A Member of the China Netcom Group

MPLS based SP Network Design and Considerations

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Agenda

- Asia Netcom IP/MPLS Network
- MPLS TE implementation
- Traffic monitoring and analysis
- Constraint vs. CSPF
- Traffic load-balancing for capacity management
- MPLS TE repotimization
- Traffic reroute without FRR and LSP rerouting
- MPLS TE as SP point of view

Asia Netcom IP/MPLS Network

- Asia Netcom is subsidiary of China Netcom, the second largest telco in mainland China
- IP/MPLS and MPLS VPN network infrastructures is top of our own SONET/SDH subsea cable system
- Selected MPLS-TE (Multi-Protocol label switching – Traffic Engineering)
- LSRs (core) are Cisco single platform
- IGP is ISIS
- MPLS VPN network supporting multiple Class of Service
- Separated Asia region IP network from Global Crossing AS3549. Asia Netcom is a former Asia Global Crossing

MPLS TE implementation

- Motivation

  Watching traffic flow / utilization matrix between POPs
  - MPLS can achieve using simple SNMP tools
  - Appropriate backbone upgrade

  To provide single MPLS core network for IP network and IPVPN network
  - MPLS core can achieve traffic isolation with two different AS

  Implement EXP bit base CoS feature
  - prevent that pure IP packets occupy prioritized queues

  Support dynamic routing based on IGP (CSPF) and constraint route both
  - Intentionally, traffic flow can be controlled.

MPLS TE implementation

- IP BACKBONE

Design

- Adequately provisioned…over-provisioning is effective and Ideal
- Lowest packet loss
- Negligible queuing delay
- Appropriate / shortest path
- Fastest error detection and rerouting

Requirement

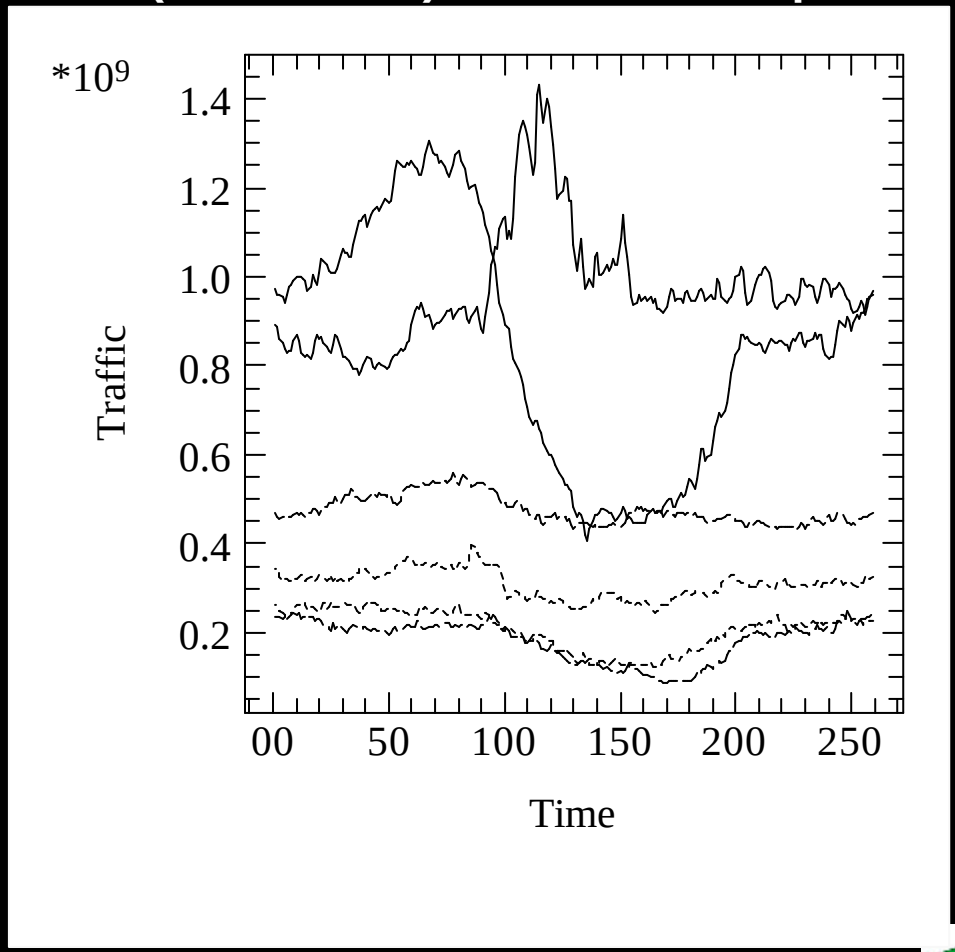
- Limited capital
- Increase efficiency of capacity utilization

