlt ist stat

================================================================
                                        Mlt IST Message Statistics
================================================================
PROTOCOL MESSAGE            COUNT
----------------------------------------------------------------

Ist Down                 :  0
Hello Sent               :  0
Hello Recv               :  0
Learn MAC Address Sent   :  0
Learn MAC Address Recv   :  0
MAC Address AgeOut Sent  :  0
MAC Address AgeOut Recv  :  0
MAC Address Expired Sent :  0
MAC Address Expired Sent :  0
Delete Mac Address Sent  :  0
Delete Mac Address Recv  :  0
Smlt Down Sent           :  0
Smlt Down Recv           :  0
Smlt Up Sent             :  0
Smlt Up Recv             :  0
Send MAC Address Sent    :  0

Send MAC Address Recv    :  0
IGMP Sent                :  0
IGMP Recv                :  0
Port Down Sent           :  0
Port Down Recv           :  0
Request MAC Table Sent   :  0
Request MAC Table Recv   :  0
Unknown Msg Type Recv    :  0

Passport-8603:3#
```

2 Enter the **show mlt info** command to display all the MLTs in the switch, their admin-type, running type, ports, VLANs etc. (Figure 140).

3 Check to ensure that IST is up and running by using the **show mlt ist info** command (Figure 146).

Figure 146 show mlt ist info command output

```
Passport-8603:3# show mlt ist info

================================================================
                                        Mlt IST Info
================================================================
MLT   IP                    VLAN     ENABLE   IST
ID    ADDRESS               ID       IST      STATUS
----------------------------------------------------------------

Passport-8603:3#
```

4 If IST is not running, check to ensure that:

- **a** The correct VLAN ID exists on either side of the IST
- **b** The IST configuration contains the correct local and peer IP addresses

5 If IST is running, check whether the SMLT port is operating by using the **`show mlt smlt info`** command (Figure 147).

- **a** if the SMLT status is SMLT, the status is correct

Figure 147 show mlt smlt info command output

```
Passport-8603:3# show mlt smlt info

================================================================
                                        Mlt SMLT Info
================================================================
MLT   SMLT     ADMIN    CURRENT
ID    ID       TYPE     TYPE
----------------------------------------------------------------
Passport-8603:3#
```

- **b** if the SMLT status is NORMAL, the link is running in a normal (single) mode and not SMLT mode. The reasons for this could be as follows:
  - — the remote SMLT link is not operational
  - — the ID is not configured on the other switch. To determine this, check to see whether the SMLT IDs match
  - — the IST is not up and running

Troubleshooting problems with a single user

To determine if only a single user is affected, check the VLAN FDB tables on both IST switches using the **`show vlan info fdb-entry`** <v*lan-id*> command. Both FDB tables should be synchronized.

The command displays whether:

- The MAC address is learnt on the local SMLT port (i.e., SMLT REMOTE flag is false). See (Figure 148).

  or

- The MAC address is learned through IST from a remote SMLT port (that is, the SMLT REMOTE flag is true).

The FDB table entry for the client connected to the user access switch must specify the SMLT port as INTERFACE in both IST switches.

Figure 148 show vlan info fdb-entry command output

```
8610:5/show/vlan/info# fdb-entry 1

================================================================
                        Vlan Fdb
================================================================
VLAN         MAC                                  QOS    SMLT
ID STATUS   ADDRESS     INTERFACE   MONITOR     LEVEL REMOTE
----------------------------------------------------------------
1 learned 00:08:c7:d0:82:cd Port-1/16 false    1      false
1 self    00:80:2d:12:36:00 -         false    1      false
2 out of 7 entries in all fdb(s) displayed.
8610:5#
```

Global MAC filtering

You can globally configure MAC filtering to disallow bridging or routing of any packets transmitted or received from specified MAC addresses, on any VLAN.

To global filter MAC addresses, use the following command:

```
config fdb fdb-filter
```

This command includes the following options:

config fdb fdb-filter followed by:	
`info`	Show current level parameter settings and next level directories.
`add <mac>`	Adds a global fdb filter. • *mac* is the MAC address to filter on. Enter the MAC address in the following format {0x00:0x00:0x00:0x00:0x00:0x00:0x00}.
`remove <mac>`	removes a global fdb filter. • *mac* is the MAC address to filter on. Enter the MAC address in the following format {0x00:0x00:0x00:0x00:0x00:0x00:0x00}.

Figure 149 on page 320 show an example of the Global mac filter config info command output:

Figure 149 Global mac filter config info command output

```
Passport-8610:5/config/fdb/fdb-filter# info
|
|
|
|     add :
|
|    mac - 00:11:22:23:43:21
|
|
|
|   remove : N/A
|
```

Figure 150 on page 320 shows an example of the fdb fdb-filter show command output:

show command:

Figure 150 Global mac filter show command output

```
Passport-8610:5# show fdb fdb-filter
||
||  ================================================
||  Global Fdb Filter
||  ================================================
||   MAC  ADDRESS
||  ------------------------------------------------
||   00:11:11:11:11:11
|
|   00:e0:16:70:93:0f
|
|   00:e0:7b:bf:cc:00
```

Chapter 11
Configuring multiple DSAP and SSAP per VLAN using the CLI

Release 3.5 introduced a feature that allows the configuration of multiple DSAPs or SSAPs for SNA or user-defined VLAN types.

The base implementation of the SNA VLAN allows classifying SNA 802.2 traffic to be classified into a SNA VLAN based on a 0x04 destination SAP or 0x04 source SAP. Some applications require changing these classifications to DSAP and to SSAP. The newly introduced feature allows this configuration and is extended to support any user-defined VLANs with multiple SSAPs and DSAPs.

This feature allows you to add 31 additional protocol IDs or DSAP/SSAP values, for a total of 32, when you create a sna802dot2 VLAN or a user-defined VLAN, or when you reconfigure a sna802dot2 VLAN or a user-defined VLAN.

Note: Hardware record usage increases considerably using this feature (see “Design aspects” on page 322).

This section includes the following sections:

Design aspects

You can configure this feature using the CLI or Device Manager. Regardless of your configuration tool, you must first create the SNA or user-defined VLAN, then add the DSAPs or SSAPs for this VLAN.

For user-defined VLANs, DSAP/SSAP additions can only be applied to VLANs created without any specific encapsulation type or to VLANs with an encapsulation type of LLC. The addition of DSAP/SSAP is not allowed on user-defined VLANs created with an encapsulation type of Ethernet-ii or SNAP.

For each SNA802dot2 VLAN, including 31 additional DSAP/SSAP values, 256 records are created, including:

- 8 IEEE VLAN records
- 31 * 8 = 248 protocol ID records.

In this case the default 0x04 records is always created on the switch.

For each user defined VLAN created with no encapsulation specified, a total of 280 records are created, including:

- 8 IEEE VLAN records
- 3 * 8 = 24 protocol ID records for the base protocol ID (specified during VLAN creation). One record of each type - LLC, Ethernet-ii and SNAP is created in this case.
- 31 * 8 = 248 protocol ID records for the additional DSAP/SSAP added

For each user-defined VLAN created with encapsulation set to LLC, 264 HW records are created, including:

- 8 IEEE VLAN records
- 1 * 8 = 8 protocol ID records for the base protocol ID (specified during VLAN creation). Only the LLC record is created in this case
- 31 * 8 = 248 protocol ID records for the additional DSAP/SSAP added

Nortel Networks does not recommend using more than 10 of the UserDefined VLANs including 32 DSAP/SSAP values due to the extensive hardware record usage which could affect overall system scalability.

You can check for hardware record availability by executing the CLI command **`show/sys/record-reservation`**.

There is only one SNA VLAN allowed on an individual port. The switch does not allow configuring user-defined VLANs with DSAP/SSAP of xx04 or 04xx. Other values can be configured provided they are not the same as the reserved values listed in Table 33. An exception is 0x0800 which can be configured with the encapsulation set to LLC.

Table 33 Reserved values for configuring SNA or user-defined VLANs

Protocol name	Etype	DSAP	SSAP	OUI	PID
IP_ii	0x0800				
ARP_ii	0x0806				
RARP_ii	0x8035				
IPX(old)_ii IPX_ii	0x8137 0x8138				
IPX(old)_SNAP IPX_SNAP				0x000000 0x000000	0x8137 0x8138
IPX_802.3		0xE0	0xE0		
IPX_802.3		0xFF	0xFF		
APPLE_ii APPLE_SNAP	0x809B 0X80F3			0x080007	0x809B 0x80F3
DEC_LAT	0x6004				
DEC_ELSE	0x6000 - 0x6003 0x6005 - 0x6009				
DEC_BPDU	0x8038				
SNA_ii	0x80D5				

Table 33 Reserved values for configuring SNA or user-defined VLANs

Protocol name	Etype	DSAP	SSAP	OUI	PID
SNA_LLC		0x04 XX	XX 0x04		
NetBIOS		0xF0 XX	XX 0xF0		
XNS XNS_comp	0x0600 0x0807				

Configuring with the CLI

The CLI command syntax to create a protocol-based VLAN is shown in Figure 151.

Figure 151 config vlan create command output

