Traffic Engineering and MPLS Shu Li UUNET Japan shuli@uu.net

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- Traffic Engineering Concept
- Why Traffic Engineering?
- Traditional Traffic Engineering and Case Studies
- Why Traffic Engineering Using MPLS
- Additional Merits on MPLS



Traffic Engineering Concept

Definition: Mapping Real Traffic to Physical Circuits



Why Traffic Engineering

Redundancy

Capacity

Efficient Use of Limited Resource



Redundancy





Capacity and Efficiency





Traffic Engineering Goal

Achieve most efficient utilization of the limited resources and good service of quality.



IP Layer Traffic Engineering

- Choose link with the lowest cost (metric).
- Load share on equal cost links.
- Hop by Hop forwarding decision.
- Changing metric on a link affects all traffic
 - It may be OK for a few routers.
 - It is difficult for about 10 routers.
 - It is impossible for 100 routers.



Traditional Tools for TE

FR/ATM has been used for TE

Mapping physical topology to virtual layer 1 topology which is independent of the physical topology





TE based on FR/ATM

- Remove hop by hop traffic decision.
 - Changing metric only affects the traffic between two ends.
- Move traffic away from the shortest path.
 - VCs can be set up on any physical path.
- Guaranteed bandwidth for the traffic of two ends.
- Stable IP layer by layer 2 re-routing



Case Study: Ease Congestion





Case Study: Load Balance







Traffic Engineering using MPLS

Network architecture returns to the old one, but we have traffic engineering function.



Why using MPLS on TE?

• High speed interface.

- OC48, OC192 are not available for ATM
- ATM overhead
 - OC48 --> 498Mbps
 - OC192 --> 1.99Gbp



Other Reasons

- Remove the overlay architecture
 - Operation and Management of one network
 - Leverage the lack of engineer
- Low cost
 - One can do TE without additional investment
- Gaining TE function on all interface (not just FR/ATM interfaces)



MPLS Traffic Engineering

Load balance on equal paths





MPLS Traffic Engineering

Load balance on equal paths (CSPF)

- Least-fill
 - Use the path with most available bandwidth
- Most-fill
 - Use the path with least available bandwidth
- Random
- BGP
 - Load share equal path, not youngest router ID





Load balance on equal paths





MPLS Traffic Engineering Can set hot standby secondary path





• Re-route the path

- RSVP can detect a path failure in several seconds



MPLS TE v.s. MPLS VPN

- Traffic Engineering
 - Only choice for high speed TE
- VPN
 - FR/ATM
 - IPSec/L2TP/PPTP
 - MPLS VPN
 - MPLS CCC







- Necessity of Traffic Engineering
- FR/ATM Based Traffic Engineering
- MPLS Features in Traffic Engineering
- MPLS/GMPLS in Future Backbone Networks





Thanks!

