

1+1 SR-APS Without Bridging

The Automatic Protection Switching (APS) feature provides link redundancy and allows switchover of Packet over SONET (POS) circuits in the event of circuit failure and is often required when you connect Synchronous Optical Networking (SONET) equipment to telecommunications equipment. In the single router (SR) APS feature both protect and working interfaces must be on same router.

APS is a mechanism of using a protect POS interface in the SONET network as the backup for a working POS interface. When the working interface fails, the protect interface quickly assumes its traffic load. Based on the configuration, the two circuits can be terminated in the same router. The protection mechanism has a 1+1 architecture with bidirectional connection. Bridging refers to the transmission of user data to both working interface and protect interface. In nonbridging scenario the user data is sent to working interface only.

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Finding Feature Information

Your software release may not support all the features documented in this module. For the latest caveats and feature information, see Bug Search Tool and the release notes for your platform and software release. To find information about the features documented in this module, and to see a list of the releases in which each feature is supported, see the feature information table.

Use Cisco Feature Navigator to find information about platform support and Cisco software image support. To access Cisco Feature Navigator, go to http://www.cisco.com/go/cfn. An account on Cisco.com is not required.

Prerequisites for 1+1 SR-APS Without Bridging

Configure the working interface first, along with the IP address of the interface. This configuration helps to prevent the protect interface from becoming the active circuit during APS configuration. If the protect interface

becomes active in case if it has been configured first by mistake, you can use **shut** or **no shut** command to make the working interface active.

Restrictions for 1+1 SR-APS Without Bridging

- Both the protect and working interfaces should be configured identically. No warning message will be displayed if the configurations are different between the interfaces.
- Behavior of the APS pair (protect and working interfaces) will be indeterministic if the configurations of protect and working interfaces are not identical.
- APS switch over within 50 milliseconds is not supported during online insertion and removal (OIR) or during crash of the shared port adapter (SPA) or carrier card (CC).
- APS switching simultaneously with Route Processor (RP) or forwarding plane (FP) high availability (HA) need not be within 50 milliseconds.

Information About 1+1 SR-APS Without Bridging

1+1 SR-APS Without Bridging

The APS feature provides link redundancy and allows switchover of POS circuits in the event of circuit failure and is often required when you connect SONET equipment to telecommunications equipment. In the SR-APS feature both protect and working interfaces must be on same router.

APS is a mechanism of using a protect POS interface in the SONET network as the backup for a working POS interface. When the working interface fails, the protect interface quickly assumes its traffic load. Based on the configuration, the two circuits can be terminated in the same router. The protection mechanism has a 1+1 architecture with bidirectional connection.

In the 1+1 architecture, there is one working interface (circuit) and one protect interface, and the same payload from the transmitting end is sent to both the receiving ends. The receiving end decides the interface that needs to be used. The line overhead (LOH) bytes (K1 and K2) in the SONET frame indicate both status and action. When one interface is down or the K1/K2 bytes have changed, APS brings up the protect interface using regular interface configuration messages.

Bridging refers to the transmission of user data to both the working interface and the protect interface. In nonbridging scenario the user data is sent to the working interface only. You must set the working interface to be the active interface.

SR-APS uses Protect Group Protocol (PGP) between working and protect interfaces. The protect interface APS configuration should include an IP address of a loopback interface on the same router to communicate with the working interface using PGP. Using the PGP, POS interfaces can be switched in case of a degradation or loss of channel signal, or manual intervention. In bidirectional mode, the receive and transmit channels are switched as a pair.

In bidirectional APS the local and the remote connections negotiate the ingress interface to be selected for the data path. The egress interface traffic is not transmitted to both working and protect interfaces.

How to Configure 1+1 SR-APS Without Bridging

Configuring APS Working and Protect Interfaces

Perform this task to configure APS working and protect interfaces.

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **interface pos** *slot/sub-slot/port*
4. **aps working** *circuit-number*
5. **aps protect** *circuit-number ip-address*
6. **end**
7. **show controllers pos**
8. **show interfaces pos**
9. **show aps**

DETAILED STEPS

Procedure

	Command or Action	Purpose
Step 1	**enable** **Example:** `Router> enable`	Enables privileged EXEC mode. • Enter your password if prompted.
Step 2	**configure terminal** **Example:** `Router# configure terminal`	Enters global configuration mode.
Step 3	**interface pos** *slot/sub-slot/port* **Example:** `Router(config)# interface pos 2/0/0`	Specifies the POS interface to be configured as the working interface and enters interface configuration mode.
Step 4	**aps working** *circuit-number* **Example:** `Router(config-if)# aps working 1`	Configures the interface as a working interface.

