Configuring APS MSP

SYSTEM ADMINISTRATOR GUIDE

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Contents

1 Contents of this Document

This document describes how to configure, monitor, and administer Automatic Protection Switching (APS) and multiplex section protection (MSP) on Packet over SONET/SDH (POS) and second-generation Asynchronous Transfer Mode (ATM) OC ports.

2 Overview

Besides providing facility protection for traffic on the optical fiber ports, APS and MSP on the SmartEdge® router provide equipment protection for the traffic card hosting the working port. If the traffic card fails and the protect port is on another traffic card, the SmartEdge OS switches the affected traffic to the protect port and allows the failed card to be serviced. APS and MSP also provide protection against line faults or failures for ATM OC ports.

The SmartEdge OS supports a subset of Synchronous Optical Network/Synchronous Digital Hierarchy (SONET/SDH) APS that is described in the Telcordia publication *GR-253-CORE, SONET Transport Systems, Common Criteria, Section 5.3* and the SDH specification described in *ITU-T Recommendation G..783*. MSP is described in *ITU-T Recommendation G.841*. Annex B of ITU-T G.841 is not supported.

2.1 Requirements and Restrictions

2.1.1 Active Subscriber Count

Active subscriber counts are a function of the configuration, memory, processing power, and bandwidth desired for each subscriber. Each router and hardware variant has a maximum active subscriber figure, which may be achieved under deployment scenarios. Enabling APS or MSP requires additional memory for each configured port and may impact the maximum number of subscribers that can be supported.

2.1.2 Line Card Compatibility

APS and MSP is offered for second-generation ATM OC and channelized optical ports on these traffic card types:

- *8-port ATM OC-3c/STM-1c* line card

- *2-port ATM OC-12c/STM-4c* line card

- *8-port POS OC-3c/STM-1c* line card

- *4-port POS OC-12c/STM-4c* line card

- *4-port POS OC-48c/STM-16c* line card

- *Channelized 8/4-port OC-3/STM-1 or 2/1-OC-12/STM-4* line card

- The SmartEdge 100 router line cards do not support APS/MSP groups.

• APS is not supported on Ethernet WAN-PHY configured ports.

Note: The line cards defined to be second-generation ATM OC are listed in the *Card Types* section in *Configuring Cards* document.

2.1.3 Configuration Caution and Performance Note

Caution!

Risk of service disruption. When an APS or MSP working or protect port is removed (unconfigured) from an APS/MSP group, all sessions currently active on the ports are terminated. Only sessions configured on the working port can be brought back up as normal. To reduce the risk of service disruption beyond this temporary termination of sessions when you unconfigure a working or protect port from an APS/MSP group, do not remove either the working or protect port without first performing an APS/MSP `aps switch force` command on the active port to switch all sessions to the working port and locking out the protect port.

Note: Configuring and enabling APS or MSP can have a negative impact on the performance of the SmartEdge router. Consult your support representative for more information.

2.1.4 POS APS Feature Compatibility

The SmartEdge OS implementation of APS is linear 1+1.

Note: MLPPP is not supported for the OC3c/STM-1c, OC12c/STM-4C,or OC48c/STM-16c cards. MLPPP applies only to the Channelized 8/4-port OC-3/STM-1 or 2/1-OC-12/STM-4 line cards.

Table 1 summarizes encapsulation and feature compatibility for POS APS ports.

