Applicability of Abstraction and Control of Traffic Engineered Networks (ACTN) to Packet Optical Integration (POI) service assurance

draft-poidt-teas-actn-poi-assurance-00

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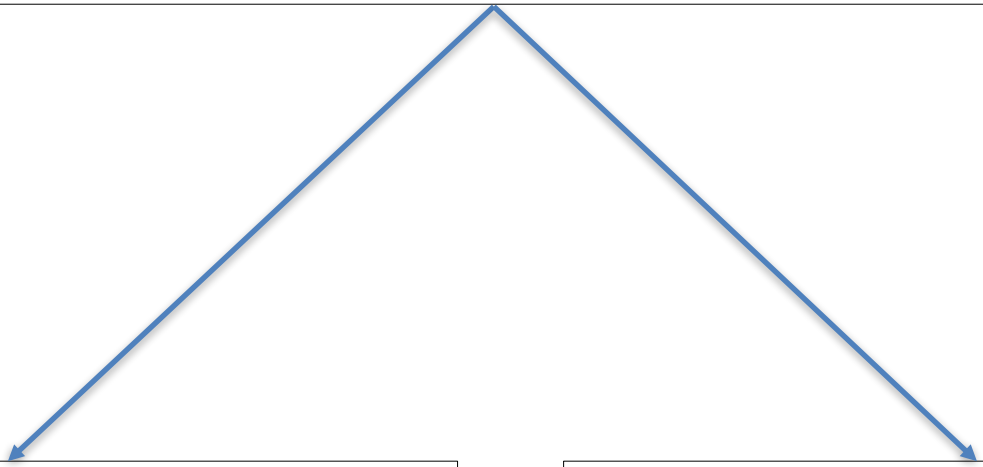
ACTN POI Next Steps - Overview

ACTN POI (step 1)
- Inventory, Service and Topology Discovery
- Establishment of L2VPN/L3VPN with TE requirements



ACTN POI (step 2a) – service assurance
- Optical Network failures and degradation
- IP/Optical Edge failures

TEAS WG

ACTN POI (step 2b) – pluggable
- Pluggable WDM interfaces on routers
- Same scenarios as in step 1

CCAMP WG

ACTN POI Next Steps - Motivation

- Interest from operators to analyse applicability of ACTN to additional POI capabilities/architectures
  - Service assurance
  - Pluggable WDM interfaces on the routers
- Why new drafts?
  - Not to overweight the current draft
  - Difference level of maturity of the content
- Why different WGs?
  - POI service assurance impacts both IP and Optical technologies TEAS WG scope
  - Pluggable impacts O-PNC and P-PNC for optical tunnel setup CCAMP WG scope
- Keep CCAMP, TEAS and OPSAWG updated

