Understanding APS Reflector Channel

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Introduction

This document explains the reflector channel, or reflector mode, of Cisco's Automatic Protection Switching (APS) over Packet Over SONET (POS) feature. In order to enhance the operation of APS, the APS reflector mode decreases the remote timeout that occurs when a remote router learns of a switchover between the working router and protect router in an APS circuit.

Prerequisites

Requirements

There are no specific requirements for this document.

Components Used

The information in this document is based on the Cisco IOS® Software Releases 12.0(7)S and 11.2(18)GS introduced APS reflector mode on the Cisco 12000 series (CSCdm64396).

For more information, see the Release Notes. All 12000 series POS interface types that support 1+1 linear APS support reflector mode. These interfaces include the 4xOC3, 1xOC12, 4xOC12, and OC48. The Optical Services Modules (OSMs) for the Cisco 7600 series also support reflector mode.

The information in this document was created from the devices in a specific lab environment. All of the devices used in this document started with a cleared (default) configuration. If your network is live, make sure that you understand the potential impact of any command.

Conventions

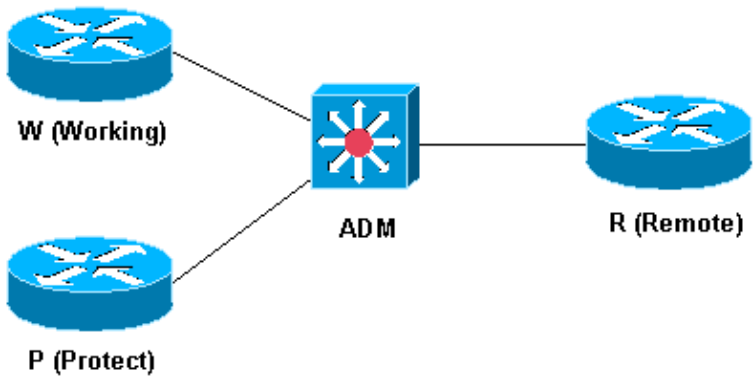
Refer to Cisco Technical Tips Conventions for more information on document conventions.

Background Information

APS reflector mode establishes a communication channel between the local router (or router pair) and the remote router (or router pair) at the other end of the SONET path. These routers act as Path Terminating

Equipment (PTE). Reflector mode takes advantage of the fact that the intervening Add−Drop Multiplexers (ADMs) are SONET Line Terminating Equipment (LTE) and transmit path overhead unchanged.

Here is an example:



W and P each transmit a distinctive identifying signature in the path overhead of the standard SONET or Synchronous Digital Hierarchy (SDH) frame. R reflects it back in a different part of the path overhead.

Reflector mode provides two new capabilities:

- Support for Multiplexed Switch Protocol (MSP) for SDH ADMs that do not implement the MSP K1 and K2 protocol (through bytes in the standard SONET line overhead) on tributary interfaces. (Such ADMs otherwise switch normally in unidirectional mode.) Here is how Reflector mode gets around this problem:

    1. The ADM bridges the signature that R reflects back to W and P.
    2. P reads the reflected signature, and learns whether the ADM listens to W or P.

       This information can compensate for the lack of K1/K2 information. This information permits P to enforce a simple APS−like protocol.
    3. The **aps reflector** command configures P into this mode, and causes all incoming K1/K2 information to be discarded.
- Improved routing convergence. Reflector mode enhances routing convergence because the remote router now has early notice of a switch between W to P, and can tear down its now−outdated adjacency with the now−deselected system, and need not wait for a timeout. The convergence enhancement does not depend on whether the **aps reflector** command is configured. The W, P, and R routers must support reflector mode requirements. Intermediate System−to−Intermediate System (IS−IS) supports APS reflector mode as of Cisco IOS Software Release 12.0(7)S. Open Shortest Path First (OSPF) supports APS reflector mode as of Cisco IOS Software Releases 12.0(11.03)S and 12.0(11.03)SC (CSCdr57673).

The output in this section was captured in a lab environment to illustrate how a remote PTE tears down a layer−3 adjacency immediately, and results in about four seconds to switch to the new adjacency.

1. Capture the output of the **show clns neighbors** command. The IP neighbor at the remote end of the SONET path is named core−02.

```
top#show clns neighbors
System Id  Interface   SNPA    State    Holdtime  Type  Protocol
bottom     PO3/0       *HDLC*  Up       24         L2   IS-IS
core-02    PO0/0       *HDLC*  Up        2         L2   IS-IS
```

2. Force a switchover to the P interface. Observe the log output.

```
May 25 20:29:20.943 UTC: %SONET-6-APSREMSWI: POS0/0:
Remote APS status now Protect
May 25 20:29:23.387 UTC: %CLNS-5-ADJCHANGE: ISIS:
Adjacency to edge-02(POS0/0) Down, hold time expired
May 25 20:29:24.807 UTC: %CLNS-5-ADJCHANGE: ISIS:
Adjacency to  core-01 (POS0/0) Up, new adjacency
```