Table 1   POS APS Feature Compatibility

Feature	Supported	Notes
Encapsulation		
Cisco High-level Data Link Control (CHDLC)	Yes	Required
PPP	Yes	
Static CLIPS	No	Supported on bidirectional revertive MSP

Table 1   POS APS Feature Compatibility

Feature	Supported	Notes
Dynamic CLIPS	No	Supported on bidirectional revertive MSP
Routing RIP	Yes	
OSPF	Yes	
ISIS	Yes	
PIM	Yes	
BGP	Yes	
IP Services	Yes	
RFC 1483 bridge encapsulation of Dynamic Host Configuration Protocol (DHCP).	Yes	
IP Service Policies		
NAT	Yes	
Forward policy	Yes	
Service policy	Yes	
IP Security		
AAA	Yes	
RADIUS	Yes	
TACACS+	Yes	
Circuit Types		
On-demand	No	
On-demand via AAA	No	
Explicit ranges	No	
Tunnels GRE	Yes	
L2TP LNS	Yes	
L2TP LAC	Yes	
QoS Policing/metering	Yes	
PWFQ (queuing)	No	Apply only to MLPPP link group
Flow Admission Control	No	PPA2 cards only
Management		

Table 1   POS APS Feature Compatibility

Feature	Supported	Notes
NetOp EMS	Yes	Configuration and monitoring of Frame Relay circuits is supported
SNMP	Yes	
APS		
RDI-P	Yes	Required
REI-P	Yes	Required
1+1	Yes	
1:1	No	
1:N	No	
Bidirectional switching	Yes	Default for POS APS cards
Unidirectional switching	Yes	Default for ATM APS cards
Revertive switching	Yes	
Nonrevertive switching	Yes	Default
Use of protection line for extra traffic	No	
Scalability		
Maximum PVCs per group	16,000	
Maximum protected PVCs per system	48,000	
Maximum APS groups per system	8	
Switchover time	<2.5 seconds	

Note: ASE support for ATM APS is described in Section 2.2 on page 8.

2.1.5   MSP Feature Compatibility

The SmartEdge OS implementation of MSP is linear 1+1 and has the following features and configuration requirements:

- The following protocols and services are required or supported on MSP ports:

    – Required: HDLC encapsulation (for all POS cards)

    – Supported: SDH high order path remote defect indication (HP-RDI-P) and high order path remote error indication (HP-REI) generation.

— Supported: RFC 1483 bridge encapsulation of Dynamic Host Configuration Protocol (DHCP).

— Supported on ATM ports (not supported on POS ports): Clientless IP service selection (CLIPS) over bidirectional revertive MSP.

2.1.6   Configuration Restrictions

- Working and protect ports can be on the same traffic card or different traffic cards of the same type.

- For each working port, a single protect port exists and each port must be of the same type. For example, a port on an OC-3c/STM-1c traffic card must be paired with a port on another OC-3c/STM-1c traffic card; an OC-3c/STM-1c traffic card cannot be paired with an OC-12c/STM-4c traffic card.

- The SmartEdge OS APS and MSP implementations support bidirectional and unidirectional modes:

  — In bidirectional mode, traffic is transmitted and received on the active port only; traffic is switched from the working port to the protect port (or conversely from the protect port to the working port) based on the quality of the received signal. When a failure occurs on either or both the Tx or Rx line, both lines are switched to the protect port.

  — In unidirectional mode, traffic is transmitted and received on both the working and protect ports. When a failure occurs on one of the lines (either Tx or Rx), traffic on only the failed line is switched to the other port at the end that experienced the failure. When the failure occurs on both lines, both lines are switched to the other port at the end that experienced the failure.

  — POS ports support only bidirectional mode; ATM ports support both unidirectional and bidirectional modes.

- By default, protection is nonrevertive, but revertive switching is offered as an option.

  If you configured an APS/MSP group for revertive switching and the working port becomes available after a switch to the protect port, the working port enters the wait to restore (WTR) state. If the working port remains clear throughout the WTR interval, a switch back to the working port occurs when the WTR interval expires. Both POS and ATM ports support revertive and nonrevertive switching.

- ATM ports support medium access control (MAC) addresses, which are typically obtained from the traffic card. We recommend that you configure your own MAC address from the CLI to prevent traffic loss when you replace an ATM traffic card with failed and protect ports.

- Using the `aps switch` command (in port configuration mode), you can manage ports in an APS/MSP group to switch the working and protect ports, or temporarily disable APS or MSP switching.