Action

- Traffic monitoring and analysis is significant for maintain and reduce the International circuit cost
- Reconsider breakthrough of SPF based routing

Traffic monitoring and analysis

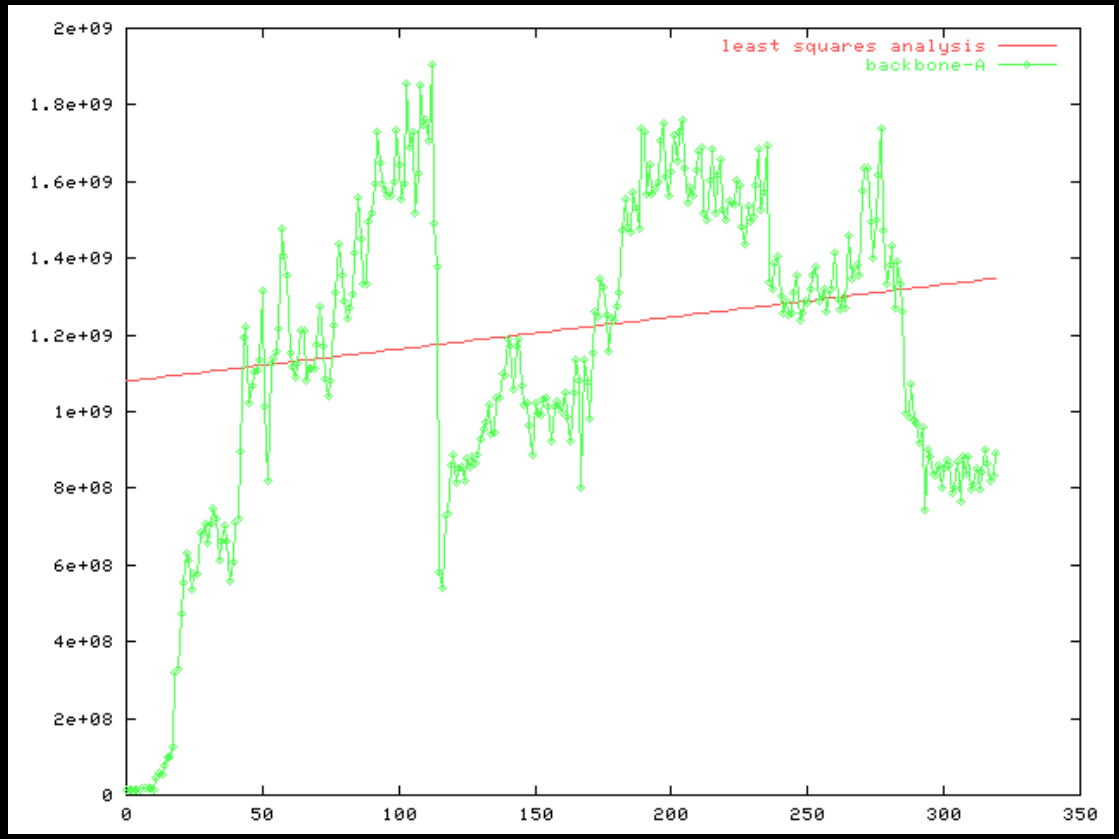
- Traffic profile and utilization (5 min scale) on the Link is quite unique and peak time also….