	Command or Action	Purpose
Step 5	**aps protect** *circuit-number ip-address* **Example:** `Router(config-if)# aps protect 1 209.165.200.224`	Configures the interface as a protect interface. Specifies the IP address of loopback interface on the same router that contains the working interface.
Step 6	**end** **Example:** `Router(config-if)# end`	Exits interface configuration mode and returns to privileged EXEC mode.
Step 7	**show controllers pos** **Example:** `Router(config)# show controllers pos`	Displays information about the POS controllers so that you can verify that the interface is configured correctly.
Step 8	**show interfaces pos** **Example:** `Router(config)# show interfaces pos`	Displays information about the configured interfaces.
Step 9	**show aps** **Example:** `Router(config)# show aps`	Displays information about APS on the configured router.

Configuring Other APS Options

Perform this task to configure other APS options.

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **interface pos** *slot/sub-slot/port*
4. **aps force** *circuit-number*
5. **aps group** *group-number*
6. **aps lockout** *circuit-number*
7. **aps manual** *circuit-number*
8. **aps revert** *minutes*
9. **end**

DETAILED STEPS

Procedure

	Command or Action	Purpose
Step 1	**enable** **Example:** `Router> enable`	Enables privileged EXEC mode. • Enter your password if prompted.
Step 2	**configure terminal** **Example:** `Router# configure terminal`	Enters global configuration mode.
Step 3	**interface pos** *slot/sub-slot/port* **Example:** `Router(config)# interface pos 2/0/0`	Specifies the POS interface to be configured as the working interface and enters interface configuration mode.
Step 4	**aps force** *circuit-number* **Example:** `Router(config-if)# aps force 1`	(Optional) Manually switches the specified circuit to a protect interface, unless a request of equal or higher priority is in effect.
Step 5	**aps group** *group-number* **Example:** `Router(config-if)# aps group 20`	(Optional) Allows more than one protect or working interface group to be supported on a router.
Step 6	**aps lockout** *circuit-number* **Example:** `Router(config-if)# aps lockout 1`	(Optional) Prevents a working interface from switching to a protect interface.
Step 7	**aps manual** *circuit-number* **Example:** `Router(config-if)# aps manual 1`	(Optional) Manually switches a circuit to a protect interface, unless a request of equal or higher priority is in effect.
Step 8	**aps revert** *minutes* **Example:** `Router(config-if)# aps revert 3`	(Optional) Enables automatic switchover from the protect interface to the working interface after the working interface becomes available.
Step 9	**end** **Example:**	Exits interface configuration mode and returns to privileged EXEC mode.

	Command or Action	Purpose
	`Router(config-if)# end`	

Monitoring and Maintaining APS

Perform this task to monitor and maintain APS.

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **show controllers pos**
4. **show interfaces pos**
5. **show aps**

DETAILED STEPS

Procedure

	Command or Action	Purpose
Step 1	**enable** **Example:** `Router> enable`	Enables privileged EXEC mode. • Enter your password if prompted.
Step 2	**configure terminal** **Example:** `Router# configure terminal`	Enters global configuration mode.
Step 3	**show controllers pos** **Example:** `Router(config)# show controllers pos`	Displays information about the POS controllers so that you can verify that the interface is configured correctly.
Step 4	**show interfaces pos** **Example:** `Router(config)# show interfaces pos`	Displays information about the configured interfaces.
Step 5	**show aps** **Example:** `Router(config)# show aps`	Displays information about APS on the configured router.

Configuring SONET Alarm Reporting

To configure the thresholds and the type of SONET alarms that are reported, use any of the following commands. The commands listed in this section are optional. To display the current Bit Error Rate (BER) threshold setting or to view the reporting of the SONET alarms, use the **show controllers pos** command.

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **interface pos** *slot/sub-slot/port*
4. **pos threshold** {**b1-tca** | **b2-tca** | **b3-tca** | **sd-ber** | **sf-ber**} *rate*
5. **pos report** {**b1-tca** | **b2-tca** | **b3-tca** | **lais** | **lrdi** | **pais** | **plop** | **prdi** | **rdool** | **sd-ber** | **sf-ber** | **slof** | **slos**}
6. **end**