ACTN POI Service Assurance - Use Cases

1. Optical Network failures and degradation

- Fault Detection
- Performance Monitoring
- Protection Switching
- Maintenance

2. IP/Optical Edge failures (router port or router node failures)

- Fault detection
- Protection switching

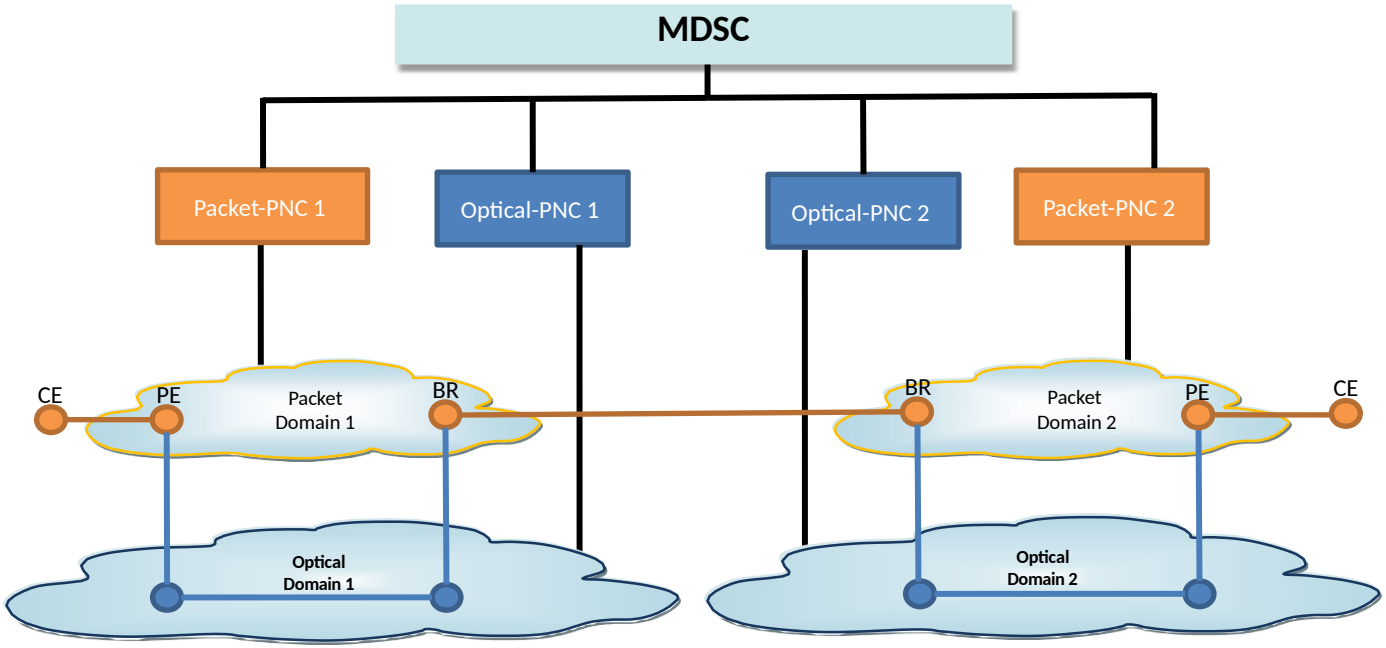


Figure 1 - Reference Scenario

Status and Next Steps

- Draft -00 is just an outline
  - Show planned next steps on ACTN POI
  - Get interest to join this work
- Issue tracking and current version available on Git
  - https://github.com/italobusi/draft-poidt-teas-actn-poi-assurance
- Discuss all ACTN POI drafts during the weekly ACTN POI calls
- Next Steps:
  - Work on a more substantial content for the draft

BACKUP

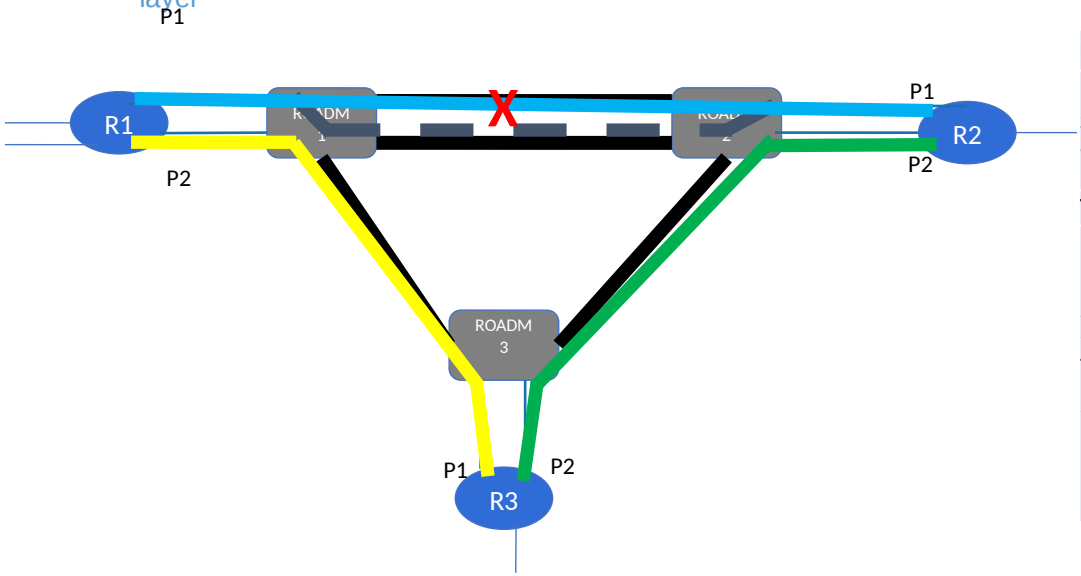
IP and DWDM protection coordination - network resiliency

