A PERFORMANCE STUDY FRAMEWORK FOR MULTI-PROTOCOL LABEL SWITCHING (MPLS) NETWORKS

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Abstract

With the rapid increase in real-time and high-priority applications, such as video streaming and online business transactions, Internet Service Providers (ISPs) have to ensure a high Quality of Service (QoS) with minimum packet drops and end-to-end delays. To ensure such reliability and high QoS, researchers have devoted a lot of effort to developing forwarding mechanisms to efficiently utilize network resources and minimize forwarding latency. The Multiprotocol Label Switching (MPLS) among these mechanisms which introduces connection-oriented protocol into existing packet switching networks to provide QoS guarantees to traffic. Networks failures which can occur due to many numerous reasons (e.g. cable cuts, power outages, etc.) can cause a serious disruption to critical traffic and this is unacceptable for applications/customers that require highly reliable services. To guarantee a high QoS and enhance network performance during network failures, MPLS has been incorporated with its own recovery mechanisms which involve rerouting traffic from original faulty paths to alternate paths. Recovering traffic during failures is one of the challenges in MPLS, thus researchers have developed different recovery models to protect traffic during failures and to reduce packet loss, recovery time, disruption time in services and the pre-reserved recovery routes.

In this project, a comprehensive study is carried out on MPLS recovery mechanisms for protecting and restoring traffic after failure occurrence. In order to model the recovery mechanisms in MPLS networks, a new modeling framework for MPLS recovery is developed in this study. The new framework is based on the OMNeT++ software tool and provides an implementation of four recovery mechanisms, namely; Best Effort, Makam, Local Rerouting and Fast Reroute. The MPLS Recovery Framework can be extended to model additional recovery mechanisms in the future. The four recovery mechanisms have been modeled and simulated on a standard ISP network using a new simulation framework and the OMNeT++ platform. In order to demonstrate the usefulness of our proposed simulation framework, we have used to carry out a performance evaluation of – the four well-known recovery mechanisms in term of the following performance metrics: dropped packets, service disruption time, total recovery time and the number of pre-reserved paths.

The main contribution in this study is the development of a new simulation modeling framework for MPLS recovery mechanisms. Numerous simulation experiments have been conducted using the new framework in order to evaluate the performance of the four recovery mechanisms in MPLS networks. Our Simulation results reveal that the Fast Reroute mechanism provides a faster recovery response than the other mechanisms. However, the Fast Reroute mechanism consumes more bandwidth for recovery. It is worth noting that nowadays a number of researchers are working on enhancing this recovery mechanism in order to reduce reserved bandwidth.