

Configure Affinity for OTN

This chapter describes the XR procedure for configuring Affinity Support for OTN GMPLS.

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Configuring Affinity for GMPLS using Cisco IOS XR commands

Procedure

Step 1 Define colours and assign bits to each colour using command : **affinity-map** <*colour*> **bit-position** <*bit position*>

Example:

```
RP/0/RP0:hostname# configure
RP/0/RP0:hostname(config)# mpls traffic-eng
RP/0/RP0:hostname(config-mpls-te)# affinity-map red bit-position 1
RP/0/RP0:hostname(config-mpls-te)# affinity-map green bit-position 0
```

Note
Only one colour can be mapped to a particular bit position.

Note
Same bit map should defined at all the connected nodes.

Step 2 Assign one or multiple colours to the OTN link using command **affinity-name**<*colour*>

Example:

```
RP/0/RP0:hostname# configure
RP/0/RP0:hostname(config)# mpls traffic-eng
RP/0/RP0:hostname(config-mpls-te)# gmpls optical-nni
RP/0/RP0:hostname(config-te-gmpls-nni)# topology instance ospf abc area 5
RP/0/RP0:hostname(config-te-gmpls-nni-ti)# controller otu4 0/0/0/1
RP/0/RP0:hostname(config-te-gmpls-nni-ti-cntl)# affinity-name red blue green yellow
```

Note
Assign colour to all the ports of the connected nodes.

Step 3 Define an attribute set using command **attribute-set path-option**

This will define the affinity constraints.

Example:

```
RP/0/RP0:hostname# configure terminal
RP/0/RP0:hostname(config)# mpls traffic-eng
RP/0/RP0:hostname(config-mpls-te)# attribute-set path-option Affinity1
RP/0/RP0:hostname(config-te-attribute-set)# affinity include red
```

Step 4 Configure **attribute-set** for **path–option** for OTN tunnel.

This will assign affinity constraints to OTN tunnel. Following are the constraint type:

- **include** : The TE link will be eligible for path-calculation if it has all the colours listed in the constraint. The link may have additional colours.
- **include-strict** : The TE link will be eligible for path-calculation only if it has the same set of colours listed in the constraint. The link should not have any additional colour.
- **exclude**: The TE link will be eligible for path-calculation if it does not have all the colours listed in the constraint
- **exclude-all**: This constraint is not associated with any colour.If this constraint is configured for a tunnel, path-calculator will only accept the links that do not have any colour.

  Note
  In case of exclude-all constraint, other configured constraints for the same tunnel will be ignored.

Example:

```
RP/0/RP0:hostname# configure
RP/0/RP0:hostname(config)# mpls traffic-eng
RP/0/RP0:hostname(config-mpls-te)# gmpls optical-nni
RP/0/RP0:hostname(config-te-gmpls-nni)# controller Odu-Group-Te 7
RP/0/RP0:hostname(config-te-gmpls-tun-0x7)# signalled-bandwidth ODU2
RP/0/RP0:hostname(config-te-gmpls-tun-0x7)# destination ipv4 unicast 192.168.0.3
RP/0/RP0:hostname(config-te-gmpls-tun-0x7)# path-option 1 dynamic attribute-set Affinity1
protected-by 2 restored-from 3 lockdown
RP/0/RP0:hostnam (config-te-gmpls-tun-0x7)# path-option 2 dynamic attribute-set Affinity2
lockdown
```

Step 5 Verify the configurations using show commands.