Problem Statement, value added by SDN:

- SDN controller must be able to reroute traffic at IP and DWDM layer, after an unexpected physical fault
- Coordination between IP and DWDM protections should be able to guarantee a better service availability
- SDN controller must be aware of the change in topology and must take consequent action to protect the traffic at both IP and DWDM layer

Expected benefits:

- Better and easier control of network resources, easier and more efficient planning of network protections OPEX and CAPEX reduction
- IP services less impacted by faults DWDM network better service availability at the same CAPEX

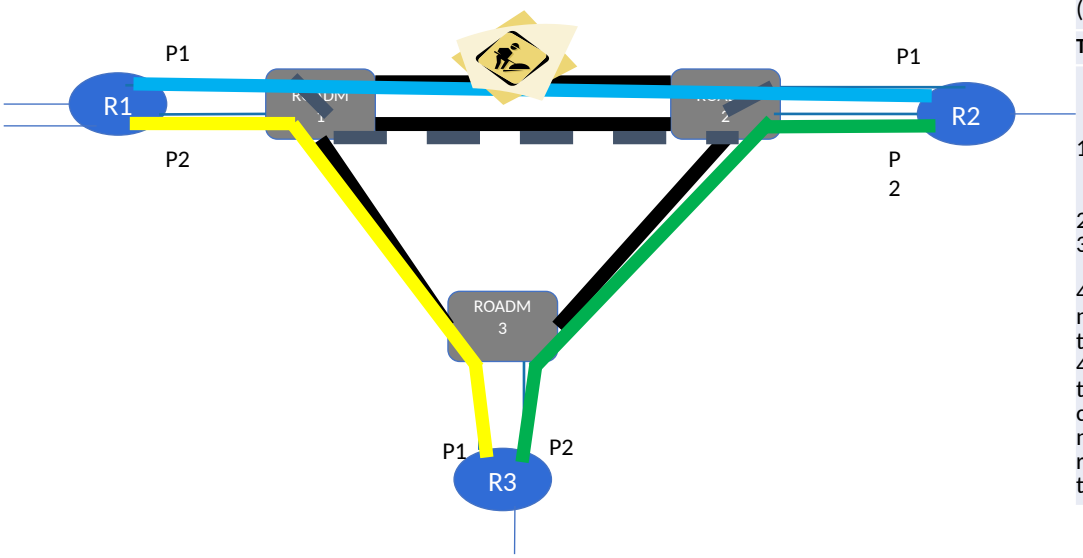


INITIAL CONDITION
SDN controller knows network topology at both IP and optical layer, and is also aware of interconnection links. The IP link R1/p1-R2/p1 (BLUE) , R1/p2-R3/p1 (YELLOW) and R3/p2-R2/p2 (GREEN) are already provisioned
TEST DETAIL
1. Fiber cut on DWDM section transporting BLUE IP link 2. IP traffic (FRR protection) must be restored in below that 50ms 3. DWDM link must be restored in few minutes 4. After DWDM link is restored, SDN controller moves back the traffic on the BLUE dashed IP link without traffic impact 5. When the faulty DWDM link is restored, , before the revert of the OCH takes place, SDN controller has to move IP traffic to the YELLOW and GREEN links. After the WSON has reverted the OCH link to the original path (BLUE), SDN controller moves IP traffic to the BLUE link (all operations must be hitless on traffic)

IP and DWDM protection coordination - network resiliency during maintenance events

Problem Statement, value added by SDN:

- Before planned maintenance operation on DWDM network takes place, IP traffic should be moved hitless to another link
- SDN controller must reroute IP traffic before the events takes place. It should be possible to lock IP traffic to the protection route until the maintenance event is finished, unless a fault occurs on such path



Expected benefits:

- IP services not affected by maintenance operation on DWDM network better service availability at the same CAPEX