2.2 ASE Support for ATM APS

When the working and protect Automatic Protection Switching (APS) ATM ports are in different slots, and when traffic has to traverse the Advanced Services Engine (ASE) card for such as deep packet inspection (DPI) services, the ASE card replicates traffic moving towards the ports in the APS/MSP group.

Use the `show security aps` command with the `statistics` keyword to view APS statistics.

2.2.1 Restrictions and Requirements

- ASE support for ATM APS applies only to DPI services.

- This feature is supported on the XCRP4 Controller card.

- When APS working and protect ports are on different slots, and when replication is performed on the ASE card, replication bandwidth is factored during load balancing of ATM APS subscribers.

2.3 Terminology

The term *APS configuration* used in this document and other documents in the SmartEdge OS Library refers to the configuration of both APS and MSP groups.

The term traffic card refers to a SmartEdge 100 media interface card (MIC) or a SmartEdge 400 or SmartEdge 800 traffic card, unless otherwise noted.

3 Configuration Tasks and Examples

3.1 Configure an APS/MSP Group

To configure an APS/MSP group, perform the tasks described in Table 2; enter all commands in APS configuration mode, unless otherwise noted.

Table 2   Configure an APS Group

Step	Task	Root Command	Notes
1.	Create an APS/MSP group or select one for modification, and access APS configuration mode.	*aps group*	Enter this command in global configuration mode. Specify either ATM or POS as the group type. The default type is POS.
2.	Set the mode for the APS/MSP group.	*architecture 1+1*	
3.	Associate a description with the group.	*description (APS)*	
4.	Optional. Specify the revertive switching algorithm and WTR interval.	*revert*	The default algorithm is nonrevertive.

3.2 Configure the Working and Protect Ports

Before you can assign a port as a working port in an APS/MSP group, the group must first be created. After the APS/MSP group is created, assign the working and protect ports to it in any order.

Note: ATM working ports can have their configurations changed at any time. ATM replicates the port configuration commands from the working port to the protect port, including the creation of ATM permanent virtual circuits (PVCs). This configuration can be applied to only ATM working ports; you can configure the port before adding it to a protect group, but not ATM virtual paths (VPs) or PVCs. After the port is added as a working port, the configuration is replicated to the protect port if it has been bound to the same APS/MSP group, or it is replicated after the protect port is added.

3.2.1 Configuration Restrictions

The following requirements apply to the port configuration:

- Applies to both ATM and POS ports:

  – The working and protection ports must have identical configurations.

To configure a POS or an ATM port, see *Configuring POS Ports* section of the document, *Configuring ATM, Ethernet, and POS Ports.*

— The working and protection ports must be on the same type of card.

— You cannot remove a port from the configuration using the **no** form of the `port` command (in global configuration mode) while it is a member of an APS/MSP group. You cannot remove a traffic card from the configuration using the **no** form of the `card` command (in global configuration mode) if any one of the ports of the card is a member of an APS/MSP group.

— The system lights the standby LED on a traffic card if at least one of the ports of the card is a member of an APS/MSP group as a protect port; the Active LED is turned off if all its ports are members of APS/MSP groups as protect ports.

• Applies to POS ports only:

— You must specify Cisco HDLC encapsulation for the ports.

— Do not bind either port before you assign it, either as a working or protect port, to the APS/MSP group; however, you must make the ports operational using the `no shutdown` command (in port configuration mode).

— After you add ports to an APS/MSP group, bind the working port to an existing interface using the `bind interface` command (in port configuration mode). Do not bind the protect port. Binding a working port to an interface using the `bind interface` command (in port configuration mode) is not considered a change to the port configuration; thus, this action is allowed on an APS/MSP working port.

— If you need to change the configuration of a working port, ensure that you apply the configuration changes to both the working and protect ports; the configurations must be identical. If a port has already been assigned as a working or protect port in an APS/MSP group, remove that port first from the APS/MSP group before making any subsequent changes to the configuration for the port.