Example:

```
RP/0/RP0:hostname# show mpls traffic-eng affinity-map

Tue Jun 26 15:12:01.948 IST
                      Affinity Name     Bit-position            Affinity Value
Affinity Table
  ---------------------------------   --------------        ----------------------
----------------
                                 red               2           0x::4
Mapping
                              yellow               3           0x::8
Mapping
                                blue              21           0x::20:0
Mapping
```

```
                              green              31           0x::8000:0
Mapping

RP/0/RP0:hostname# show mpls traffic-eng link-management optical-nni controller otu2 0/0/0/22

Tue Nov  7 11:52:51.063 IST
System Information::
NNI OTN Links Count: 3 (Maximum NNI OTN Links Supported 300)
Link Name:: OTU20_0_0_22 (Handle:0x00000170, Addr: V4-Unnum 192.168.0.1 [17])
Link Status         : Up
Link Label Type     : G709_ODU
Physical BW         : OTU2 (10.709Gbps)
Max LSP Bandwidth Per Priority(kbps):
  Priority[0] : 7495557
  Priority[1] : 0
  Priority[2] : 0
  Priority[3] : 0
  Priority[4] : 0
  Priority[5] : 0
  Priority[6] : 0
  Priority[7] : 0
Fixed ODU Capabilities:
     Signal Type       Stages            Flags             Resources
                   1   2   3   4   T S 1.25G 2.5G V L Maximum    Unreserved
                   -   -   -   -   - - ----- ---- - - -------    ----------
   ODU2                            Y Y Y     N    N N 1          0
   ODU0            2               Y Y Y     N    N N 8          6
   ODU1            2               Y Y Y     N    N N 4          3
Flex  ODU Capabilities:
     Signal Type       Stages            Flags               Bandwidth(kbps)
                   1   2   3   4   T S 1.25G 2.5G V L Maximum   Unreserved  Max Lsp
                   -   -   -   -   - - ----- ---- - - --------  ----------  --------
   ODUFlex CBR     2               Y Y Y     N    N N 9995277   7495557     7495557
   ODUFlex GFPFix  2               Y Y Y     N    N N 9995277   7494313     7494313

SRLG Values:1,
TTI Mode            : Section Monitoring
TCM ID              : 0
IGP Neighbor Count  : 1
Flooding Status: (1 area)
IGP Area[1]:: OSPF, ring, 0: Flooded
Remote Link Id:V4-Unnum 192.168.0.2 [16], TE Metric: 1
Delay(Configured/Computed/ToFlood): 0/0/300000 micro-sec
Attributes          :  0x2
Attribute Names     :  red(1)



RP/0/RP0:hostname# show mpls traffic-eng topology

IGP Id: 192.168.0.4, MPLS TE Id: 192.168.0.4 Router Node  (OSPF ring area 0)
  Link[0]:Point-to-Point, Nbr IGP Id:192.168.0.2, Nbr Node Id:2, gen:28399
      Attribute Flags: 0x2
      Ext Admin Group:
          Length: 256 bits
          Value : 0x::2
     Attribute Names: red(1)
      Intf Id:13 Nbr Intf Id:15 TE Metric:1
      Uni Delay:300000
      SRLGs: 3
      Switching Capability:otn, Encoding:g709-otn
      Physical BW:10709224 (kbps), Max Reservable BW:10709224 (kbps)
      Max LSP Bandwidth Per Priority(kbps):
```

```
        Priority[0] : 7495556
        Priority[1] : 0
        Priority[2] : 0
        Priority[3] : 0
        Priority[4] : 0
        Priority[5] : 0
        Priority[6] : 0
        Priority[7] : 0
      Fixed ODU Capabilities:
           Signal Type       Stages            Flags             Resources
                         1   2   3   4   T S 1.25G 2.5G V L Maximum    Unreserved
                         -   -   -   -   - - ----- ---- - - -------    ----------
           ODU2                          Y Y Y     N    N N 1          0
           ODU0          2               Y Y Y     N    N N 8          6
           ODU1          2               Y Y Y     N    N N 4          3
      Flex  ODU Capabilities:
           Signal Type       Stages            Flags               Bandwidth(kbps)

                         1   2   3   4   T S 1.25G 2.5G V L Maximum   Unreserved  Max Lsp

                         -   -   -   -   - - ----- ---- - - --------  ----------  --------

           ODUFlex CBR   2               Y Y Y     N    N N 9995277   7495556     7495556

           ODUFlex GFPFix 2              Y Y Y     N    N N 9995277   7494312     7494312
```

```
RP/0/RP0:hostname# show mpls traffic-eng attribute-set path-option test2

Thu Dec 21 14:12:43.364 IST
Attribute Set Name: test2 (Type: path option)
  Bandwidth: 0 kbps (CT0) (Default)
  Number of affinity constraints: 3
     Include bit map           : 0x2
     Include ext bit map       :
         Length: 256 bits
         Value : 0x::2
     Include affinity name     : red(1)
     Include bit map           : 0x4
     Include ext bit map       :
         Length: 256 bits
         Value : 0x::4
     Include affinity name     : blue(2)
     Include bit map           : 0x8
     Include ext bit map       :
