APS Configuration Guide

Application Note

CONFIDENTIAL

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1. Introduction

This document explains how to setup Automatic Protection Switching (APS) features. This module implements the APS protocol and linear protection switching mechanisms for point-to-point VLAN-based ETH SNC in Ethernet transport networks.

Automatic Protection Switching is defined by the ITU G.8031 standard.

1.1. ITU G.8031

Protection switching is a fully allocated survivability mechanism. It is fully allocated in the sense that the route and bandwidth of the protection entity is reserved for a selected working entity.

ITU-T Rec. G.8031 specifies linear 1+1 protection switching architecture and linear 1:1 protection switching architecture. The linear 1+1 protection switching architecture operates with either unidirectional or bidirectional switching. The linear 1:1 protection switching architecture operates with bidirectional switching.

1.1.1. 1+1 Protection

In the linear 1+1 protection switching architecture, a protection transport entity is dedicated to each working transport entity. The normal traffic is copied and fed to both working and protection transport entities with a permanent bridge at the source of the protected domain. The traffic on working and protection transport entities is transmitted simultaneously to the sink of the protected domain, where a selection between the working and protection transport entities is made based on some predetermined criteria, such as server defect indication. Although selection is made only at the sink of the protected domain in linear 1+1 protection switching architecture, bidirectional 1+1 protection switching needs APS coordination protocol so that selectors for both direction selects the same entity. On the other hand, unidirectional 1+1 protection switching does not need APS coordination protocol.

1.1.2. 1:1 Protection

In the linear 1:1 protection switching architecture, the protection transport entity is dedicated to the working transport entity. However, the normal traffic is transported either on the working transport entity or on the protection transport entity using a selector bridge at the source of the protected domain. The selector at the sink of the protected domain selects the entity which carries the normal traffic. Since source and sink need to be coordinated to ensure that the selector bridge at the source and the selector at the sink select the same entity, APS coordination protocol is necessary.

1.2. APS Protocols

APS information is carried within the APS PDU which is one of a suite of Ethernet OAM PDUs. OAM PDU formats for each type of Ethernet OAM operation are defined in ITU-T Rec. Y.1731.

2. Configuration

In the normal case, an APS configuration requires CFM MEP instances to be instantiated in both ends of a protected flow.

An example of an APS configuration is shown below, with the associated CFM configuration:

```
# show running-config feature cfm all-defaults
Building configuration...
cfm sender-id-tlv disable
cfm port-status-tlv disable
cfm interface-status-tlv disable
cfm organization-specific-tlv disable
!
cfm domain MyDomain
 format none
 level 3
 sender-id-tlv chassis-management
 port-status-tlv enable
 interface-status-tlv enable
 organization-specific-tlv defer
 service MyService
  format icc "ICC000MEG0000"
  type port
  continuity-check interval 1s
  sender-id-tlv defer
  port-status-tlv defer
  interface-status-tlv defer
  organization-specific-tlv defer
  mep 201
   direction down
   interface GigabitEthernet 1/2
   vlan 100
   pcp 0
   no smac
   remote mep 200
   continuity-check
   alarm-level 2
   alarm-time-present 2500
   alarm-time-absent 10000
   admin-state enable
   exit
  mep 301
   direction down
   interface GigabitEthernet 1/3
   vlan 100
   pcp 6
   no smac
   remote mep 300
   continuity-check
   alarm-level 1
   alarm-time-present 2500
   alarm-time-absent 10000
   admin-state enable
   exit
!

# show running-config feature aps all-defaults
Building configuration...
aps 10
 working-mep domain MyDomain service MyService mep-id 201
 protect-mep domain MyDomain service MyService mep-id 301
```

```
mode 1-for-1
no revertive
wait-to-restore 300
hold-off-time 0
admin-state disable
```

2.1. Configuration of parameters

The syntax for APS global level CLI configuration command is:

```
aps <inst>
```

Where:

```
inst                    APS instance number
```

The syntax for APS level CLI configuration command is:

```
admin-state { enable | disable }
hold-off-time <hold_off>
mode { 1-for-1 | bidirectional-1-plus-1 | unidirectional-1-plus-1 [ tx-aps ] }
no hold-off-time <hold_off>
no protect-mep
no revertive
no wait-to-restore <wtr>
no working-mep
protect-mep domain <md_name> service <ma_name> mep-id <mepid>
revertive
wait-to-restore <wtr>
working-mep domain <md_name> service <ma_name> mep-id <mepid>
```