DETAILED STEPS

Procedure

	Command or Action	Purpose
Step 1	**enable** **Example:** `Router> enable`	Enables privileged EXEC mode. • Enter your password if prompted.
Step 2	**configure terminal** **Example:** `Router# configure terminal`	Enters global configuration mode.
Step 3	**interface pos** *slot/sub-slot/port* **Example:** `Router(config)# interface pos 2/0/0`	Specifies the POS interface to be configured as the working interface and enters interface configuration mode.
Step 4	**pos threshold** {**b1-tca** | **b2-tca** | **b3-tca** | **sd-ber** | **sf-ber**} *rate* **Example:** `Router(config-if)# pos threshold b1-tca 4`	(Optional) Configures the BER threshold values for signal failure (SF), signal degrade (SD), or threshold crossing alarms (TCAs).
Step 5	**pos report** {**b1-tca** | **b2-tca** | **b3-tca** | **lais** | **lrdi** | **pais** | **plop** | **prdi** | **rdool** | **sd-ber** | **sf-ber** | **slof** | **slos**} **Example:** `Router(config-if)# pos report b2-tca`	(Optional) Enables reporting of selected SONET alarms.

	Command or Action	Purpose
Step 6	**end** **Example:** `Router(config-if)# end`	Exits interface configuration mode and returns to privileged EXEC mode.

Configuring LAIS as an APS Switchover Trigger

When you place the working interface into administrative shutdown state, the switchover happens with or without **pos ais-shut**. When **pos ais-shut** is enabled on the interface, the interface sends the line alarm indication signal (LAIS) alarm to the remote end of the administrative shutdown, and the LAIS alarm makes the switchover bit faster. The **carrier-delay msec** *milliseconds* command and **ppp timeout retry seconds** [*milliseconds*] command are also used to make the APS switchover happen faster.

The **carrier-delay msec** *milliseconds* command delays the link down event processing for POS interfaces. For example, if the carrier delay is set to 50 milliseconds (ms), the router will ignore all link down events that are cleared within 50 msec. If the link goes down there will be no APS switchover for 50 ms. The default carrier delay is 2 seconds and there will be no APS switchover for 2 seconds after the link goes down. Hence the carrier delay is set to 50 ms for faster switchover.

The **ppp timeout retry seconds** [*milliseconds*] command sets the PPP retry timeout to the specified time. For example, if the timeout retry is set to 200 ms, the router tries to establish PPP link in 200 ms after it detects the signal outage due to APS switchover. If the default retry timeout of 2 seconds is used, then the PPP link will be established 2 seconds after the APS switchover. Hence the PPP timeout retry is set to 50 ms for faster switchover.

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **interface pos** *slot/sub-slot/port*
4. **pos ais-shut**
5. **carrier-delay msec** *milliseconds*
6. **ppp timeout retry seconds** [*milliseconds*]
7. **end**

DETAILED STEPS

Procedure

	Command or Action	Purpose
Step 1	**enable** **Example:** `Router> enable`	Enables privileged EXEC mode. • Enter your password if prompted.

	Command or Action	Purpose
Step 2	**configure terminal** **Example:** `Router# configure terminal`	Enters global configuration mode.
Step 3	**interface pos** *slot/sub-slot/port* **Example:** `Router(config)# interface pos 2/0/0`	Specifies the POS interface to be configured as the working interface and enters interface configuration mode.
Step 4	**pos ais-shut** **Example:** `Router(config-if)# pos ais-shut`	Sends line alarm indication signal (LAIS) alarm on Admin shut of the interface.
Step 5	**carrier-delay msec** *milliseconds* **Example:** `Router(config-if)# carrier-delay msec 50`	Delays the link down event processing for POS interfaces and makes the APS switchover faster.
Step 6	**ppp timeout retry seconds** [*milliseconds*] **Example:** `Router(config-if)# ppp timeout retry 0 200`	Sets the maximum waiting period for a response during PPP negotiation and makes the APS switchover faster.
Step 7	**end** **Example:** `Router(config-if)# end`	Exits interface configuration mode and returns to privileged EXEC mode.

Configuration Examples for 1+1 SR-APS Without Bridging

Example Configuring 1+1 SR-APS Without Bridging

The following example shows the configuration sequence for 1+1 SR-APS:

```
interface loopback 1
ip address 1.1.1.1 255.255.255.0
interface pos 2/0/0
     aps group 1
     aps working 1
     pos ais-shut
     end
interface pos 3/0/0
     aps group 1
     aps protect 1 192.0.2.2
```

```
     pos ais-shut
     end
```

