

**Fast Rerouting Against Multi-Link Failures Without Topology Constraint**

**Abstract:**

Multi-link failures may incur heavy packet loss and degrade the network performance. Fast rerouting has been proposed to address this issue by enabling routing protections. However, the effectiveness and efficiency issues of fast rerouting are not well addressed. In particular, the protection performance of existing approaches is not satisfactory even if the overhead is high, and topology constraints need to be met for the approaches to achieve a complete protection. To optimize the efficiency, we first answer the question that whether label-free routing can provide a complete protection against arbitrary multi-link failures in any networks. We propose a model for interfacespecific- routing which can be seen as a general label-free routing. We analyze the conditions under which a multi-link failure will induce routing loops. And then, we present that there exist some networks in which no interface-specific-routing (ISR) can be constructed to protect the routing against any *k*-link failures (*k \_* 2). Then, we propose a tunneling on demand (TOD) approach, which covers most failures with ISR, and activate tunneling only when failures cannot be detoured around by ISR. We develop algorithms to compute ISR properly so as to minimize the number of activated tunnels, and compute the protection tunnels if necessary. We prove that TOD can protect routing against any single-link failures and dual-link failures. We evaluate TOD by simulations with real-world topologies. The results show that TOD can achieve a near 100% protection ratio with small tunneling overhead for multi-link failures, making a better tradeoff than the state-of-the-art label-based approaches.

**Existing System:**

Advanced fast rerouting approaches are developed to protect the routing against link failures. Instead of waiting for the routing protocol to converge, a fast rerouting approach can switch traffic to backup next hops or backup paths quickly. However, fast rerouting faces the problem of efficiency, which has not been well addressed. That is, the protection performance is not satisfactory even if the overhead is high. We discuss the problem in more details by considering

two broad categories of fast rerouting separately, namely *label-free approaches* and *label-based approaches*.

**Proposed System:**

In this paper, we propose an ISR path model because ISR makes full use of label-free information known in current stage. We find that a routing cannot always form a rooted tree or a traversal, and our ISR paths can be seen as a general model for all possible label-free routings. Based on the model, we present the condition under which a given ISR can provide complete protection against any multi-link failures in a network.

Proactive approaches compute routings in advance, and switch paths to available ones as soon as a failure is detected. Because routing computation is not needed after a failure occurs, the disruption time can be greatly reduced. Many studies focus on proactive approaches in past decade. Our study in this paper also belongs to this category.