INITIAL CONDITION
SDN controller knows that the DWDM link, carrying IP link R1/p1-R2/p1 (BLUE) will go in maintenance operation at a specified time
TEST DETAIL
1. Few minutes before the maintenance window, SDN controller reroutes hitless all IP traffic passing on BLUE IP link to the YELLOW and GREEN IP links 2. Fiber cut (maintenance) on the DWDM section has no impact on traffic 3. WSON restore the OCH link and doesn't revert to the original link until the maintenance window is finished 4a. IP traffic is locked to the protection path, unless a fault occurs, until maintenance window is finished, then SDN controller moves back the IP traffic hitless after WSON has reverted to the original path 4b. When the WSON restore the OCH link, IP traffic has to be moved back to the new IP LINK (BLUE dashed). When the maintenance window is concluded, before the revert of the OCH takes place, SDN controller has to move IP traffic to the YELLOW and GREEN links. After the WSON has reverted the OCH link to the original path (BLUE), SDN controller moves IP traffic to the BLUE link (all operations must be hitless on traffic)

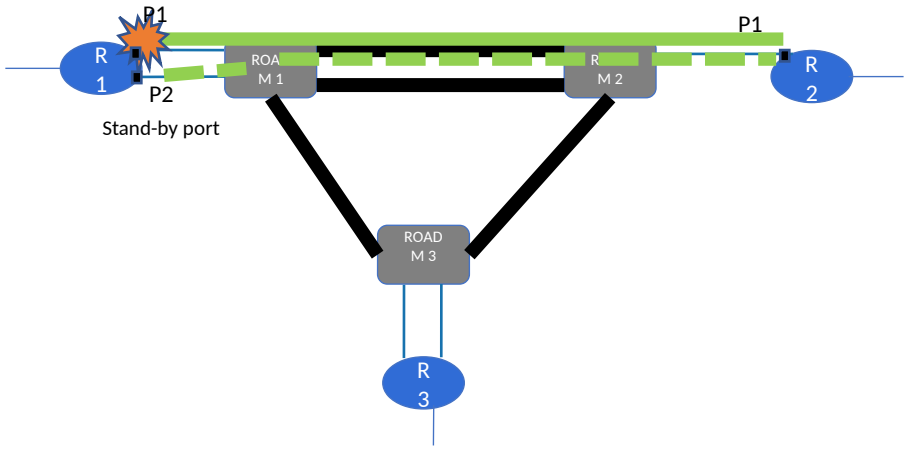
Router port failure – 1:N “protection

Problem Statement, value added by SDN:

- Ability to distinguish failures (IP port failure or transport network failure)
- In case of IP port failure, reuse of same ROADM optical resources (lambda, optical path) and reuse of remote IP port

Expected benefits:

- Reduce IP interfaces over-provisioning and save optical channels interfaces and spectrum occupation CAPEX reduction



INITIAL CONDITION

SDN controller knows network topology at both IP and optical layer, and is also aware of interconnection links. The IP link R1/p1-R2/p1 (GREEN) is already provisioned.

TEST DETAIL

1. Fault on R1/p1, or on the interconnection link with the ROADM1
2. R1 copies failed port configuration (IP address, routing policy etc) on the stand-by port
3. SDN controller tears down green optical channel
4. SDN controller activates a new optical channel between R1/p2 IP port and the original one on R2, using original lambda and optical path
5. SDN controller creates new IP link (GREEN dashed) between R1/p2 and R2/p1

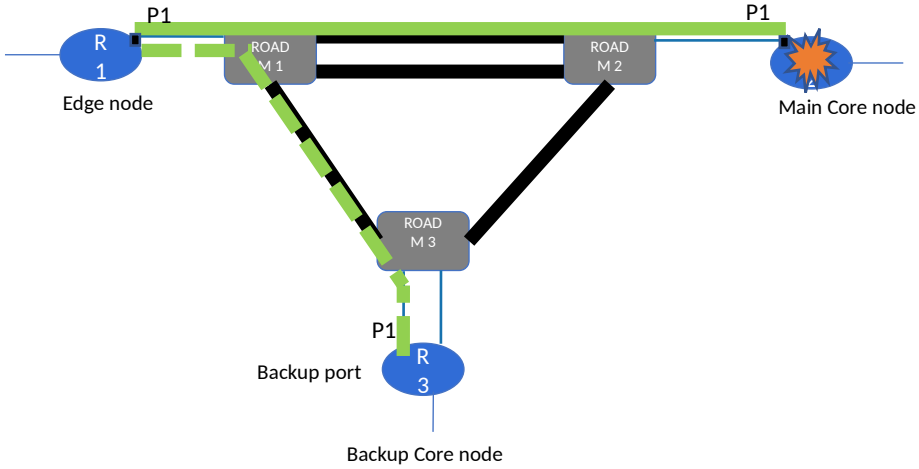
Dual-homing and node failure

Problem Statement, value added by SDN:

- Ability to distinguish failures (IP node failure or transport network failure)
- In case of IP core node failure, re-route optical resources and reuse local edge IP port

Expected benefits:

- Reduce IP edge interfaces over-provisioning and save optical channels interfaces and spectrum occupation CAPEX reduction



INITIAL CONDITION
SDN controller knows network topology at both IP and optical layer, and is also aware of interconnection links. The IP link R1/p1-R2/p1 (GREEN) is already provisioned. R2 is main core node, R3 is backup node
TEST DETAIL
1. Fault on R2, or on the interconnection link with the ROADM2 2. SDN controller knows that there is a backup node, and creates the connectivity from R1/p1-R3/p1 using the same interface in R1 and ROADM1. 3. SDN controller tears down GREEN optical channel 4. SDN controller activates a new optical channel between R1/p1 IP port and R3/p1 5. SDN controller creates new IP link (GREEN dashed) between R1/p1 and R3/p1

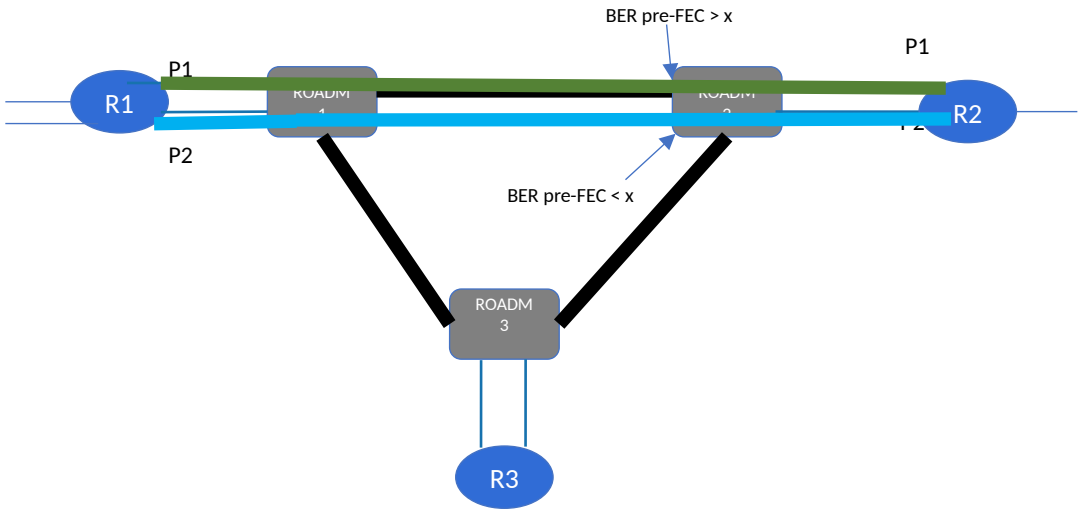
Alert in case of degrade of DWDM link performance

Problem Statement, value added by SDN:

- SDN controller must be able to monitor DWDM links optical performances, and alert the operator in case of BER PRE-FEC values over a specified threshold
- The warning about BER PRE-FEC threshold crossing should be related di IP links

Expected benefits:

- Automatic optical degrade avoidance better service availability at the same CAPEX



INITIAL CONDITION

SDN controller knows network topology at both IP and optical layer, and is also aware of interconnection links. The IP links R1/p2-R2/p2 (BLUE) and links R1/p1-R2/p1 (GREEN) are already provisioned.
Both DWDM links have acceptable BER pre-FEC values. Operator can chose a specified threshold of BER pre-FEC, that will trigger an alert on SDN controller

TEST DETAIL

1. Operator can choose the desired threshold of BER pre-FEC for the trigger of the alert condition
2. When the threshold is crossed, an alert related to the involved IP links must be shown on SDN controller