• Applies to ATM ports only:

— Link dampening must be enabled for the working port of an ATM APS/MSP protection group to prevent the port from rapidly and continually changing state (from up to down and down to up).

— ATM operations, administration, and maintenance (OAM) cells received on both working and protect ports are processed.

— You can initiate the sending of OAM loopback cells on both the working and protect ports, using the `ping atm` command (in exec mode). You can initiate OAM loopback only on the working port, regardless of whether it is in an active or a standby state.

> — You can create up to 24 APS/MSP groups.

3.3 Example Configuration of an APS/MSP Group

The following example shows how to create the APS/MSP group **lab48** with revertive switching and a WTR of **10** minutes, configure the ports on two OC-48c/STM-16c cards for the group, and add them to the group:

```
[local]Redback(config)#aps group lab48 pos
[local]Redback(config-aps)#architecture 1+1 bidirectional
[local]Redback(config-aps)#revert 10
[local]Redback(config-aps)#exit
[local]Redback(config)#port pos 1/1
[local]Redback(config-port)#encapsulation cisco-hdlc
[local]Redback(config-port)#aps working lab48
[local]Redback(config-port)#bind interface if-lab48 local
[local]Redback(config-port)#no shutdown
[local]Redback(config-port)#exit
[local]Redback(config)#port pos 2/1
[local]Redback(config-port)#encapsulation cisco-hdlc
[local]Redback(config-port)#aps protect lab48
[local]Redback(config-port)#no shutdown
[local]Redback(config-port)#exit
```

3.4 MLPPP with APS Example

```
config
!
service multiple-contexts
!
software license
 all-ports password <plain text passcode> card ch-oc3oc12-8or2-port slot 2
!
aps group aps1 pos
!
!
context redkite1
!
 interface mp_aps_chstm1->chds3->chds1_1
  ip address 26.26.26.1/24
!
 interface mp_aps_chstm1->chds3->e1_1
  ip address 27.27.27.1/24
!
 ppp keepalive check-interval minutes 3 response-timeout 5 retries 3 data-check
!
!
link-group mp1_aps_ds1_1 mp
 bind interface mp_aps_chstm1->chds3->chds1_1 redkite1
link-group mp1_aps_e1_1 mp
 bind interface mp_aps_chstm1->chds3->e1_1 redkite1
!
!
card ch-oc3oc12-8or2-port 2
 no shutdown
 clock-source global-reference
!
!
! APS/MSP group aps1: 2/2 working, 2/6 protect; on working port 2/2,
   using SDH AUG mapping au4-tu3 to channelize:
```

```
! chSTM1 (APS) -> chDS3 -> MLPPP (DS1 member links)
! chSTM1 (APS) -> chDS3 -> MLPPP (E1 member links)
!
port channelized-stm1 2/2 pos
 no shutdown
 aps working aps1
 aug-mapping au4-tu3
 clock-source card-reference
 !
 port channelized-ds3 2/2:2
  no shutdown
  clock-source card-reference
 !
 !
 ! MLPPP bundle over APS/MSP, 8 DS1 member links
 !
  port ds1 2/2:2:4
   no shutdown
   clock-source card-reference
   encapsulation ppp
   link-group mp1_aps_ds1_1
  !
  port ds1 2/2:2:5
   no shutdown
   clock-source card-reference
   encapsulation ppp
   link-group mp1_aps_ds1_1
  !
  port ds1 2/2:2:6
   no shutdown
   clock-source card-reference
   encapsulation ppp
   link-group mp1_aps_ds1_1
  !
  port ds1 2/2:2:7
   no shutdown
   clock-source card-reference
   encapsulation ppp
   link-group mp1_aps_ds1_1
  !
  port ds1 2/2:2:8
   no shutdown
   clock-source card-reference
   encapsulation ppp
   link-group mp1_aps_ds1_1
  !
  port ds1 2/2:2:9
   no shutdown
   clock-source card-reference
   encapsulation ppp
   link-group mp1_aps_ds1_1
  !
  port ds1 2/2:2:10
   no shutdown
   clock-source card-reference
   encapsulation ppp
   link-group mp1_aps_ds1_1
  !
  port ds1 2/2:2:28
   no shutdown
   clock-source card-reference
   encapsulation ppp
   link-group mp1_aps_ds1_1
  !
 !
port channelized-ds3 2/2:3
 no shutdown
 clock-source card-reference
 !
 !
 ! MLPPP bundle over APS/MSP, 8 E1 member links
 !
  port e1 2/2:3:4
   no shutdown
   clock-source card-reference
   encapsulation ppp
```

```
      link-group mp1_aps_e1_1
     !
    port e1 2/2:3:5
     no shutdown
     clock-source card-reference
     encapsulation ppp
     link-group mp1_aps_e1_1
    !
    port e1 2/2:3:6
     no shutdown
     clock-source card-reference
     encapsulation ppp
     link-group mp1_aps_e1_1
    !
    port e1 2/2:3:7
     no shutdown
     clock-source card-reference
     encapsulation ppp
     link-group mp1_aps_e1_1
    !
    port e1 2/2:3:8
     no shutdown
     clock-source card-reference
     encapsulation ppp
     link-group mp1_aps_e1_1
    !
    port e1 2/2:3:9
     no shutdown
     clock-source card-reference
     encapsulation ppp
     link-group mp1_aps_e1_1
    !
    port e1 2/2:3:10
     no shutdown
     clock-source card-reference
     encapsulation ppp
     link-group mp1_aps_e1_1
    !
    port e1 2/2:3:21
     no shutdown
     clock-source card-reference
     encapsulation ppp
     link-group mp1_aps_e1_1
    !
   !
  !
 port channelized-stm1 2/6 pos
  no shutdown
  aps protect aps1
 !
 !
 end
```