Traffic monitoring and analysis

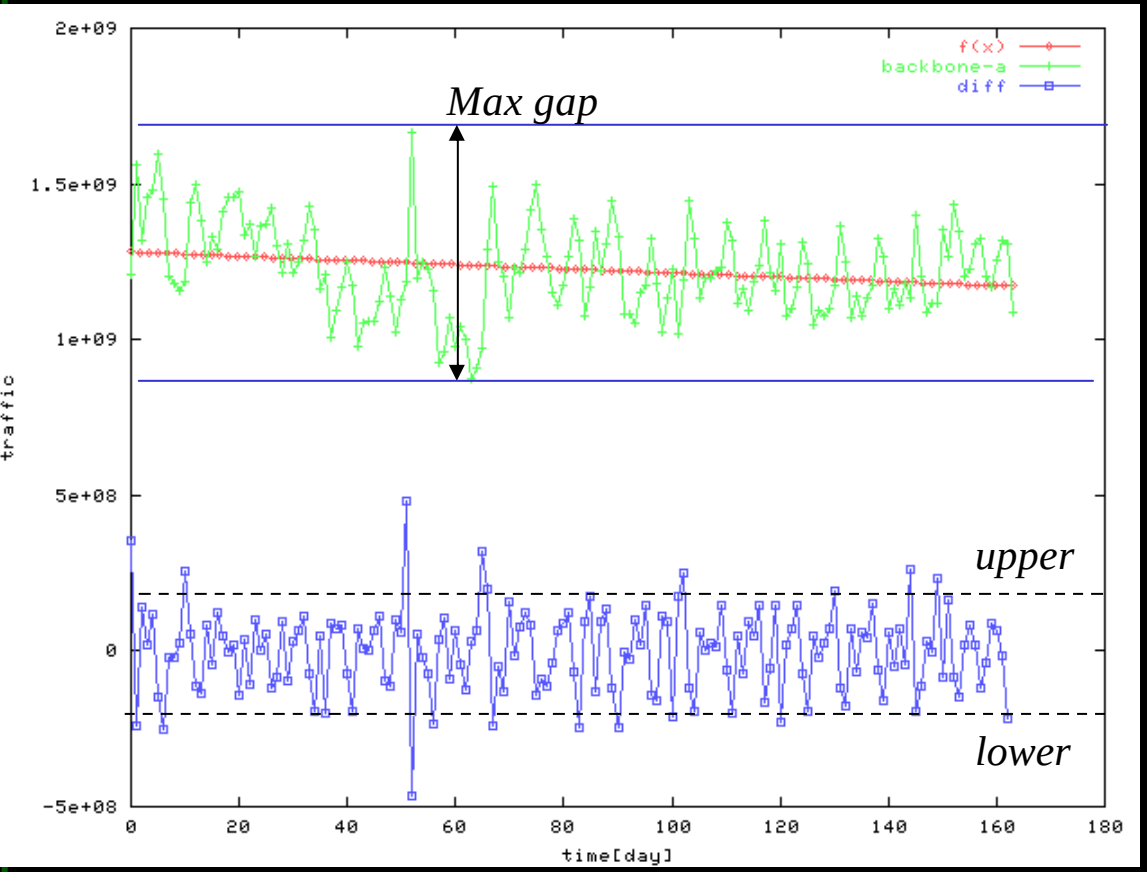
- Do we need to maintain LSP BW accordingly real traffic statistics?
  - Router can derive feasible (?) value of LSP BW from traffic statistics automatically.
  - Automatic LSP BW calculation mechanism supporting some feature.
- If LSP BW set 1kbps or low value, we assume network problem occur??
  - IP traffic can be propagated over the LSP even traffic exceed BW value.
  - Won't be able to see any potential critical problem.

Traffic monitoring and analysis



- Long term traffic watching is good to see what happened and what was needed so did

Traffic monitoring and analysis



- Also Mid-term traffic (24hours scale) view has shown traffic pitch and variance
- Traffic profile is obviously affected by new customer join, peering bgp reset, and another unforeseen factors
- Monitoring Upper/Low level threshold