```
Passport-8610:5 config vlan [vlan id] create byprotocol ?
create a vlan by protocol
Required parameters:
<sid>            = spanning tree id {1..64}
<ip|ipx802dot3|ipx802dot2|ipxSnap|ipxEthernet2|appleTalk|decLat|decOther|sn
a802dot2|snaEthernet2|netBios|xns|vines|ipV6|usrDefined|rarp> = protocol id
{ip|ipx802dot3|ipx802dot2|ipxSnap|ipxEthernet2|appleTalk|decLat|decOther|sn
a802dot2|snaEthernet2|netBios|xns|vines|ipV6|usrDefined|rarp}
Optional parameters:
<pid> = user defined pid number in Decimal {0..65535}
name <value> = name of vlan {string length 0..20}
color <value> = color of vlan {0..32}
encap <value> = frame encapsulation {ethernet-ii|llc|snap}
Command syntax:
```

You can then add or remove DSAP or SSAP if byprotocol = sna802dot2 or userDefined using the new commands **`addDsapSsap`** and **`removeDsapSsap`**:

`addDsapSsap <value>` = {dsapssap values DSSS} values are in hex

`removeDsapSsap<value>` values are in hex

32 entries are allowed for `sna802dot2` or `userDefined` VLANs.

Example

Passport-8610:5**`/config/vlan/2# create byprotocol 1 sna addDsapSsap 0x0805`**

This adds DsapSsap 0x0805 to the SNA VLAN 2. (This example assumes that VLAN2 has already been created.)

Example

Passport-8610:5/config/vlan/2# **`create byprotocol 1 UserDefined addDsapSsap 0x0805`**

This adds DsapSsap 0805 to the UserDefined VLAN 2, and only for LLC frames. (This example assumes that user-defined VLAN 2 has already been created.)

Chapter 12
Configuration examples

This chapter provides examples of common link aggregation configuration tasks, including the CLI commands you use to create the configuration.

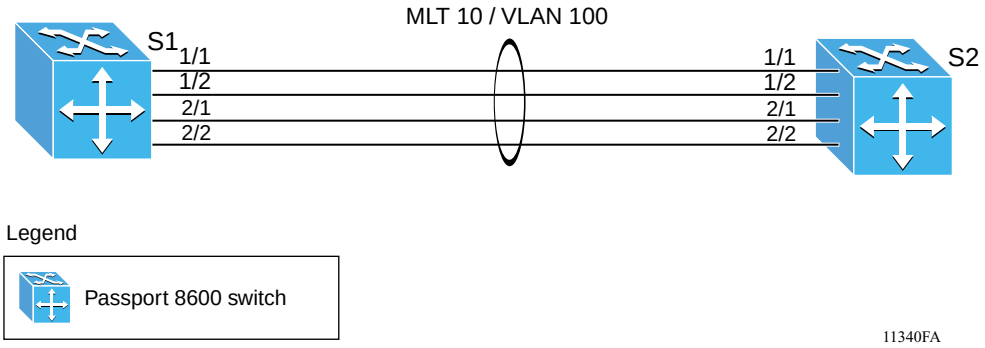
- For conceptual information about VLANs and Link aggregation, See Chapter 1, “Layer 2 operational concepts,” on page 27.

This chapter includes the following topics:

Creating a MultiLink Trunk within a VLAN

This configuration example shows how to create a Multilink Trunk (MLT) and a VLAN (VLAN 100) between two Passport 8600 switches, which is used to carry user traffic (Figure 152).

Figure 152 MLT within a VLAN



The following sections provide step-by-step procedures that show how to configure switch S1 and S2 for this example.

Configure S1:

1 Create VLAN 100:

```
Passport-8600:5# config vlan 100 create byport 1
```

2 Create MLT 10:

```
Passport-8600:5# config mlt 10 create
Passport-8600:5# config mlt 10 add ports 1/1,1/2,2/1,2/2
Passport-8600:5# config mlt 10 add vlan 100
```

Configure S2:

1 Create VLAN 100:

```
Passport-8600:5# config vlan 100 create byport 1
```

2 Create MLT 10:

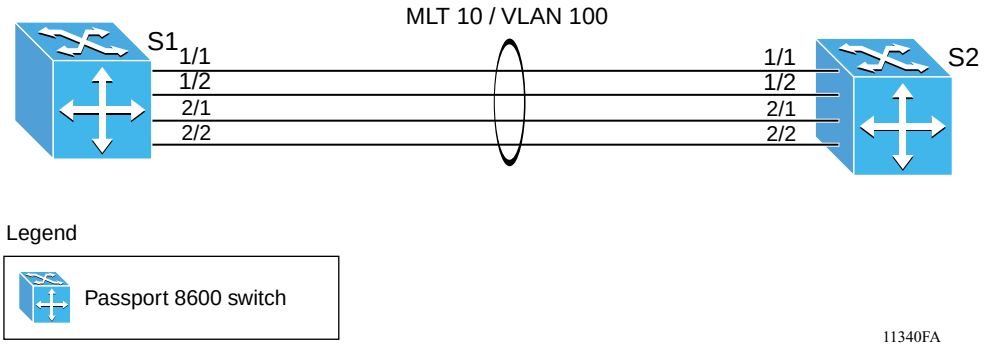
```
Passport-8600:5# config mlt 10 create
Passport-8600:5# config mlt 10 add ports 1/1,1/2,2/1,2/2
Passport-8600:5# config mlt 10 add vlan 100
```

LACP configuration example

This configuration example shows how to configure and enable a point-to-point Link Aggregation Group (LAG) using LACP (Figure 153).

Note: You must configure all aggregatable ports in MLT 10 to use the same key used for MLT 10.
Note:

Figure 153 LACP configuration example



The following sections provide step-by-step procedures that show how to configure switch S1 and S2 for the example shown in Figure 153.

Configure S1:

1. Create VLAN 100 and add ports to the VLAN:

```
Passport-8600:5# config vlan 100 create byport 1
Passport-8600:5# config vlan 100 ports add
1/1-1/2,2/1-2/2
```

2. Configure LACP on S1 switch ports:

```
Passport-8600:5# config ether 1/1-1/2,2/1-2/2 lacp
aggregation true
Passport-8600:5# config ether 1/1-1/2,2/1-2/2 lacp key 10
Passport-8600:5# config ether 1/1-1/2,2/1-2/2 lacp enable
```

3 Create MLT 10 and configure LACP:

Ensure the LACP key is same as in (Step 2).

```
Passport-8600:5# config mlt 10 create
Passport-8600:5# config mlt 10 lacp key 10
Passport-8600:5# config mlt 10 lacp enable
```

Configure S2:

1 Create VLAN 100 and add ports to the VLAN:

```
Passport-8600:5# config vlan 100 create byport 1
Passport-8600:5# config vlan 100 ports add
1/1-1/2,2/1-2/2
```

2 Configure LACP on S2 switch ports:

```
Passport-8600:5# config ether 1/1-1/2,2/1-2/2 lacp
aggregation true
Passport-8600:5# config ether 1/1-1/2,2/1-2/2 lacp key 10
Passport-8600:5# config ether 1/1-1/2,2/1-2/2 lacp enable
```

3 Create MLT 10 and configure LACP:

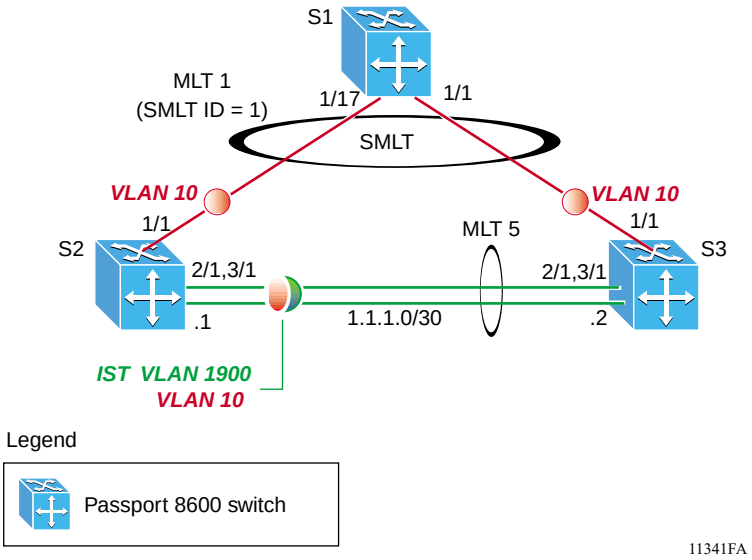
Ensure the LACP key is same as in (Step 2).

```
Passport-8600:5# config mlt 10 create
Passport-8600:5# config mlt 10 lacp key 10
Passport-8600:5# config mlt 10 lacp enable
```

SMLT Triangle configuration example

This configuration example shows how to create an SMLT triangle using three Passport 8600 switches and a VLAN (VLAN 10), which is used to carry user traffic (Figure 154).

Figure 154 SMLT triangle configuration example



The following sections provide step-by-step procedures that show how to configure switch S1, S2, and S3 for this example.

Configure S2:

1. Disable the control packet rate limit for ports 2/1 and 3/1:

   ```
   Passport-8600:5# config ether 2/1,3/1 cp-limit disable
   ```

2. Create IST VLAN 1900:

   ```
   Passport-8600:5# config vlan 1900 create byport 1
   ```

3. Create VLAN 10:

   ```
   Passport-8600:5# config vlan 10 create byport 1
   ```

4. Create MLT 5 and add ports 2/1 and 3/1 as MLT port members:

```
Passport-8600:5# config mlt 5 create
Passport-8600:5# config mlt 5 add ports 2/1,3/1
```

5. Enable tagging on MLT 5:

```
Passport-8600:5# config mlt 5 perform-tagging enable
```

6. Add VLAN 1900 and VLAN 10 to MLT 5:

```
Passport-8600:5# config mlt 5 add vlan 1900
Passport-8600:5# config mlt 5 add vlan 10
```

7. Configure a VLAN ID for VLAN 1900:

```
Passport-8600:5# config vlan 1900 ip create 1.1.1.1/30
```

8. Create IST MLT 5 and add VLAN 1900:

```
Passport-8600:5# config mlt 5 ist create ip 1.1.1.2
vlan-id 1900
```

9. Create an SMLT:

```
Passport-8600:5# config mlt 1 create
Passport-8600:5# config mlt 1 smlt create smlt-id 1
Passport-8600:5# config mlt 1 perform-tagging enable
Passport-8600:5# config mlt 1 add vlan 10
Passport-8600:5# config mlt 1 add ports 1/1
Passport-8600:5# config ether 1/1 untagged-frames-discard
enable
```

Configure S3:

1. Disable the control packet rate limit for ports 2/1 and 3/1:

```
Passport-8600:5# config ether 2/1,3/1 cp-limit disable
```

2. Create IST VLAN 1900:

```
Passport-8600:5# config vlan 1900 create byport 1
```

3. Create VLAN 10:

```
Passport-8600:5# config vlan 10 create byport 1
```

4. Create MLT 5 and add ports 2/1 and 3/1 as MLT port members:

```
Passport-8600:5# config mlt 5 create
Passport-8600:5# config mlt 5 add ports 2/1,3/1
```

5 Enable tagging on MLT 5:

```
Passport-8600:5# config mlt 5 perform-tagging enable
```

6 Add VLAN 1900 and VLAN 10 to MLT 5:

```
Passport-8600:5# config mlt 5 add vlan 1900
Passport-8600:5# config mlt 5 add vlan 10
```

7 Configure a VLAN ID for VLAN 1900:

```
Passport-8600:5# config vlan 1900 ip create 1.1.1.2/30
```

8 Create IST MLT 5 and add VLAN 1900:

```
Passport-8600:5# config mlt 5 ist create ip 1.1.1.1
vlan-id 1900
```

9 Create an SMLT:

```
Passport-8600:5# config mlt 1 create
Passport-8600:5# config mlt 1 smlt create smlt-id 1
Passport-8600:5# config mlt 1 perform-tagging enable
Passport-8600:5# config mlt 1 add vlan 10
Passport-8600:5# config mlt 1 add ports 1/1
Passport-8600:5# config ether 1/1 untagged-frames-discard
enable
```

Configure S1:

1 Create VLAN 10:

```
Passport-8600:5# config vlan 10 create byport 1
```

2 Create MLT 1 and add ports 1/1 and 1/17 as MLT port members:

```
Passport-8600:5# config mlt 1 create
Passport-8600:5# config mlt 1 add ports 1/1,1/17
Passport-8600:5# config ether 1/1,1/17
untagged-frames-discard enabled
```

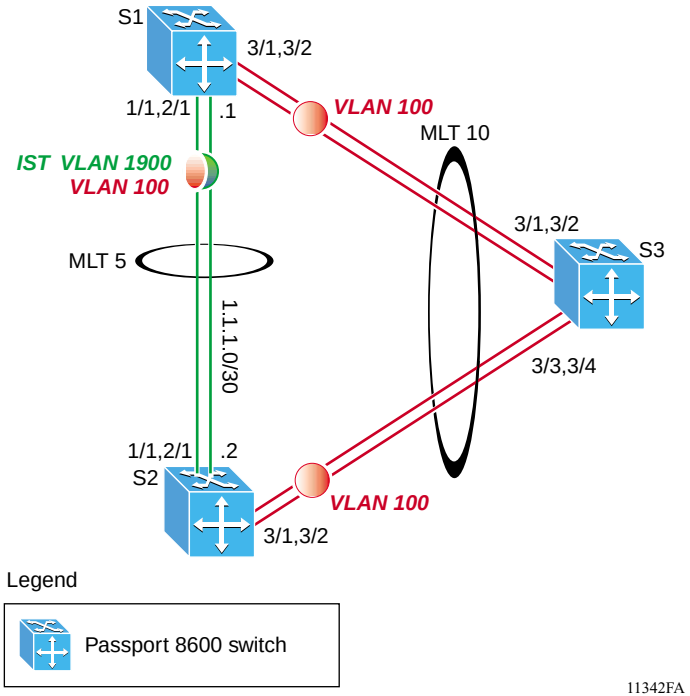
3 Add VLAN 10 to MLT 1:

```
Passport-8600:5# config mlt 1 add vlan 10
```

SMLT and IEEE 802.3ad configuration example

This configuration example shows how to build and configure a triangle SMLT network, using LACP to enable the dynamic setup of SMLT links (Figure 155).

Figure 155 SMLT and IEEE 802.3ad configuration example



The following sections provide step-by-step procedures that show how to configure switch S1, S2, and S3 for this example.

Configure S1:

1 Create IST VLAN 1900:

```
Passport-8600:5# config vlan 1900 create byport 1
Passport-8600:5# config mlt 5 create
Passport-8600:5# config mlt 5 add ports 1/1,2/1
Passport-8600:5# config mlt 5 perform-tagging enable
Passport-8600:5# config mlt 5 add vlan 1900
Passport-8600:5# config vlan 1900 ip create 1.1.1.1/30
Passport-8600:5# config mlt 5 ist create ip 1.1.1.2
vlan-id 1900
```

2 Create the SMLT VLAN and add ports:

```
Passport-8600:5# config vlan 100 create byport 1
Passport-8600:5# config vlan 100 ports add 3/1,3/2
Passport-8600:5# config vlan 100 add-mlt 5
```

3 Configure LACP on ports:

```
Passport-8600:5# config ether 3/1,3/2 lacp aggregation
true
Passport-8600:5# config ether 3/1,3/2 lacp key 10
Passport-8600:5# config ether 3/1,3/2 lacp enable
```

4 Create SMLT and configure LACP:

Ensure Keys match port and keys are same for both SMLT aggregation switches.

```
Passport-8600:5# config mlt 10 create
Passport-8600:5# config mlt 10 smlt create smlt-id 10
Passport-8600:5# config mlt 10 perform-tagging enable
Passport-8600:5# config mlt 10 add vlan 100
Passport-8600:5# config mlt 10 lacp key 10
Passport-8600:5# config mlt 10 lacp enable
Passport-8600:5# config ether 3/1,3/2
discard-untagged-frames enable
```

Configure S2:

1 Create IST VLAN 1900:

```
Passport-8600:5# config vlan 1900 create byport 1
Passport-8600:5# config mlt 5 create
Passport-8600:5# config mlt 5 add ports 1/1,2/1
Passport-8600:5# config mlt 5 perform-tagging enable
Passport-8600:5# config mlt 5 add vlan 1900
Passport-8600:5# config vlan 1900 ip create 1.1.1.2/30
Passport-8600:5# config mlt 5 ist create ip 1.1.1.1
vlan-id 1900
```

2 Create the SMLT VLAN and add ports:

```
Passport-8600:5# config vlan 100 create byport 1
Passport-8600:5# config vlan 100 ports add 3/1,3/2
Passport-8600:5# config vlan 100 add-mlt 5
```

3 Configure LACP on ports:

```
Passport-8600:5# config ether 3/1,3/2 lacp aggregation
true
Passport-8600:5# config ether 3/1,3/2 lacp key 10
Passport-8600:5# config ether 3/1,3/2 lacp enable
```

4 Create SMLT and configure LACP:

Ensure Keys match port and keys are same for both SMLT aggregation switches.

```
Passport-8600:5# config mlt 10 create
Passport-8600:5# config mlt 10 smlt create smlt-id 10
Passport-8600:5# config mlt 10 perform-tagging enable
Passport-8600:5# config mlt 10 add vlan 100
Passport-8600:5# config mlt 10 lacp key 10
Passport-8600:5# config mlt 10 lacp enable
Passport-8600:5# config ether 3/1,3/2
discard-untagged-frames enable
```

Configure S2:

1 Create VLAN 100 and add ports:

```
Passport-8600:5# config vlan 100 create byport 1
Passport-8600:5# config vlan 100 ports add 3/1-3/4
```

2 Configure LACP on ports:

```
Passport-8600:5# config ether 3/1-3/4 lacp aggregation
true
Passport-8600:5# config ether 3/1-3/4 lacp key 20
Passport-8600:5# config ether 3/1-3/4 lacp enable
```

3 Create MLT 10 and configure LACP:

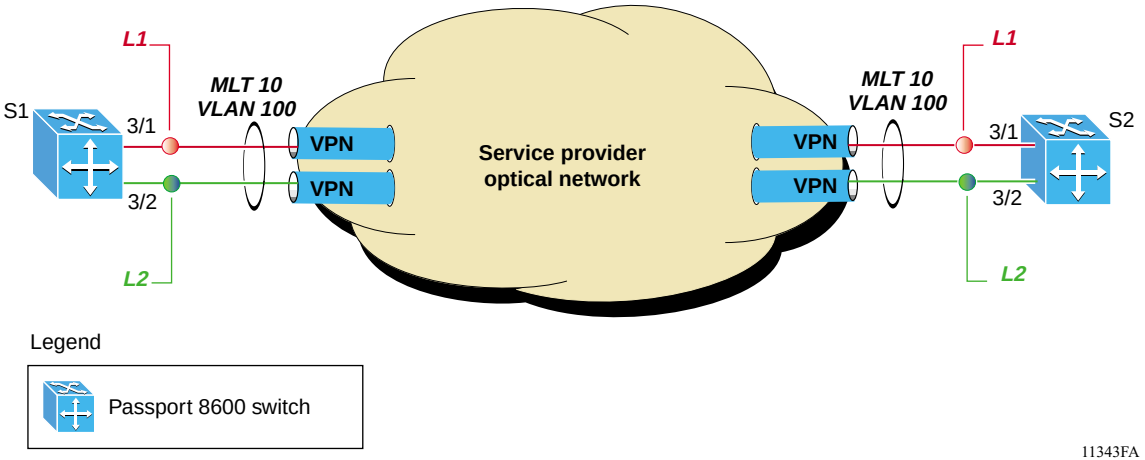
Ensure Keys match port and keys are same for both SMLT aggregation switches.

