PROPOSAL TITLE:

Evaluation of IP and MPLS TE Protection Algorithms

PRIMARY INVESTIGATOR:

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ABSTRACT:

There are two opposing views regarding the efficacy of IP-based TE using IGP metric optimization. In one view, IP-based TE using IGP metric optimization will always be inferior to MPLS TE in either or both of two respects: recovery in case of element failures and efficiency of bandwidth usage. In another view, as indicated by several recent studies, the difference between the two approaches is minimal.

We propose to study, by simulation, select metric optimization algorithms with the goal of evaluating their ability to provide adequate recovery (with preserved bandwidth guarantees) in the face of single link, node, and Shared Risk Link Group (SRLG) failures.

Performance of these algorithms will be compared with a number of MPLS TE protection approaches, e.g.

a) Dynamic CSPF-based computation of primary and secondary tunnels with fixed (i.e. delay-based) metric setting
b) Dynamic CSPF-based computation of primary tunnels and Fast ReRoute (FRR) backup tunnels using off-line backup placement procedures
c) Optimized off-line computation of primary and secondary tunnels
d) Optimized off-line computation of primary and local FRR backup tunnels

(Note: Concrete algorithms for c) and d) are under investigation)

The study will also evaluate the robustness of these algorithms whenever there is a change in the traffic matrix or network topology.

DESCRIPTION OF PROJECT AND RESEARCH GOALS:

Traffic Engineering (TE) enables a router to direct traffic along a specific path; this capability is crucial for efficiently utilizing network resources and providing a reliable service. The TE capability is becoming even more important as an increasing number of
network providers migrate their legacy circuit and ATM/FR networks to a common IP/MPLS based network infrastructure.

One of the key benefits of MPLS technology is its ability to forward traffic along a specific path (i.e., traffic engineering). The path can be determined in two ways: specified by a user or computed based on a constraint. In the latter case, the computation is based on dynamic routing topology information obtained from routing protocols such as OSPF and IS-IS. In short, MPLS TE application enables the establishment of traffic engineered label switch paths (LSPs). In addition to traffic engineering, MPLS provides several additional features such as the ability to setup backup LSPs, mechanisms to detect link or node failures, and fast (e.g., 50 milliseconds) reroute of traffic with or without bandwidth QoS guarantees. These features have stimulated an increased interest in MPLS LSP protection and restoration schemes (see [MPLS-BACKUP]). Thus, MPLS TE together with fast reroute (FRR) provides a highly reliable service with very fast recovery times.

In contrast with MPLS, IP routing (e.g., OSPF, IS-IS) makes independent forwarding decisions on each hop and consequently does not offer the same degree of control as MPLS TE in steering traffic along a specific path. Although IP routing algorithms are fault-tolerant, they tend to take a much longer time to react to topology changes resulting from a link or node failure. For example, the IGP protocol may take a few seconds to react to topology changes. One of the detrimental side effects of this slow reaction time is that during routing transitions, traffic on certain forwarding paths is disrupted. Although a certain level of packet loss may be acceptable for best effort traffic, this amount of packet loss due to service disruption is unacceptable for premium services such as voice, video, and other mission critical data. Furthermore, unlike MPLS TE with FRR, IP routing may not be able to provide backup paths with bandwidth guarantees equivalent to that available on the primary (i.e., protected) forwarding paths.

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REFERENCES:

ANY REQUIRED/EXPECTED RESEARCH COOPERATION WITH CISCO

Collaboration with following architects from Bruce Davie's group on selection of optimization algorithms, simulation, and testing scenarios:

Anna Charny and Jean Philippe Vasseur

NAMES OF CISCO CHAMPIONS:

Bruce Davie (Cisco Fellow)
Anna Charny (MPLS TE Lead Architect)
Jean Philippe Vasseur (MPLS TE Lead Architect)

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