Constraint vs. CSPF

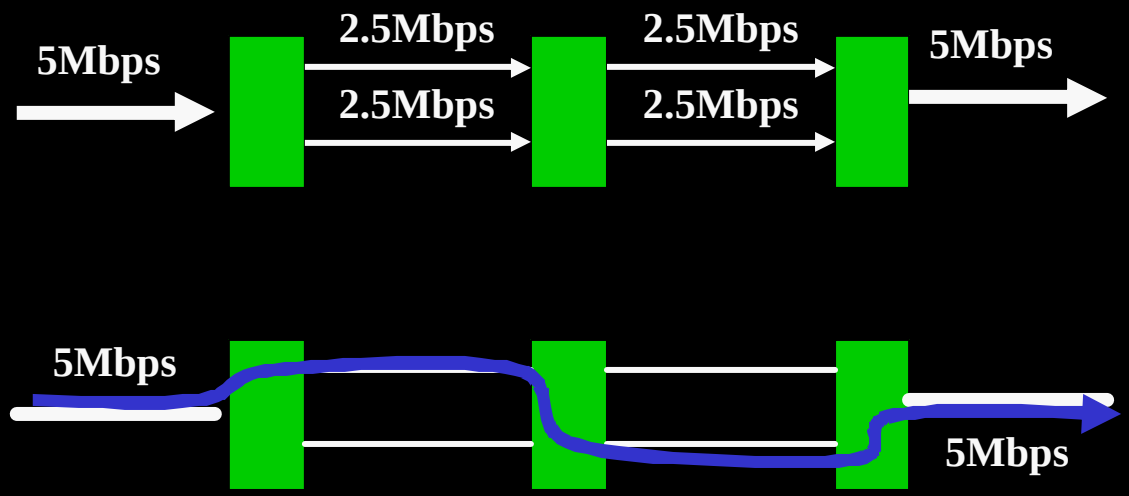
- CSPF : LSP established based on IGP metric
- Constraint : LSP established based on hop-by-hop explicit-route

Research:

- CSPF is better than Constraint in terms of LSP management and maintenance
- But should consider adaptation of own IP/IPVPN network topology and traffic flow + volume
- Traffic optimization and maximization of constraint routing is feasible
- For IP network, when a link down and execute LSP reroute based on CSPF is generating the other link congestions that condition affect many customers.
- LSP disperse is difficult under CSPF + cascade inter-Hub design
- LSP bandwidth tuning according to real traffic data per tunnel destination is pretty hard…
- Affinity tuning is not flexible in terms of backup link selections and redundancy purpose

Constraint vs. CSPF

- Selected CSPF
  - LSP path maintenance is easier than explicit (constraint) LSPs
  - LSP path established between head-end and tail-end based on IGP / BW available information.
  - Traffic flow is follow CSPF = pure IGP SPF selected path
  - a LSP could not perform load-sharing, like a IGP under multiple links connections.