```
Passport-8600:5# config mlt 10 create
Passport-8600:5# config mlt 10 perform-tagging enable
Passport-8600:5# config mlt 10 lacp key 10
Passport-8600:5# config mlt 10 lacp enable
Passport-8600:5# config ether 3/1-3/4
discard-untagged-frames enable
```

Enabling VLACP on Ethernet links configuration example

This configuration example shows how to enable VLACP on the Ethernet links to ensure that link failures are propagated through the SP network (Figure 156).

Figure 156 Enabling VLACP on Ethernet links configuration example



The following sections provide step-by-step procedures that show how to configure switch S1, and S2 for this example.

Configure S1:

1 Configure MLT 10 and add VLAN 100:

```
Passport-8600:5# config vlan 100 create byport 1
Passport-8600:5# config mlt 10 create
Passport-8600:5# config mlt 10 add ports 3/1,3/2
Passport-8600:5# config mlt 10 add vlan 100
```

2 Enable VLACP on both Ethernet ports

```
Passport-8600:5# config ethernet 3/1-3/2 vlacp enable
```

Configure S2:

1 Configure MLT 10 and add VLAN 100:

```
Passport-8600:5# config vlan 100 create byport 1
Passport-8600:5# config mlt 10 create
Passport-8600:5# config mlt 10 add ports 3/1,3/2
Passport-8600:5# config mlt 10 add vlan 100
```

2 Enable VLACP on both Ethernet ports

```
Passport-8600:5# config ethernet 3/1-3/2 vlacp enable
```

Note: The fast periodic time value of 200 ms is not supported for this software release. The minimum supported fast periodic time value is 400 ms.

Per-VLAN Spanning Tree Plus (PVST+)

PVST+ is an extension of the Cisco System PVST with support for IEEE 802.1Q standard, and is the default spanning tree protocol used on Cisco System switches. PVST+ uses a separate spanning tree instance for each configured VLAN and supports the IEEE 802.1Q STP across IEEE 802.1Q regions.

When you configure PVST+, it uses, by default, IEEE 802.1Q single STP BPDUs on VLAN 1 and PVST BPDUs for other VLANs. This allows a PVST+ switch to connect to a switch using IEEE 802.1Q spanning tree as a tunnel for PVST. PVST+ BPDUs are tunneled across the 802.1Q VLAN region as multicast data.

The single STP is addressed to the well-known STP MAC address: 01-80-C2-00-00-00. The PVST BPDUs for other VLANs are addressed to multicast address: 01-00-0C-CC-CC-CD.

PVST+ can be used to load balance the VLANs by changing the VLAN bridge priority.

For conceptual information about PVST+, refer to "Per-VLAN Spanning Tree Plus (PVST+)" on page 56.

This section includes the following topics:

Configuring PVST+ on a Passport 8600 switch

You can configure a PVST+ instance under the Passport 8600 switch spanning tree group (STG) level for each VLAN that connects to a Cisco System switch running PVST+.

Use the following commands to configure PVST+ on the Passport 8600 switch:

```
Passport 8600:6# config stg <1-64> create <ports> vlan
<1-4094> ntstg disable
```

The ntstg parameter is enabled by default, which provides the default group STP operation. When you set the ntstg parameter to disable, PVST+ is enabled for this particular VLAN.

To view spanning tree forwarding state, enter the following command:

```
Passport 8600:6# show ports info stg main <port number>
```

To view the spanning tree configuration, enter the following command:

```
Passport 8600:6# show stg info config
```

To view the spanning tree status, enter the following command:

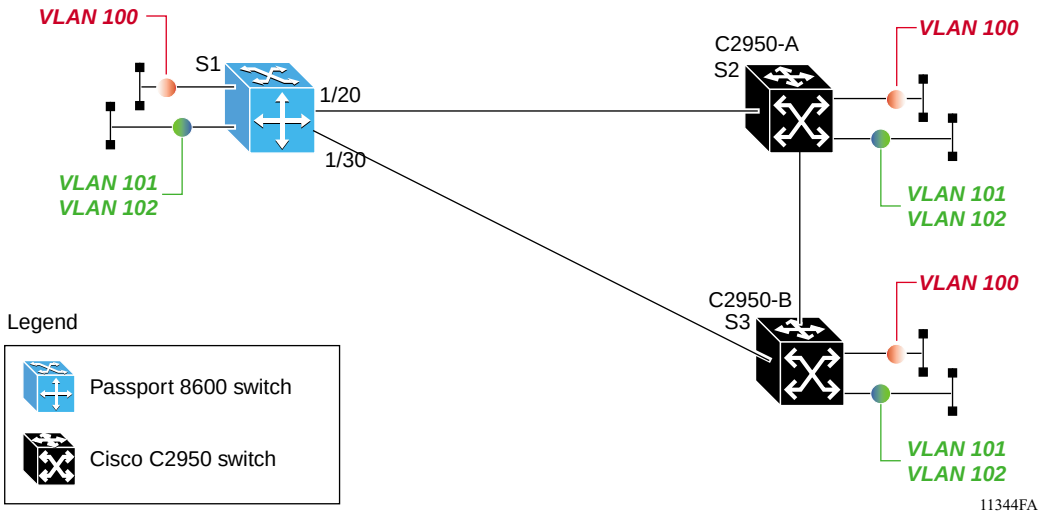
```
Passport 8600:6# show stg info status
```

Configuration example—Basic setup

Figure 157 shows a basic configuration example where a single Passport 8600 switch is using PVST+ to connect to two Cisco Systems switches.

The following sections provide step-by-step procedures that show how to configure PVST+ on Passport 8600 switch S1, for this example.

Figure 157 Basic setup configuration example



Configure Passport 8600 switch S1:

1 Configure ports 1/20 and 1/30 with VLAN tagging:

```
Passport-8610:6# config ethernet 1/20,1/30
perform-tagging enable
```

2 Configure a PVST+ STG instance for each VLAN:

```
Passport-8610:6# config stg 20 create 1/5,1/20,1/30 vlan
100 ntstg disable
Passport-8610:6# config stg 21 create 1/6,1/20,1/30 vlan
101 ntstg disable
Passport-8610:6# config stg 22 create 1/7,1/20,1/30 vlan
102 ntstg disable
```

3 Create VLAN 100:

```
Passport-8610:6# config vlan 100 create byport 20
Passport-8610:6# config vlan 100 ports add 1/5,1/20,1/30
```

4 Create VLAN 101:

```
Passport-8610:6# config vlan 101 create byport 21
Passport-8610:6# config vlan 101 ports add 1/6,1/20,1/30
```

5 Create VLAN 102:

```
Passport-8610:6# config vlan 102 create byport 22
Passport-8610:6# config vlan 102 ports add 1/7,1/20,1/30
```

Configure Cisco C2950 switches S2 and S3:

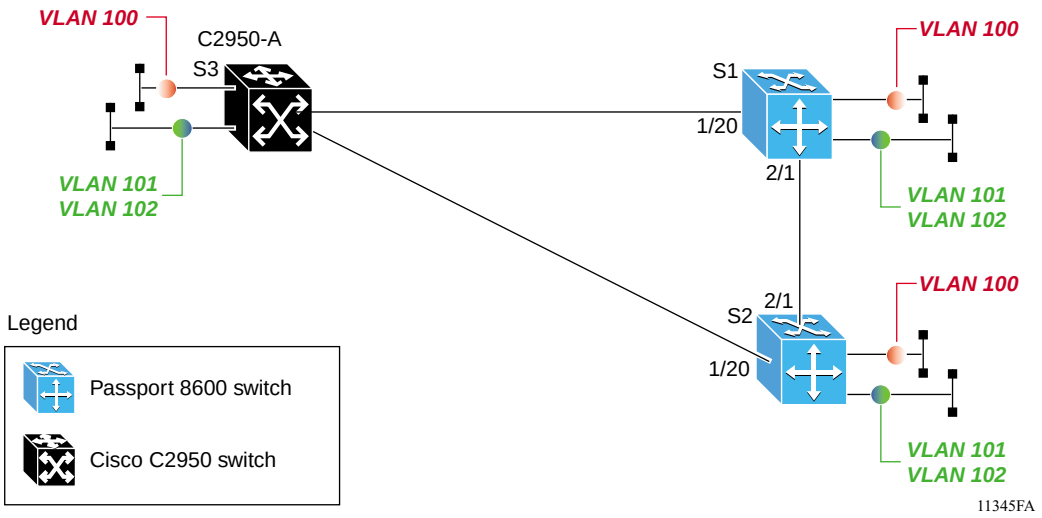
By default, PVST+ is enabled on the switches. The only configuration requirement is for you to add the VLANs (via the VLAN database), and then add the ports to each VLAN:

```
version 12.1
!
interface FastEthernet0/17
 switchport access vlan 100
 switchport mode access
 no ip address
!
interface FastEthernet0/18
 switchport access vlan 101
 switchport mode access
 no ip address
!
interface FastEthernet0/19
 switchport access vlan 102
 switchport mode access
 no ip address
!
interface FastEthernet0/20
 switchport trunk allowed vlan 100-102
 switchport mode trunk
 no ip address
!
interface FastEthernet0/21
 switchport trunk allowed vlan 100-102
 switchport mode trunk
 no ip address
!
```

Configuration Example—Load Balancing with Passport 8600 switches as distribution switches

This configuration example shows how to perform load-balancing with the Passport 8600 switches (S1 and S2) as distribution switches, and the Cisco C2950 switch (S3) as an access switch (Figure 158).

Figure 158 Load balance configuration example



This configuration example shows how to complete the following tasks:

- Configure the Cisco C2950 switch as an access switch.
- Configure Passport 8600 switches (S1 and S2) as distribution switches
- Forward all even number VLANs from C2950-A (S3) to Passport 8600 switch S1.

  This is accomplished by configuring the STG bridge priority. By default, all STG groups have a bridge priority of 32768. To increase the STG priority, you can lower the STG priority to a lower value for all even number VLANs (for this example, use 4096).

- Forward all odd number VLANs from C2950-A (S3) to Passport 8600 switch S2.

  To increase the STG priority, you can lower the STG priority to a lower value for all odd number VLANs (for this example, use 4096).

For the configuration files used for Passport 8600 switches S1 and S2 in this configuration example, refer to "Configuration files for S1 and S2:" on page 344.

The following sections provide step-by-step procedures that show how to perform load-balancing with the Passport 8600 switches (S1 and S2) as distribution switches, and the Cisco C2950 switch (S3) as an access switch for this example.

Configure Passport 8600 switch S1:

1 Configure ports 1/20 and 2/1 with VLAN tagging:

```
Passport-8610:6# config ethernet 1/20,2/1 perform-tagging
enable
```

2 Configure a PVST+ STG instance for each VLAN:

```
Passport-8610:6# config stg 20 create 1/5,1/20,2/1 vlan
100 ntstg disable
Passport-8610:6# config stg 21 create 1/6,1/20,2/1 vlan
101 ntstg disable
Passport-8610:6# config stg 22 create 1/7,1/20,2/1 vlan
102 ntstg disable
```

3 Configure bridge priority for each even number VLAN STG group:

```
Passport-8610:6# config stg 20 priority 4096
Passport-8610:6# config stg 22 priority 4096
```

4 Create VLAN 100:

```
Passport-8610:6# config vlan 100 create byport 20
Passport-8610:6# config vlan 100 ports add 1/5,1/20,2/1
```

5 Create VLAN 101:

```
Passport-8610:6# config vlan 101 create byport 21
Passport-8610:6# config vlan 101 ports add 1/6,1/20,2/1
```

6 Create VLAN 102:

```
Passport-8610:6# config vlan 102 create byport 22
Passport-8610:6# config vlan 102 ports add 1/7,1/20,2/1
```

Configure Passport 8600 switch S2:

1. Configure ports 1/20 and 2/1 with VLAN tagging:

```
Passport-8610:6# config ethernet 1/20,2/1 perform-tagging
enable
```

2. Configure a PVST+ STG instance for each VLAN:

```
Passport-8610:6# config stg 20 create 1/5,1/20,2/1 vlan
100 ntstg disable
Passport-8610:6# config stg 21 create 1/6,1/20,2/1 vlan
101 ntstg disable
Passport-8610:6# config stg 22 create 1/7,1/20,2/1 vlan
102 ntstg disable
```

3. Configure bridge priority for each odd number VLAN STG group:

```
Passport-8610:6# config stg 21 priority 4096
```

4. Create VLAN 100:

```
Passport-8610:6# config vlan 100 create byport 20
Passport-8610:6# config vlan 100 ports add 1/5,1/20,2/1
```

5. Create VLAN 101:

```
Passport-8610:6# config vlan 101 create byport 21
Passport-8610:6# config vlan 101 ports add 1/6,1/20, 2/1
```

6. Create VLAN 102:

```
Passport-8610:6# config vlan 102 create byport 22
Passport-8610:6# config vlan 102 ports add 1/7,1/20, 2/1
```

Configuration files for S1 and S2:

The following sections provide the configuration files used for Passport 8600 switches S1 and S2 in the configuration example shown Figure 158 on page 342.

S1 configuration file:

```
#
# PORT CONFIGURATION - PHASE I
#
ethernet 1/20 perform-tagging enable
ethernet 2/1 perform-tagging enable
#
# STG CONFIGURATION
```