3.4.1 Notes

- You can configure an MLPPP bundle on a Channelized OC-3/STM-1 or OC-12/STM-4 line card with all the links of the bundle within a port of the card. The links of a bundle cannot span cards or ports. Each link could be an E1, DS1, DS3, or DS0 groups.

  Note: The difference in speed between the slowest and fastest links in an MLPPP bundle cannot exceed the speed of a single DS0 channel.

- You can mark the port where MLPPP is configured for APS support. The working and protect ports in such a situation can be on the same or different cards. The protect port automatically has a channel structure of the working port.

- These APS ports can have other channels that are not part of an MLPPP bundle.

- Multiple MLPPP bundles can reside on the same APS port.

- All packets going out on an MLPPP bundle from a PPA2 POS card that supports MLPPP is encapsulated with MLPPP.

3.5 Add Ports to an APS/MSP Group

To assign a port to an APS/MSP group, enter the `aps` command with either the `working` or `protect` keyword. Table 3 summarizes the task. You can add ports in any order. Enter the `aps` command in port configuration mode.

Table 3   Assign a Working Port and Protect Port

Task	Root Command	Notes
Assign the port to the APS/MSP group.	*aps*	Use either the `working` or `protect` keyword. Ports must have the same type and framing. This command enables APS for SONET framed ports and MSP for SDH framed ports.

3.6 CLIPS Configuration for MSP

The following example shows how to create an MSP group for CLIPS over ATM POS:

```
[local]Redback(config)#aps group atm-msp atm
[local]Redback(config-aps)#revert 5
[local]Redback(config-aps)#architecture 1+1 bidirectional
[local]Redback(config-aps)#end
!...
[local]Redback(config)#port atm 4/1
[local]Redback(config-atm-oc)#framing sdh
[local]Redback(config-atm-oc)#no shutdown
[local]Redback(config-atm-oc)#aps working atm-msp
[local]Redback(config-atm-oc)#atm pvc 1 32 profile ubr encapsulation bridge1483
[local]Redback(config-atm-pvc)#service clips dhcp context local
[local]Redback(config-atm-pvc)#end
!...
[local]Redback(config)#port atm 11/1
[local]Redback(config-atm-oc)#framing sdh
[local]Redback(config-atm-oc)#no shutdown
[local]Redback(config-atm-oc)#aps protect atm-msp
[local]Redback(config-atm-oc)#end
```

4 APS Operations

4.1 Manage Ports in an APS/MSP Group

To manage the ports in an APS group, perform one or more of the tasks described in Table 4. Enter all commands in port configuration mode unless otherwise noted.

