Quality of Service using Traffic Engineering over MPLS: An Analysis

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Praveen Bhaniramka, Wei Sun, Raj Jain
The Ohio State University
Contact: Jain@CIS.Ohio-State.Edu

These slides, ID, and a paper are available online at
http://www.cis.ohio-state.edu/~jain/ietf/
Overview

Traffic Engineering: Trunks, LSPs, Links

Simulation Model

Results for 4 different scenarios

Conclusions
Traffic Engineering

Optimize the utilization of network resources
Using MPLS
- Explicit Routing
- Policy Routing
- Traffic aggregation and disaggregation
- Constraint Based Routing
Flows, Trunks, LSPs, and Links

Label Switched Path (LSP):
All packets with the same label

Trunk: Same Label+Exp

Flow: Same MPLS+IP+TCP headers

<table>
<thead>
<tr>
<th>DL</th>
<th>Label</th>
<th>Exp</th>
<th>SI</th>
<th>TTL</th>
<th>IP</th>
<th>TCP</th>
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Flows, Trunk, LSP, Link
Sources 1..n send TCP and UDP packets to Dest 1..n
R2-R3-R5 is a high bandwidth (45 Mbps) path.
R2-R4-R5 is a low bandwidth (15 Mbps) path.
All links have 5ms delay
TCP1 MSS = 512 B, TCP2 MSS = 1024 B,
UDP MSS = 210 B
Simulation Scenarios

Normal IP with Best Effort routing

Two trunks using Label Switched Paths

- Trunk 1: R1-R2-R3-R5-R6
  - TCP and UDP sources are multiplexed over this trunk
- Trunk 2: R1-R2-R4-R5-R6
  - Only TCP sources over this trunk

Three trunks using Label Switched Paths

- All three flows are isolated.

Non End-to-end trunks.
Case 1: No Trunks, No MPLS

15 Mbps path not used at all
TCP suffers as UDP increases its rate
Unfairness among TCP flows

Raj J
Two trunks w UDP + TCP Mixed

Total throughput > 45 Mbps (both paths used)
TCP flows sharing the trunk with UDP suffer
TCP flow not sharing with UDP do not suffer
TCP flows are not affected by UDP and achieve a fairly constant throughput.
Non End-to-End Trunks

TCP flows are affected by UDP in the shared path
Other Factors

Queue Service Policies: WFQ, WF2Q, WF2Q+
Packet drop policies: RED, Tail drop
Round Trip Time
TCP parameters: MSS, window size, etc.
Summary

Total network throughput improves significantly with proper traffic engineering.
Congestion-unresponsive flows affect congestion-responsive flows.
- Separate trunks for different types of flows.
Trunks should be end-to-end.
- Trunk + No Trunk = No Trunk.