Where:

```
admin-state             Enable or disable this APS instance
hold-off-time           When a new (or more severe) defect occurs, the hold-off
                        timer will be started and the event will be reported
                        after the timer expires.
mode                    Specify the APS' architecture and direction
no                      Negate a command or set its defaults
protect-mep             Specify which MEP provides signal-fail for the protect
                        port. The domain parameters <md_name> service <ma_name>
                        mep-id <mepid> refer to the Domain, Service and MEP
                        defined as part the CFM module. The specified MEP must be
                        a port MEP.
revertive               Traffic switches back to the working port after the
                        wait-to-restore timer has expired after the defect
                        conditions causing a switch have cleared.
wait-to-restore         Only used in revertive mode. Indicates the number of
                        seconds after a defect has cleared until operation is
                        switched back to the working port.
working-mep             Specify which MEP provides signal-fail for the working
                        port. The domain parameters <md_name> service <ma_name>
                        mep-id <mepid> refer to the Domain, Service and MEP
                        defined as part the CFM module. The specified MEP must
                        be a port MEP.
1-for-1                 1:1, that is, source determines which port traffic goes
                        into.
bidirectional-1-plus-1  Bidirectional 1+1, that is, traffic goes into both
                        ports, and sink selects based on local defects and APS
                        PDUs received from the far end.
unidirectional-1-plus-1 Unidirectional 1+1, that is, traffic goes into both
                        ports, and sink selects exclusively based on local
                        defects.
tx-aps                  Transmit APS PDUs even in unidirectional 1+1. Reception
                        of APS PDUs in this mode are only used for informational
                        purposes.
```

An example is shown below:

```
(config)# aps 10
(config-aps)# working-mep domain MyDomain service MyService mep-id 201
(config-aps)# protect-mep domain MyDomain service MyService mep-id 301
(config-aps)# mode unidirectional-1-plus-1 tx-aps
(config-aps)# revertive
(config-aps)# wait-to-restore 200
(config-aps)# hold-off-time 500
(config-aps)# admin-state enable
```

2.2. Using control commands

The syntax for APS level CLI command is:

```
aps <inst> clear
aps <inst> exercise
aps <inst> freeze
aps <inst> lockout
aps <inst> switch { force | manual { protect-to-working | working-to-protect } }
#
```

Where:

```
clear              Clear a switchover, exercise request and a WTR condition
exercise           Exercise the APS instance. Use 'aps <inst> clear' to
                   clear the request.
freeze             Freezes the state of the APS instance. While in this mode,
                   additional near-end commands, condition changes, and received
                   APS information are ignored. Use 'no aps <inst> freeze' to
                   get out of this mode.
lockout            Lockout APS instance of protection. Use 'aps <inst> clear' to
                   clear the request.
switch             Request a switchover from the working path to the protection
                   path or vice versa. Use 'aps <inst> clear' to clear the
                   request.
force              Causes a switchover to protect if no lockout is in effect.
manual             Causes a switchover if the signal is good and no lockout is
                   in effect.
protect-to-working Causes a manual signal switchover from the protection path to
                   the  working path if the protection path signal has not
                   failed.
working-to-protect Causes a manual signal switchover from the working path to
                   the protection path whether or not the working path signal is
                   active or not.
```

Example:

```
# aps 10 switch manual protect-to-working
```

2.3. Show Status

The syntax of the show aps CLI command is:

```
show aps [ <range_list> ] [ statistics ]
```

Where:

```
<range_list>    A list of APS instance ranges.
statistics      Show APS PDU statistics.
```

Example:

```
# show aps 1,10,20-30
Failure of Protocol defect abbreviations:
C: dFOP-CM, Configuration Mismatch (received APS PDU on working interface within
last 17.5 seconds).
P: dFOP-PM, Provisioning Mismatch (far and near ends are not using the same mode;
bidir only)
N: dFOP-NR, No Response (far end hasn't agreed on 'Requested Signal' within 50 ms;
bidir only)
T: dFOP-TO, Time Out (near end hasn't received a valid APS PDU within last 17.5
seconds; bidir only)

                                        Working   Protect   Tx APS    Rx APS
Inst Operational State Protection State   MEP State MEP State R/S   R B R/S   R B
Dfcts Command
---- ----------------- ----------------- --------- --------- --------- ---------
----- -----------------
   1 Administratively disabled
  10 Active            Signal Fail (P)    SF        SF        SF-P  0 0 NR    0 0
---T Forced switch
#
#
# show aps 1,10 statistics
Inst Rx Valid     Rx Invalid   Tx
---- ------------ ------------ ------------
   1            0            0            0
  10            0            0          251
#
```