Table 4   Manage Ports in an APS/MSP Group

Task	Root Command	Notes
Request a lockout of the protect port.	*aps switch*	Use the `lockout` keyword.
Request a high-priority (forced) switch of either the working or protect port.	*aps switch*	Use the `forced` keyword.
Request a low-priority (manual) switch of either the working or protect port.	*aps switch*	Use the `manual` keyword.
Remove a posted request.	*aps switch*	Use the `no` form to remove a posted request.
Remove (unconfigure) an ATM port from a group.	See Section 4.1.3 on page 17	
Remove (unconfigure) a POS port from a group.	See Section 4.1.1 on page 15	
Replace an ATM port in a group.	See Section 4.1.4 on page 17.	
Replace a POS port in a group.	See Section 4.1.2 on page 17".	
Shut down an ATM port in a group.	See Section 4.1.5 on page 18	
Delete a group.	*aps group*	Enter this command in global configuration mode. Use the `no` form to delete the group.

4.1.1 Delete (Unconfigure) a POS Port from an APS/MSP Group

Before you delete a POS port from an APS/MSP group (that is, before you change its configuration so that it no longer belongs to the group), enter the `show aps` command with the `detail` keyword (in any mode) to determine the status of the working and protect ports. To remove a POS port from an

APS/MSP group, perform the tasks described in Table 5. Enter all commands in port configuration mode.

Caution!

Risk of service disruption. When you delete a POS working or protect port from an APS/MSP group, all sessions currently active on the port are terminated. Only sessions on the working port can be brought back up as normal. To reduce the risk of service disruption beyond this temporary termination of sessions when deleting a POS working or protect port from an APS/MSP group, perform one of the procedures provided in Table 5. Otherwise, the system might enter an undesirable state.

Note: Table 5 documents the procedures for configuring a POS port to remove it from an APS/MSP group only.

Table 5   Delete (Unconfigure) a POS Port from an APS/MSP Group

Port to Delete	Status of Traffic	Procedure
Protect	Active	1. Force all sessions on the protect port to the working port with the `aps switch force` command for the protect port. 2. Lock out the protect port with the `aps switch lockout` command for the protect port. 3. Remove the protect port with the `no aps` command for the protect port; the working port is not removed.
	Standby	1. Lock out the protect port with the `aps switch lockout` command for the protect port. 2. Remove the protect port with the `no aps` command for the protect port; the working port is not removed.
Working	Active	1. Lock out the protect port with the `aps switch lockout` command for the protect port. 2. Remove the working port with the `no aps` command for the working port; the protect port is not removed.
	Standby	1. Force all sessions on the protect port to the working port with the `aps switch force` command for the protect port. 2. Lock out the protect port with the `aps switch lockout` command for the protect port. 3. Remove the working port with the `no aps` command for the working port; the protect port is not removed.

4.1.2 Replace a POS Port in an APS/MSP Group

Before you replace a POS port in an APS/MSP group, enter the `show aps` command with the `detail` keyword (in any mode) to determine the traffic status of the working and protect ports; perform the tasks in Table 6.

Note: Table 6 documents the procedures for replacing a POS port in an APS/MSP group only.