The following example shows the sample output of APS configured on a router with a working interface:

```
Router# show aps
POS2/1/1 APS Group 0: protect channel 0 (Inactive)
        Working channel 1 at 10.0.1.1 (Enabled)
        bidirectional, revertive (60 seconds)
        PGP timers (default): hello time=1; hold time=3
                hello fail revert time=120
        SONET framing; SONET APS signalling by default
        Received K1K2: 0x00 0x05
                No Request (Null)
        Transmitted K1K2: 0x00 0x05
                No Request (Null)
        Remote APS configuration: (null)
POS2/1/0 APS Group 0: working channel 1 (Active)
        Protect at 10.0.1.1
        PGP timers (from protect): hello time=1; hold time=3
        SONET framing
        Remote APS configuration: (null)
```

The following example shows the display of POS controllers:

```
Router# show controller pos 2/1/0
POS2/1/0
SECTION
  LOF = 0          LOS    = 1                            BIP(B1) = 0
LINE
  AIS = 2          RDI    = 2          FEBE = 14         BIP(B2) = 0
PATH
  AIS = 2          RDI    = 2          FEBE = 4          BIP(B3) = 6
  PLM = 0          UNEQ   = 0          TIM  = 0          TIU     = 0
  LOP = 1          NEWPTR = 2          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)
  COAPS = 13          PSBF = 0
  State: PSBF_state = False
  Rx(K1/K2): 00/00  Tx(K1/K2): 00/00
  Rx Synchronization Status S1 = 00
  S1S0 = 00, C2 = CF
  Remote aps status (none); Reflected local aps status (none)
CLOCK RECOVERY
  RDOOL = 0
  State: RDOOL_state = False
PATH TRACE BUFFER: STABLE
  Remote hostname : SPA-APS2
  Remote interface: POS2/2/0
  Remote IP addr  : 10.1.1.1
  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
Clock source:  internal
```

The following example shows the configuration information and statistics for a POS interface:

```
Router# show interface pos 2/1/0
POS2/1/0 is up, line protocol is up  (APS working - active)
```

```
Hardware is SPA-4XOC12-POS
Internet address is 10.1.1.2/24
MTU 4470 bytes, BW 155000 Kbit/sec, DLY 100 usec,
   reliability 255/255, txload 1/255, rxload 1/255
Encapsulation HDLC, crc 16, loopback not set
Keepalive set (10 sec)
Scramble disabled
Last input 00:00:02, output 00:00:01, output hang never
Last clearing of "show interface" counters never
Input queue: 0/375/0/0 (size/max/drops/flushes); Total output drops: 0
Queueing strategy: fifo
Output queue: 0/40 (size/max)
30 second input rate 0 bits/sec, 0 packets/sec
30 second output rate 0 bits/sec, 0 packets/sec
   102477 packets input, 2459448 bytes, 0 no buffer
   Received 0 broadcasts (0 IP multicasts)
   0 runts, 4 giants, 0 throttles 0 parity
   4 input errors, 0 CRC, 0 frame, 0 overrun, 0 ignored, 0 abort
   102486 packets output, 2459934 bytes, 0 underruns
   0 output errors, 0 applique, 2 interface resets
   0 unknown protocol drops
   0 output buffer failures, 0 output buffers swapped out
   10 carrier transitions
```

Additional References

Related Documents

Related Topic	Document Title
APS commands	*Cisco IOS Interface and Hardware Component Command Reference*

Standards

Standard	Title
None	--

MIBs

MIB	MIBs Link
None	To locate and download MIBs for selected platforms, Cisco software releases, and feature sets, use Cisco MIB Locator found at the following URL: http://www.cisco.com/go/mibs

RFCs

RFC	Title
None	

Technical Assistance

Description	Link
The Cisco Support website provides extensive online resources, including documentation and tools for troubleshooting and resolving technical issues with Cisco products and technologies. To receive security and technical information about your products, you can subscribe to various services, such as the Product Alert Tool (accessed from Field Notices), the Cisco Technical Services Newsletter, and Really Simple Syndication (RSS) Feeds. Access to most tools on the Cisco Support website requires a Cisco.com user ID and password.	http://www.cisco.com/cisco/web/support/index.html

Feature Information for 1+1 SR-APS Without Bridging

The following table provides release information about the feature or features described in this module. This table lists only the software release that introduced support for a given feature in a given software release train. Unless noted otherwise, subsequent releases of that software release train also support that feature.

Use Cisco Feature Navigator to find information about platform support and Cisco software image support. To access Cisco Feature Navigator, go to https://cfnng.cisco.com/. An account on Cisco.com is not required.

Table 1: Feature Information for 1+1 SR-APS Without Bridging

Feature Name	Releases	Feature Information
1+1 SR-APS Without Bridging	Cisco IOS XE Release 3.1S	This feature provides support to 1+1 single router APS without bridging. There were no commands introduced or modified by this feature.