```
#
stg 20  create vlan 100 mac 01:00:0c:cc:cc:cd ntstg disable
stg 20  add ports 1/5,1/20,2/1
stg 20  priority 4096
stg 21  create vlan 101 mac 01:00:0c:cc:cc:cd ntstg disable
stg 21  add ports 1/6,1/20,2/1
stg 22  create vlan 102 mac 01:00:0c:cc:cc:cd ntstg disable
stg 22  add ports 1/7,1/20,2/1
stg 22  priority 4096
#
# VLAN CONFIGURATION
#
vlan 100 create byport 20
vlan 100 ports remove 1/1-1/4,1/6-1/19,1/21-1/48,2/2-2/8,3/1-3/8
member portmember
vlan 100 ports add 1/5,1/20,2/1 member portmember
vlan 101 create byport 21
vlan 101 ports remove 1/1-1/5,1/7-1/19,1/21-1/48,2/2-2/8,3/1-3/8
member portmember
vlan 101 ports add 1/6,1/20,2/1 member portmember
vlan 102 create byport 22
vlan 102 ports remove 1/1-1/6,1/8-1/19,1/21-1/48,2/2-2/8,3/1-3/8
member portmember
vlan 102 ports add 1/7,1/20,2/1 member portmember
```

S2 configuration file:

```
#
# PORT CONFIGURATION - PHASE I
#
ethernet 1/20 perform-tagging enable
ethernet 2/1 perform-tagging enable
#
# STG CONFIGURATION
#
stg 20  create vlan 100 mac 01:00:0c:cc:cc:cd ntstg disable
stg 20  add ports 1/5,1/20,2/1
stg 21  create vlan 101 mac 01:00:0c:cc:cc:cd ntstg disable
stg 21  add ports 1/6,1/20,2/1
stg 21  priority 4096
stg 22  create vlan 102 mac 01:00:0c:cc:cc:cd ntstg disable
stg 22  add ports 1/7,1/20,2/1
#
# VLAN CONFIGURATION
#
vlan 100 create byport 20
vlan 100 ports remove 1/1-1/4,1/6-1/19,1/21-1/48,2/2-2/8,3/1-3/8
member portmember
```

```
vlan 100 ports add 1/5,1/20,2/1 member portmember
vlan 101 create byport 21
vlan 101 ports remove 1/1-1/5,1/7-1/19,1/21-1/48,2/2-2/8,3/1-3/8
member portmember
vlan 101 ports add 1/6,1/20,2/1 member portmember
vlan 102 create byport 22
vlan 102 ports remove 1/1-1/6,1/8-1/19,1/21-1/48,2/2-2/8,3/1-3/8
member portmember
vlan 102 ports add 1/7,1/20,2/1 member portmember
```

Configuration Example—Load Balancing with Cisco System switch as a distribution switch

This configuration example shows how to perform load-balancing with the Cisco C2950 switches (S2 and S3) as distribution switches, and the Passport 8600 switch (S1) as an access switch (see Figure 157 on page 340).

This configuration example shows how to complete the following tasks:

- Configure the Passport 8600 switch (S1) as an access switch.
- Configure Cisco C2950 switches (S2 and S3) as distribution switches.
- Forward all even number VLANs from Passport 8600 switch (S1) to Cisco C2950 switch S2.
- Forward all odd number VLANs from Passport 8600 switch (S1) to Cisco C2950 switch S3.

To load balance traffic in this manner, you can configure the Cisco C2950 switch S2 as the root for all even number VLANs and the Cisco C2950 switch S3 as the root for all odd number VLANs.

To do this, enter the following commands:

1 Configure C2950 S2 as the root from all even number VLANs:

```
Cat2950-A(config)# spanning-tree vlan 100 root primary
Cat2950-A(config)# spanning-tree vlan 102 root primary
```

2 Configure C2950 S3 as the root for all odd number VLANs:

```
Cat2950-B(config)# spanning-tree vlan 101 root primary
```

(The Cisco System root command changes the bridge priority to 24576)

Cisco Systems default spanning tree settings

The section shows the default PVST+ settings used with Cisco Systems switches.

Feature	Default Value
VLAN 1	All ports assigned to VLAN 1
Enable state	PVST+ enabled for all VLANs
Bridge priority	32768
Port priority	32
Port cost	• Gigabit Ethernet: 4 • Fast Ethernet: 19 • Ethernet: 100
Port VLAN priority	Same as port priority, but configurable on a per-VLAN basis in PVST+.
Port VLAN cost	Same as port cost, but configurable on a per-VLAN basis in PVST+.
Bridge Priority	0, 4096, 8192, 12288, 16,384, 20480, 28672, 32768, 36864, 40960, 45056, 49152, 53248, 57344, or 61440.

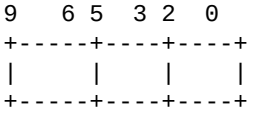
Setting the PVST+ Bridge ID Priority

- The bridge ID priority is the priority of a VLAN when the switch is in PVST+ mode.
- When the switch is in PVST+ mode without MAC address reduction enabled, you can enter a bridge priority value between 0 and 65535. The bridge priority value you enter also becomes the VLAN bridge ID priority for that VLAN.
- When the switch is in PVST+ mode with MAC address reduction enabled, you can enter one of 16 bridge priority values: 0, 4096, 8192, 12288, 16384, 20480, 24576, 28672, 32768, 36864, 40960, 45056, 49152, 53248, 57344, or 61440.
- The bridge priority is combined with the system ID extension (that is, the ID of the VLAN) to create the bridge ID priority for the VLAN.

Appendix A
Tap and OctaPID assignment

The switch fabric in the Passport 8600 modules has nine switching taps, one for each of the eight I/O slots (1 to 4 and 7 to 10) and one for the CPU slots (5 and 6). Taps 0-7 map to the eight I/O slots and can support up to eight OctaPIDs. Each OctaPID can support up to eight ports.

In the Passport 8000 Series switch, a physical port number is 10 bits long and has the following format:



bits 9–6: Tap number (0–15)

bits 5–3: OctaPID number (0–7)

bits 2-0: MAC port number (0-7)

The Tap number bits and the OctaPID number bits combined (bits 9–3) are usually referred to as the OctaPID ID.

Table 34 lists the module types that are currently available, along with the associated OctaPID ID assignments for each module.

Table 34 Available module types and OctapPID ID assignments

Module type	Port type	OctaPID ID assignment
8608GBE and 8608GBM Modules	1000BASE-SX	Table 35 next
	1000BASE-LX	
	1000BASE-ZX	
	1000BASE-XD	
8608GTE and 8608GTM Modules	1000BASE-T	Table 35 next
8608SXE Module	1000BASE-SX	Table 35 next
8616SXE Module	1000BASE-SX	Table 36 on page 351
8624FXE Module	100BASE-FX	Table 37 on page 352
8632TXE and 8632TXM Modules	10BASE-T/100BASE-TX	Table 38 on page 352
	1000BASE-SX	
	1000BASE-LX	
	1000BASE-ZX	
	1000BASE-XD	
8648TXE and 8648TXM Modules	10/100 Mb/s	Table 39 on page 352
8672ATME and 8672ATMM Modules	OC-3c MDA	Table 40 on page 353
	OC-12c MDA	
	DS3	
8681XLR Module	10GBASE-LR	Table 41 on page 353
8681XLW Module	10GBASE-LW	Table 42 on page 354
8683POSM Module	OC-3c MDA	Table 43 on page 354
	OC-12c MDA	

Table 35 describes the OctaPID ID and port assignments for the 8608GBE, 8608GBM, 8608GTE, 8608GTM, and 8608SXE modules.

Table 35 8608GBE/8608GBM/8608GTE/8608GTM, and 8608SXE modules

OctaPID ID assignment	Port assignment
OctaPID ID: 0	Port 1
OctaPID ID: 1	Port 2
OctaPID ID: 2	Port 3
OctaPID ID: 3	Port 4
OctaPID ID: 4	Port 5
OctaPID ID: 5	Port 6
OctaPID ID: 6	Port 7
OctaPID ID: 7	Port 8

Table 36 describes the OctaPID ID and port assignments for the 8616SXE Module.

Table 36 8616SXE module

OctaPID ID assignment	Port assignment
OctaPID ID: 0	Ports 1 and 2
OctaPID ID: 1	Ports 3 and 4
OctaPID ID: 2	Ports 5 and 6
OctaPID ID: 3	Ports 7 and 8
OctaPID ID: 4	Ports 9 and 10
OctaPID ID: 5	Ports 11 and 12
OctaPID ID: 6	Ports 13 and 14
OctaPID ID: 7	Ports 15 and 16

Table 37 describes the OctaPID ID and port assignments for the 8624FXE Module.

Table 37 8624FXE module

OctaPID ID assignment	Port assignment
OctaPID ID: 0	Ports 1 through 8
OctaPID ID: 1	Ports 9 through 16
OctaPID ID: 2	Ports 17 through 24

Table 38 describes the OctaPID ID and port assignments for the 8632TXE and 8632TXM Modules.

Table 38 8632TXE and 8632TZM modules

OctaPID ID assignment	Port assignment
OctaPID ID: 0	Ports 1 through 8
OctaPID ID: 1	Ports 9 through 16
OctaPID ID: 2	Ports 17 through 24
-	-
-	-
OctaPID ID: 5	Ports 25 through 32
OctaPID ID: 6	Port 33 (GBIC port)
OctaPID ID: 7	Port 34 (GBIC port)

Table 39 describes the OctaPID ID and port assignments for the 8648TXE and 8648TXM Modules.

Table 39 8648TXE and 8648TXM modules

OctaPID ID assignment	Port assignment
OctaPID ID: 0	Ports 1 through 8
OctaPID ID: 1	Ports 9 through 16
OctaPID ID: 2	Ports 17 through 24
-	-
-	-

Table 39 8648TXE and 8648TXM modules

OctaPID ID assignment	Port assignment
OctaPID ID: 5	Ports 25 through 32
OctaPID ID: 6	Port 33 through 40
OctaPID ID: 7	Port 41 through 48

Table 40 describes the OctaPID ID and port assignments for the 8672ATME and 8672ATMM Modules.

Table 40 8672ATME and 8672ATMM modules

OctaPID ID assignment	Port assignment
OctaPID ID: 0	• Ports 1 through 4 (with OC-3c MDA) • Port 1 (with OC-12c MDA) • Ports 1 through 2 (with DS-3 MDA)
OctaPID ID: 1	• Ports 5 through 8 (with OC-3c MDA) • Port 5 (with OC-12c MDA) • Ports 5 through 6 (with DS-3 MDA)
OctaPID ID: 2	Not used

Table 41 describes the OctaPID ID and port assignments for the 8681XLR Module.

Table 41 8681XLR module

OctaPID ID assignment	Port assignment
OctaPID ID: 0	Port 1
OctaPID ID: 1	
OctaPID ID: 2	
OctaPID ID: 3	
OctaPID ID: 4	
OctaPID ID: 5	
OctaPID ID: 6	
OctaPID ID: 7	

Table 42 describes the OctaPID ID and port assignments for the 8681XLW Module.

Table 42 8681XLW module

OctaPID ID assignment	Port assignment
OctaPID ID: 0	Port 1
OctaPID ID: 1	
OctaPID ID: 2	
OctaPID ID: 3	
OctaPID ID: 4	
OctaPID ID: 5	
OctaPID ID: 6	
OctaPID ID: 7	

Table 43 describes the OctaPID ID and port assignments for the 8683POSM Module.

Table 43 8683POSM module

OctaPID ID assignment	Port assignment
OctaPID ID: 0	• Ports 1 and 2 (with OC-3c MDA) • Port 1 (with OC-12c MDA)
OctaPID ID: 1	• Ports 3 and 4 (with OC-3c MDA) • Port 3 (with OC-12c MDA)
OctaPID ID: 2	• Ports 5 and 6 (with OC-3c MDA) • Port 5 (with OC-12c MDA)

Glossary

aggregation switch

A switch that aggregates multiple user access switches and provides core connections.

SMLT aggregation switches

The two switches that share an IST link.

Typically, one or more switches that connects to multiple wiring closet switches, edge switches or CPE devices, usually within a single building.

SMLT clients

A switch located at the edge of the network, such as in a wiring closet or CPE. An SMLT Client switch must be able to perform link aggregation (such as with MLT or some other compatible method) but does not require any SMLT intelligence.

Inter Switch Trunk (IST)

One or more parallel point-to-point links that connect two aggregation switches together. The two aggregation switches utilize this channel to share information so that they may operate as a single logical switch. There can be only one IST per SMLT aggregation switch.

MultiLink Trunk (MLT)

A method of link aggregation that allows multiple Ethernet trunks to be aggregated together in order to provide a single logical trunk. An MLT provides the combined bandwidth of the multiple links, as well as the physical layer protection against the failure of any single link.

Split MultiLink Trunk (SMLT)

An MLT, where one, or both, ends are split between two aggregation switches, thus forming what is typically referred to as an “SMLT triangle or SMLT square.”

Single-port SMLT

An MLT, where one, or both, ends are split between two aggregation switches; however only one port can be configured on each aggregation switch per SMLT ID.

SMLT ID

The identification number used to specify the corresponding pair of SMLT links. This number is identified between the two aggregation switches and must be paired on each aggregation switch.

SMLT set

Two SMLT aggregation switches and their directly connected SMLT clients.

SMLT square

A pair of SMLT aggregation switches connected in a full mesh as SMLT clients to another pair of SMLT aggregation switches.

SMLT triangle

A configuration where an SMLT client and the two aggregation switches form a triangle.

RSMLT VLAN

VLAN that has RSMLT enabled for router redundancy and is therefore protected by active-active SMLT-aggregation switch default gateways.

user access switch

A switch located at the edge of the network. End stations typically connect directly to a user access switch.

Peer IP address

IP addresses of the neighbor IST switch VLAN that is chosen for configuring the IST. Note that the peer IP address is the IP address of the IST VLAN on the other aggregation switch. You need only configure one VLAN with an IP address for the IST protocol to work. All other VLANs on the IST do not require an IP address if you choose not to have VLAN routing enabled.

Index

A

B

C

D

E

F

H

I

L

M

N

O

P

Q

R

S

T

U

V