Table 6   Replace a POS Port in an APS/MSP Group

Task	Root Command	Notes
Replace the working port:		
1. Remove the working port from the group.		Select the task in Table 5 based on the traffic status of the port; the protect port is not removed. The ATM configuration under the port must be reapplied to the working port after the configuration is bound to the APS/MSP working group.
2. Assign the replacement port to the group as the working port.	*aps*	Use the `working` keyword.
Replace the protect port:		
1. Remove the protect port from the group.		Select the procedure in Table 5 based on the traffic status of the port; the working port is not removed.
2. Assign the replacement port to the group as the protect port.	*aps*	Use the `protect` keyword.

4.1.3 Delete (Unconfigure) an ATM Port from an APS/MSP Group

To remove either the ATM working or protect port from an APS/MSP group (that is, to configure it so that it no longer belongs to the group), enter the `no` form of the `aps` command (in port configuration mode). When you delete an ATM working or protect port from an APS/MSP group, the system also removes the other port.

Note: When you remove an ATM working port from an APS/MSP group, all the VPs and PVCs are also removed.

4.1.4 Replace an ATM Port in an APS/MSP Group

To replace either the ATM working or protect port from an APS/MSP group, first delete the port from the group (that is, configure it so that it no longer belongs to the group): enter the `no` form of the `aps` command (in port configuration mode).

Then, add the new ATM working and protect ports to the group: enter the `aps` command (in port configuration mode). Either of these ports can be one of the ports you previously deleted.

Finally, reconfigure the ATM working port that you have added to the APS/MSP group; the system automatically replicates its configuration for the protect port.

Note: When you remove an ATM working port from an APS/MSP group, all the VPs and PVCs are also deleted.

4.1.5 Shut Down an ATM Port in an APS/MSP Group

To shut down an ATM working or protect port, perform the tasks described in Table 7.

Table 7   Shut Down an ATM Port in an APS/MSP Group

Port to Shut Down	Procedure
Protect	1. Verify the following conditions using the `show aps` command (in any mode) with the `detail` keyword for the protect port: • It is in standby mode. • It has no current or pending requests present. • It has no major or minor alarms. 2. If the port is in active mode, force all sessions on the protect port to the working port with the `aps switch force` command for the protect port. 3. Lock out the protect port with the `aps switch lockout` command for the protect port.[1] 4. Verify the protect port status using the `show aps` command with the `detail` keyword. 5. Shutdown the port, using the `shutdown` command (in port configuration mode) 6. Verify the working and protect port status using the `show aps` command with the `detail` keyword. The working port should be active and the protect port should be standby.
Working	Verify the following conditions using the `show aps` command (in any mode) with the `detail` keyword for the working port: It is in active mode. • It has no current or pending requests present. • It has no major or minor alarms. 2. Force all sessions on the working port to the protect port with the `aps switch force` command for the protect port.[2] 3. Verify the working port status using the `show aps` command with the `detail` keyword. 4. Shut down the working port, using the `shutdown` command.

(1) An LOS condition detected on the working port has a lower priority than a lockout switch. Therefore, if an LOS occurs on the working port during this procedure, packets are lost.
(2) An LOS condition detected on the protect port has a higher priority than a forced switch. Therefore, if an LOS occurs on the protect port during this procedure, traffic is switched back to the working port and packets are lost.

4.2 Change the Configuration of the Working and Protect Ports

You can change the configuration of a working port while it is a member of an APS/MSP group, but you must ensure that the configuration of the protect port is identical to that of the working port:

• For POS ports, you must manually configure the working and protect ports.

• For ATM ports, the system automatically changes the configuration of the protect port to match that of the working port. Only the description, path-trace, and shutdown commands are available for the protect port. Configuring either port with any of these commands does not change the configuration of the other port.

4.3 Replace a Traffic Card with Active Ports

If you must replace a POS or an ATM traffic card (remove it from the chassis and install a new traffic card) and that traffic card has one or more ports that are active in an APS/MSP group, perform the following procedure:

1 Enter the `show aps` command with the `detail` keyword to determine which ports on the traffic card are active.

2 For each active port on the affected traffic card, perform the following steps:

    1 Force all sessions on the active port to its standby port with the `aps switch force` command for the active port.

    2 Verify the change in status for the active and standby ports using the `show aps` command with the `detail` keyword.

    3 Shut down the previously active port, using the `shutdown` command.

Caution!