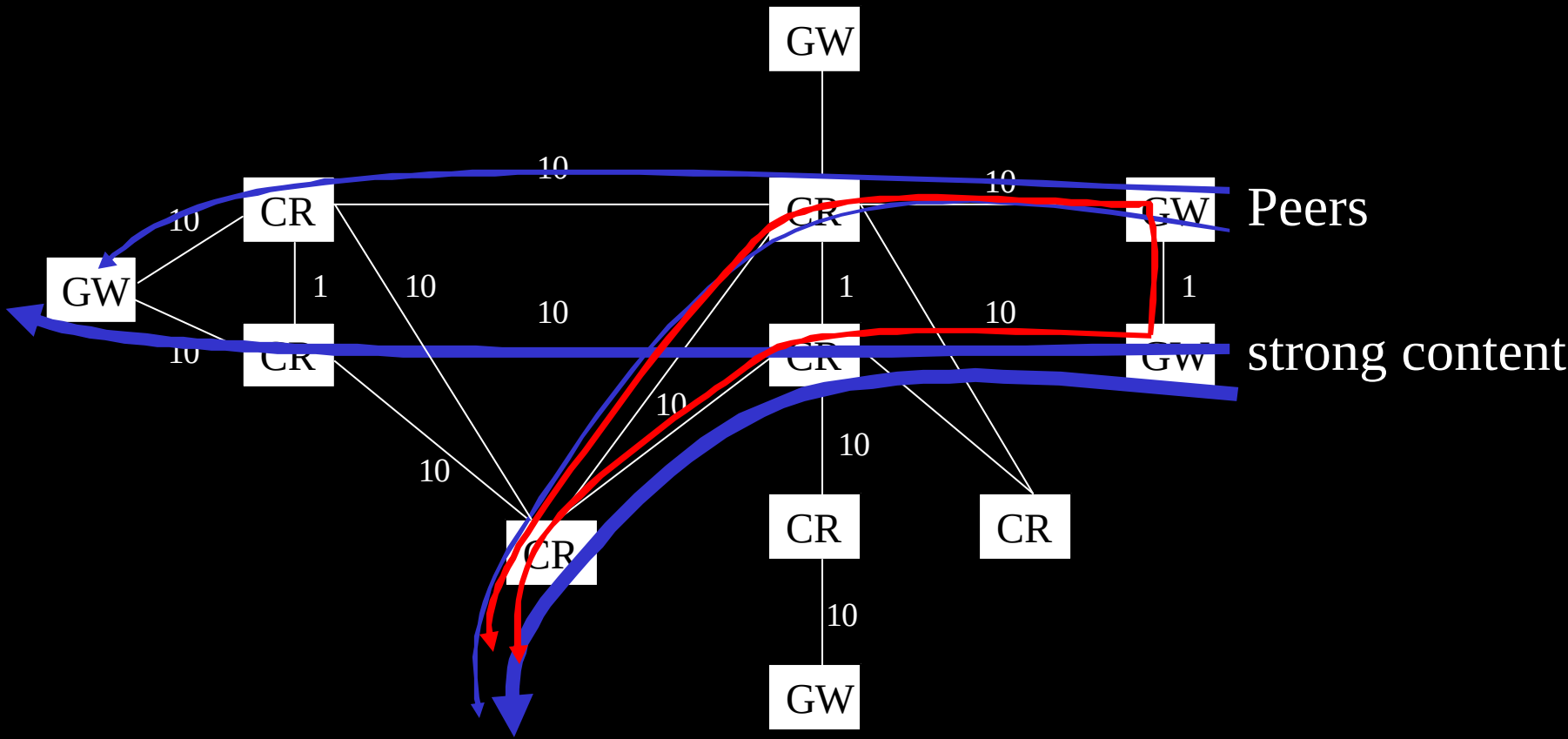


Constraint vs. CSPF

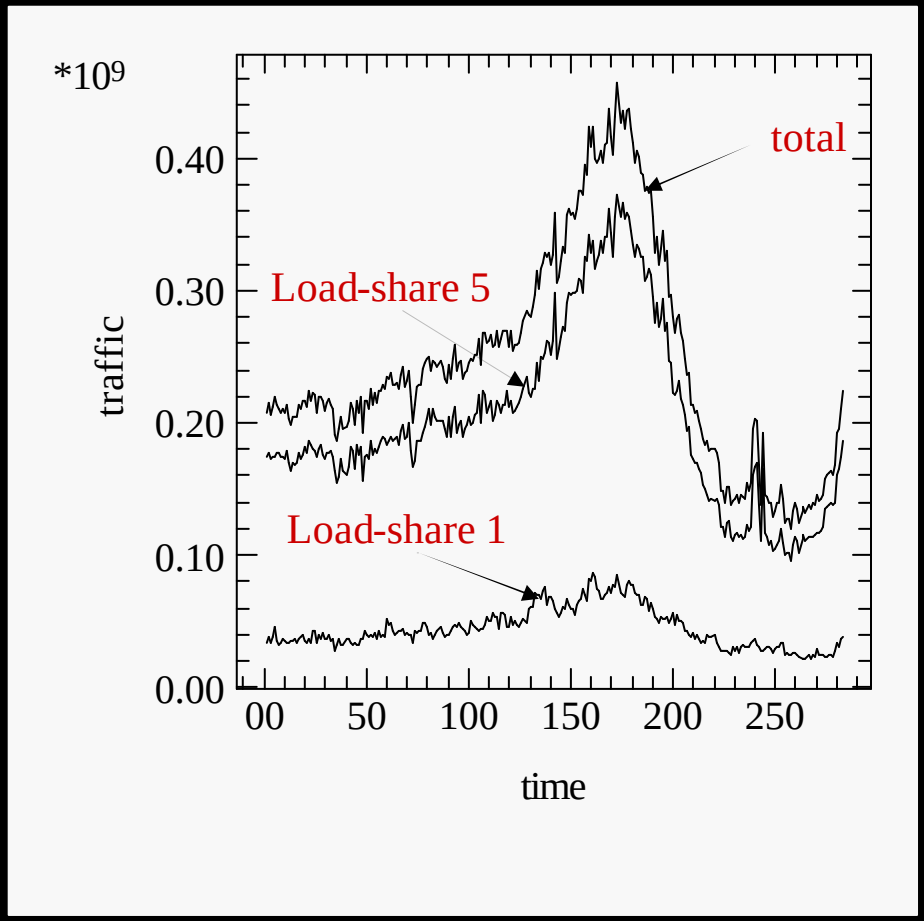
- Selected constraint
  - Possible to load-sharing among multiple links or diverse links
  - Specify LSP path, as well as 2nd / 3rd backup paths
  - Change the LSP path intentionally