3. Capture the output of the **show clns neighbors** command. The IP neighbor at the remote end of the SONET path has changed, and now uses a hostname of core−01.

```
top#show clns neighbors
System Id Interface SNPA    State  Holdtime  Type Protocol
core-01   PO0/0     *HDLC*  Up     27        L2   IS-IS
bottom    PO3/0     *HDLC*  Up     22        L2   IS-IS
```

SONET−6−APSREMSWI

SONET−6−APSREMSWI log messages announce changes in the APS status of the remote PTE. These messages are now suppressed if path−level errors like PAIS or PRDI are present in the SONET signal.

```
*Sep  5 17:41:46: %SONET-4-ALARM:  POS1/0: SLOS
*Sep  5 17:41:46: %SONET-4-ALARM:  POS2/0: APS enabling channel
*Sep  5 17:41:46: %SONET-6-APSREMSWI: POS2/0: Remote APS status now Protect

*Jun 26 20:20:06.235: %SONET-6-APSREMSWI: POS3/0: Remote APS status now non-aps
```

Issue the **show controller pos** command to view the current reflector channel information received from the remote PTE.

```
GSR_A#show controller pos 1/0
POS1/0
SECTION
  LOF = 0          LOS    = 0                            BIP(B1) = 0
LINE
  AIS = 0          RDI    = 0          FEBE = 0          BIP(B2) = 0
PATH
  AIS = 0          RDI    = 0          FEBE = 0          BIP(B3) = 0
  LOP = 0          NEWPTR = 0          PSE  = 0          NSE     = 0
Active Defects: None
Active Alarms:  None
Alarm reporting enabled for: SF SLOS SLOF B1-TCA B2-TCA PLOP B3-TCA

Framing: SONET
APS
 working (active)

 !--- Verify whether the show controller output displays the correct status
 !--- of "working (active)".

  COAPS = 0          PSBF = 0
  State: PSBF_state = False
  ais_shut = FALSE
  Rx(K1/K2): 00/00  S1S0 = 00, C2 = CF
  Remote aps status working; Reflected local aps status working

 !--- Verify a "working" status for the working APS interface.

CLOCK RECOVERY
  RDOOL = 0
  State: RDOOL_state = False
PATH TRACE BUFFER : STABLE
  Remote hostname : GSR_B
  Remote interface: POS1/0
  Remote IP addr  : 192.168.1.1
```

```
  Remote Rx(K1/K2): 00/00  Tx(K1/K2): 00/00

BER thresholds:  SF = 10e-3  SD = 10e-6
TCA thresholds:  B1 = 10e-6  B2 = 10e-6  B3 = 10e-6

GSR_A#show controller pos 2/0
POS2/0
SECTION
  LOF = 0          LOS    = 0                            BIP(B1) = 0
LINE
  AIS = 0          RDI    = 0          FEBE = 0          BIP(B2) = 0
PATH
  AIS = 0          RDI    = 0          FEBE = 0          BIP(B3) = 0
  LOP = 0          NEWPTR = 0          PSE  = 0          NSE     = 0

Active Defects: None
Active Alarms:  None
Alarm reporting enabled for: SF SLOS SLOF B1-TCA B2-TCA PLOP B3-TCA

Framing: SONET
APS
 protect (inactive)

 !--- Verify whether the show controller output displays the correct status
 !--- of "protect (inactive)".

  COAPS = 0          PSBF = 0
  State: PSBF_state = False
  ais_shut = FALSE
  Rx(K1/K2): 00/05 Tx(K1/K2): 00/05
  Signalling protocol: SONET APS by default
  S1S0 = 00, C2 = CF
  Remote aps status protect; Reflected local aps status protect

  !--- Verify a "protect" status for the protect APS interface.

RECOVERY
  RDOOL = 0
  State: RDOOL_state = False
PATH TRACE BUFFER : STABLE
  Remote hostname : GSR_B
  Remote interface: POS2/0
  Remote IP addr  : 192.168.1.1
  Remote Rx(K1/K2): 00/05  Tx(K1/K2): 00/05
BER thresholds:  SF = 10e-3  SD = 10e-6
TCA thresholds:  B1 = 10e-6  B2 = 10e-6  B3 = 10e-6
```

Remote APS Configuration: (Null)

Reflector mode requires an interface capable of reflector mode at the remote end of the SONET path. You do not need to configure the remote interface as an APS working and protect pair.

A value of "(null)" in the Remote APS configuration field of the **show controller pos** command indicates that the local end has not received reflector channel information from the remote PTE. If the remote PTE supports the reflector channel capability, a problem probably exists between the remote PTE and remote ADM.

Related Information

- **Optical Product Support Pages**
- **Technical Support & Documentation − Cisco Systems**

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