If the working and protect ports are both on the same traffic card, this procedure is immaterial; all sessions are lost when the traffic card is removed from the chassis.

Ensure that you enter the `commit` command after each configuration command and display the port APS/MSP status with the `show aps` command after each command is committed.

3 Remove the traffic card from the chassis and install the new traffic card.

4 Enter the `no` form of the `aps switch force` and `shutdown` commands for each port that you performed step 2.

4.4   Example of Lockout Switch Request

The following example shows how to temporarily disable APS/MSP switching on port **3/1** (the protect port) by requesting a lockout:

```
[local]Redback(config)#port pos 3/1
[local]Redback(config-port)#aps switch lockout
```

The following example shows how to re-enable switching by removing the lockout request:

```
[local]Redback(config)#port pos 3/1
[local]Redback(config-port)#no aps switch lockout
```

4.5   Example of a Forced Switch Request

The following example shows how to post a high-priority request to switch the sessions on working port **2/1** to the protect port:

```
[local]Redback(config)#port pos 2/1
[local]Redback(config-port)#aps switch force
```

> **Note:**   For the request to succeed, no higher-priority APS/MSP requests must be in effect.

The following example shows how to remove the high-priority request. Because the switching algorithm for the APS/MSP group is revertive, port **2/1** becomes the working port for the APS/MSP group after the WTR interval expires and no alarms have been posted against it:

```
[local]Redback(config)#port pos 2/1
[local]Redback(config-port)#no aps switch force
```

4.6   Manual Switch Request Example

The following example shows how to post a low-priority request to switch the sessions on working port **2/1** to the protect port:

```
[local]Redback(config)#port pos 2/1
[local]Redback(config-port)#aps switch manual
```

For the request to succeed, no higher-priority APS/MSP requests must be in effect.

The following example shows how to remove the low-priority request. Because the switching algorithm for the APS/MSP group is revertive, port **2/1** becomes

the working port for the APS/MSP group after the WTR interval expires and no alarms have been posted against it:

```
[local]Redback(config)#port pos 2/1
[local]Redback(config-port)#no aps switch manual
```

4.7 Show Status and Statistics

- *show aps* command

  Display the status of one or more APS groups and their working and protect ports.

- *show circuit counter* `aps` `aps-id` command

  Display the circuit counter reported for the L1 pseudo circuits is the cumulative traffic sent on the port while in working APS mode (i.e, across all port switches). If an MLPPP bundle is also present in an APS group only the constituents of the MLPPP bundle (which are part of this APS group) ARE shown, and, the MLPPP bundle circuit itself is not displayed.

- *show circuit counter* `link-group` `link-group-name` `mp` command

  Display the circuit counter reported for a specified link-group.

  Note: The terms *link-group-name* and *MLPPP bundle-name* are equivalent in this document.

4.7.1 show circuit counters aps Example

```
[local]Redback>show circuit counters aps-id 2
Circuit             Packets/Bytes Sent    Packets/Bytes Received
255/5                  18/360                 18/360
1/1                    0/0                    0/0
2/1                    0/0                    0/0
L1 Pseudo chan A     5/100                  5/100
L1 Pseudo chan B     6/120                  6/120
L1 Pseudo chan C     7/140                  7/140
```

4.7.2 show circuit counter MLPPP Link Group Example

In this example, the MLPPP bundle has which has L1 Pseudo A and Pseudo B as constituent members of the bundle.

```
[local]Redback>show circuit counters link-group bundle-verz mp
Circuit          Packets/Bytes Sent    Packets/Bytes Received
MP Bundle         9/180                 9/180
L1 Pseudo A       4/80                  4/80
L1 Pseudo B       5/100                 5/100
```