Constraint vs. CSPF

- Motivation of explicit RSVP TE tuning

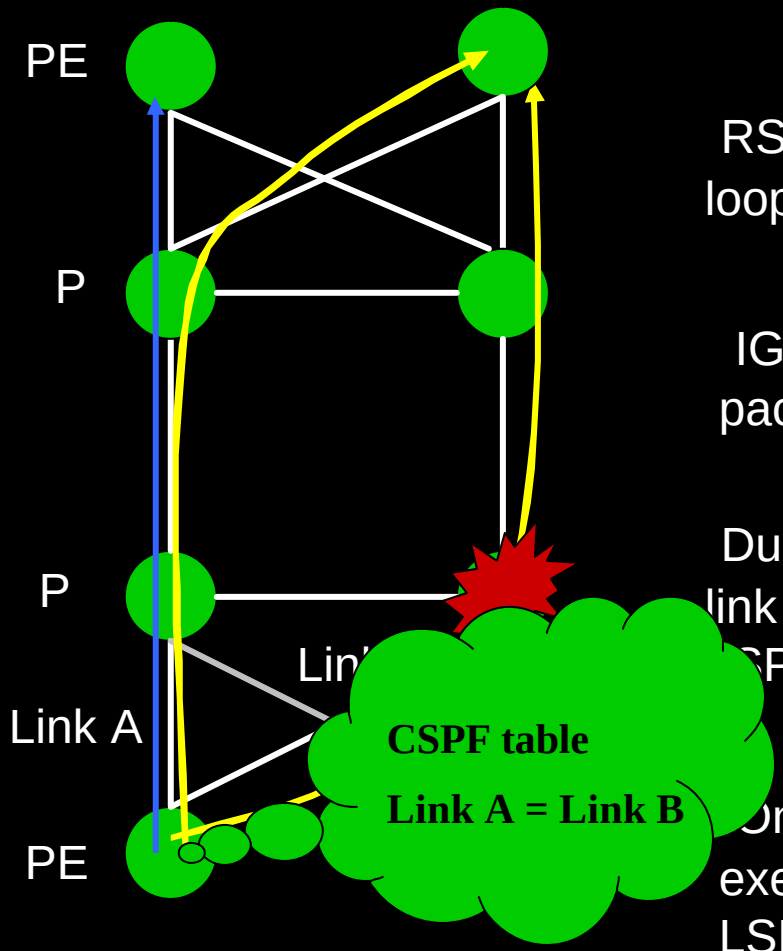


Traffic load-balancing for capacity management



- *STM4-STM16 international capacity is expensive and need more efficient capacity management*
- 2 LSPs' tunnel tail-end are same router and LSPs are routed different physical backbone and set "load-share" command
- Most likely 2 LSP s are sharing the traffic accordingly
- the outcome Imply that overflow traffic can be detoured to non-high utilization path intentionally. Detour tuning should be considered latency.

MPLS TE Reoptimization



RSVP path Message is using remote PE loopback0 as destination of RSVP session

IGP is possible to disperse path Message packet to multiple links

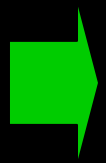
Due to maintenance or failure of P router / link down, and LSP reroute to other link. And SPs are remaining as normal condition

Once failure point is recovered, and operator execute " mpls traf reopt tunnel xxxx" but all LSP are staying on a link since CSPF recognize both links are same metric, bandwidth OK.

