

A Performance Analysis of two Multiplexers in Tandem with Correlated Arrivals

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Abstract: In this paper, we present a performance analysis of a system with two multiplexers in tandem. Each multiplexer is fed by an external arrival process that consists of the superposition of the traffic generated by independent binary Markov sources. Further, the output of the first multiplexer is fed into the second multiplexer according to an independent Bernoulli process. The probability generating function (PGF) of the queue length distribution for the second multiplexer is derived; from that the expression for the mean queue length has been determined.

Keywords: Tandem multiplexers, correlated arrivals, queue length, probability generating function, mean.

1. INTRODUCTION

Broadband networks are expected to integrate the transmission of voice, video and data in a single network. The Internet which had been designed to serve data traffic is now also expected to transport real-time traffic; however, various services differ in their QoS requirements. The Internet is based on the packet-switching technology that allows dynamic sharing of the bandwidth among different flows in the network. The packets are stored and forwarded from one node to another with each node making its routing decision until packets reach their destinations. The Internet has been using two transport protocols, TCP and UDP, for information transfer. TCP provides reliable connection-oriented communications with end-to-end control algorithm, while UDP provides a connectionless service between applications. TCP is the choice of transport protocol for loss sensitive and delay tolerant data traffic, while UDP is suitable for delay sensitive and loss tolerant real-time traffic such as voice and video. The network gives priority to UDP over TCP traffic, and the results of this paper will be applicable to the former since it does not have end to end controls.

As the packets travel through the network, the statistical properties of the traffic change in a profound way. For example, the traffic becomes smoother and the long-range dependence of the traffic dissipates due to the statistical multiplexing gains [1]. Thus the performance analysis of the traffic at the network level is very important. And the objective of this paper is to determine the performance analysis of such a network with two multiplexers.

Due to lack of exact methods, most of the previous work in the analysis of tandem networks

