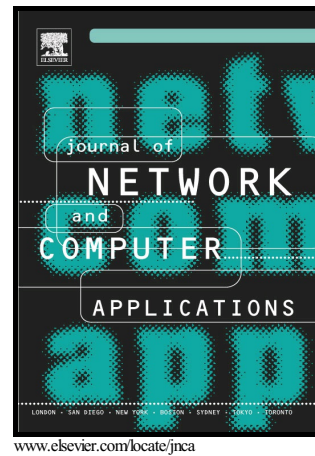


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An efficient method for evaluating the end-to-end transmission time reliability of a switched Ethernet

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Abstract

It is common practice to evaluate the end-to-end transmission time reliability of a switched Ethernet by conducting time-consuming tests under normal traffic conditions. This paper presents an efficient test method for a switched Ethernet under fixed payload with Poisson arrival, using a transmission time reliability model developed based on an end-to-end transmission delay analysis. By conducting tests with higher-than-normal frame arrival rates, the unknown parameters, i.e., service rate and fixed delay, of the model can be estimated through the method of moments or the maximum likelihood alternative. Then, the transmission time reliability under the normal frame arrival rate is extrapolated. Our numerical and simulation studies show that the resulting reliability estimates are quite accurate compared to the empirical ones obtained from verification tests. Furthermore, to illustrate the application of our method, a test was conducted using our method on a testbed of the Avionics Full Duplex Switched Ethernet (AFDX).

Keywords: Reliability evaluation, Switched Ethernet, End-to-end delay, Queueing theory, Statistical inference

1. Introduction

As the usage of computer networks and traffic load rapidly increase, the requirements on networks quality of service (QoS) become higher and higher. One typical reliability level specified for a computer network is at least 0:99999. Nowadays, VoIP, IPTV, VoD and other real-time services are very popular, and service delay caused by network congestion becomes one of the biggest concerns. Such network delay may cause huge negative impacts on economic and/or societal activities, and it is related to network transmission time reliability, which is concerned about the probability that a network will transmit information in a timely fashion under specified operating conditions. This concept was first introduced as “travel time reliability”

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