Traffic reroute without FRR and LSP rerouting

- **If you want to utilize the international capacity efficiently… and also 50ms re-routes is not required.**

```
interface Tunnel10000
 description TEST-GSR16-TUN-01
 bandwidth 100000
 ip unnumbered Loopback0
 no ip directed-broadcast
 tunnel destination 10.128.0.1
 tunnel mode mpls traffic-eng
 tunnel mpls traffic-eng autoroute announce
 tunnel mpls traffic-eng priority 4 4
 tunnel mpls traffic-eng bandwidth  10
 tunnel mpls traffic-eng path-option 1 explicit name gsr16-01
 tunnel mpls traffic-eng path-option 2 explicit name gsr16-02
 tunnel mpls traffic-eng path-option 3 dynamic
```



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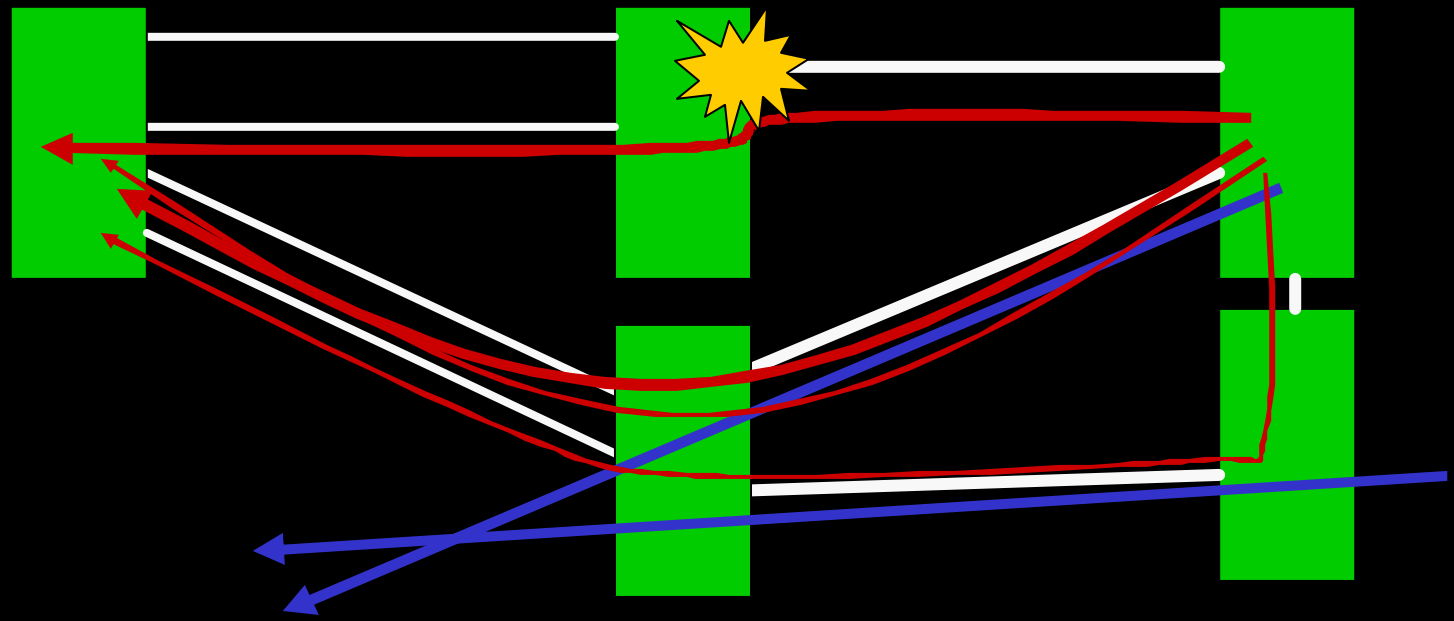
 tunnel mpls traffic-eng path-option 2 explicit name gsr16-02
```

Traffic reroute without FRR and LSP rerouting

- FRR and LSP rerouting is great solution, but backbone capacity provisioning planning and simulation of link utilization after rerouting is required.



MPLS TE as SP point of view

- It was (is) cutting-edge technology…
- Many check point and research is required….empirical evidence…
- Useful so that SP optimize costly international capacity
- MPLS/BGP IPVPN / L2VPN are popular services in Telecom Market
- Developed significant OAM functions
- Fast Rerouting is one of opportunities
- Analysis latency and traffic utilization as contingency plan
- Operation, maintenance and design …..challenge

- Possible (TRY) to find out new and efficient capacity management solution and SLA improvement