         Length: 256 bits
         Value : 0x::8
     Include affinity name     : yellow(3)
  Exclude List Name:  none (Default)
  List of tunnel IDs (count 0)


RP/0/RP0:hostname# show mpls traffic-eng tunnels 7 detail

Tue Nov  7 11:19:28.610 IST
Name: Odu-Group-Te7  Destination: 192.168.0.4  Ifhandle:0xd0
  Signalled-Name: rtrA_otn7
  Status:
    Admin:    up Oper:   up   Path:  valid   Signalling: connected
    path option 1, (LOCKDOWN) type dynamic  (Basis for Current, path weight 2)
      Protected-by PO index: none
      Path-option attribute: test_red
        Number of affinity constraints: 1
          Include bit map           : 0x2
           Include ext bit map       :
```

```
            Length: 256 bits
            Value : 0x::2
         Include affinity name     : red(1)
      Reroute pending (DROP)
  path option 2, (LOCKDOWN) type dynamic
    Path-option attribute: test_red
      Number of affinity constraints: 1
         Include bit map           : 0x2
         Include ext bit map       :
            Length: 256 bits
            Value : 0x::2
         Include affinity name     : red(1)

  Last PCALC Error [Standby]: Mon Nov  6 16:52:34 2017
    Info: No diverse path found
  Bandwidth Requested: 2498775 kbps  CT0
  Creation Time: Mon Nov  6 15:36:06 2017 (19:43:22 ago)
Config Parameters:
  Bandwidth: ODU1
  Priority: 24  0 Affinity: 0x0/0xffff
  Metric Type: TE (default)
  Path Selection:
    Tiebreaker: Min-fill (default)
  Hop-limit: disabled
  Cost-limit: disabled
  Delay-limit: disabled
  Path-invalidation timeout: 10000 msec (default), Action: Tear (default)
  AutoRoute: disabled  LockDown:  enabled  Policy class: not set
  Forward class: 0 (not enabled)
  Forwarding-Adjacency: disabled
  Autoroute Destinations: 0
  Loadshare:          0 equal loadshares
  Auto-bw: disabled
  Fast Reroute: Disabled, Protection Desired: None
  BFD Fast Detection: Disabled
  Reoptimization after affinity failure: Enabled
  Soft Preemption: Disabled
SNMP Index: 13
Binding SID: None
Path Protection Info:
  SNC Mode:SNC-N , TCM id: Not used , Type:Bi-directional APS, Non-revertive
  Restoration style: keep-failed-lsp
  Path Protection Profile Type: 1+0
  Timers WTR: 300000 milliseconds, HoldOff: 0 milliseconds
  Active Lsp: WORKING LSP, Standby Diversity Type: None
Restoration Info:
  Non-revertive
  Diverse Lsp for UNKNOWN, Diversity Type: None
Revert Schedule: Not Configured
Static-uni Info:
  Locally Client Port:   Client Ifhandle: 0x0
  Client ODU:   Client ODU Ifhandle: 0x0
    XC Id: 0
    State: Not Connected
    Uptime: Thu Jan  1 05:30:00 1970
Working Homepath ERO:
  Status: Down
  Explicit Route:
Diversity Info:
  Dependent Tunnel List:
     8

Current LSP Info:
  Instance: 2108, Signaling Area: OSPF ring area 0
```

```
    Uptime: 18:27:10 (since Mon Nov 06 16:52:18 IST 2017), Signaling State: Up, Oper State:
 Up
    G-PID: None (0)
      XC Id: 0
      State: Connected
      Uptime: Mon Nov  6 16:52:18 2017
      Egress Interface: OTU20/0/0/22 (State:Up  Ifhandle:0x170)
      Egress Controller: ODU20_0_0_22 (State:Up Ifhandle:0x190)
      Egress Sub Controller: ODU10_0_0_22_41 (State:Up, Ifhandle:0x3d0)
      Path Ingress  label: TPN: 4 BitMap Len: 8 BitMap: 7:8
      Resv Egress  label: TPN: 4 BitMap Len: 8 BitMap: 7:8
    Router-IDs: local      192.168.0.1
                downstream 192.168.0.2
    Soft Preemption: None
    SRLGs: not collected
    Path Info:
      Outgoing:
        Explicit Route:
          Strict, 192.168.0.2(16)
          Strict, 192.168.0.4(13)
          Strict, 192.168.0.4

      Record Route: Empty
      Tspec: signal_type ODU1 Bitrate 0kbps NVC 0 MT 1

      Session Attributes: Local Prot: Not Set, Node Prot: Not Set, BW Prot: Not Set
                          Soft Preemption Desired: Not Set
    Path Protection Info:
      SNC Mode:SNC-N TCM id:Not used Type:Bi-directional APS
      Path Protection Profile Type: 1+0
      Bits S:0 P:0 N:0 O:0
      Timeout WTR:0 milliseconds HoldOff:0 milliseconds
    Resv Info:
      Record Route:
        IPv4 192.168.0.2, flags 0x20 (Node-ID)
        Label         Label TPN: 4 BitMap Len: 8 BitMap: 7:8 , flags 0x1

        Unnumbered 192.168.0.2 (16), flags 0x0
        Label         Label TPN: 4 BitMap Len: 8 BitMap: 7:8 , flags 0x1
        IPv4 192.168.0.4, flags 0x20 (Node-ID)
        Label         Label TPN: 4 BitMap Len: 8 BitMap: 7:8 , flags 0x1

        Unnumbered 192.168.0.4 (13), flags 0x0
        Label         Label TPN: 4 BitMap Len: 8 BitMap: 7:8 , flags 0x1
      Fspec: signal_type ODU1 Bitrate 0kbps NVC 0 MT 1

  Persistent Forwarding Statistics:
    Out Bytes: 0
    Out Packets: 0
Displayed 1 (of 2) heads, 0 (of 0) midpoints, 0 (of 0) tails
Displayed 1 up, 0 down, 0 recovering, 0 recovered heads
```