Connect Time Limits and Performance Measures in a Dial-Up Modem Pool System

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ABSTRACT
Managing customer service is critical for both nonprofit and for-profit dial-up modem Internet service providers. When system operators face excess demand, they can either add capacity or adapt their management techniques to deal with their limited resources—this article considers the latter. We examine system configuration options and the resultant effects on customer service levels in a simulated dial-up modem pool operation. Specifically, we look at a single pool operation and examine the effects of imposing time limits in a seriously overloaded system. We analyze the results on several key customer service measures. The results show that imposing these limits will have a distinct, nonlinear impact on these measures. Customer productivity and actual system load are shown to have major impacts on the performance measures. Interactions between several system and environmental parameters are also discussed.

Keywords: Customer Service, Modem Pool, Retrial Queue, Simulation, Time Limits

INTRODUCTION
Schikora and Godfrey (2006) examined connect time limits in a dial-up modem pool (DMP). In that study, they examined the impact on the performance measures of the percent of lost customers and the percent of customers disconnected when connect time limit restrictions were placed on the system. They found that imposing DMP time limits affected these key customer service measures. The study presented here is an extension of that previous work, providing more detailed results and examining the interaction of key experimental factors.

Universities, corporations, and Internet service providers have long provided external access to computer networks using a DMP. Modems allow data to be transmitted over standard analog telephone connections, providing long-distance access to a central computer from any
place that has a telephone connection and a modem-equipped computer. Though the data transfer rates through a modem-to-modem connection are much slower than the transfer rates of a direct network connection, modems are essential for providing flexible external access to a central network for most users.

With the rapid growth in the use of home computers and the increasing popularity of the Internet over the past decade, DMP operators experienced a corresponding increase in demand for their service (Naldi, 1999). Advances in broadband availability have since reduced demand for DMP service. However, narrowband users still account for 32% of active Internet users in the United States (Website Optimization LLC, 2006), 30% of Internet users in Australia (Daniel, 2006), and 70% of Internet users in New Zealand (Auckland, 2006). Even on the African continent, government leaders are urging broadband Internet providers to lower prices because broadband remains high priced and is leading to slowed down growth in Internet usage in South Africa (Miniwatts Marketing Group, 2004). Despite the promise of high-speed connectivity, dial-up access remains a viable, low-priced means by which a significant percentage of users still access the Internet. Walczak and Parthasarathy (2006) have argued that customer discontinuance and switching remain major issues for Internet service providers. In addition, Titus (2007) outlines advantages of dial-up modems and the convenience they offer in the electronics industry in the United States. He offers an outlook for the incorporation of dial-up modems by engineers to other modems. Further, an article in The Economist (“The Slow Death of Dial-up,” 2007) states that even though there is a decrease in the use of dial-up to access the internet, several segments of society are expected to continue to use dial-up as their primary means for accessing the Internet. In fact, the article states, “The rumour of dial-up’s death has been greatly exaggerated.” Therefore, our research analyzes how to improve service to dial-up customers of Internet service providers. Specifically, we examine the situation where demand for service exceeds the capacity of an existing DMP system.

The easiest way to remedy excess demand for DMP service is simply to increase capacity by enlarging the size of the DMP—often a viable option for a for-profit operator given that increased demand leads to increased revenues. However, this approach is expensive, so increasing capacity should not be done without regard for operating efficiencies. In the case of smaller or nonprofit operators (e.g. universities), additional capacity often is not a viable option due to budget constraints. In the case of system downsizing in markets with reduced demand, very high system utilization may result and persist for some time immediately after system resizing. Regardless of the provider’s demand forecast, or whether the provider is for-profit or non-profit, system operators should be concerned with the efficiencies of their system and should focus more on using available resources efficiently. Krueger (2003) suggests using COM Port Redirector software to replace Desktop modems. This allows modem users to share a dial-out modem pool on a centralized server on their corporate network.

This article examines DMP system configuration and management issues when user demand meets or exceeds the capacity of a DMP system. In such a situation, users wanting to access the system often will receive a busy signal (in standard queuing terminology, they are blocked). They then have the option of continuing to try to access the system by redialing (retrials), or giving up and leaving the system, possibly returning later. Those customers who give up and leave the system without being served are considered lost. [Care should be taken to note the meaning of a lost customer here. Customers are lost only in the sense of the current service encounter. They are assumed to return at some later point to try for service again. Therefore, customers are lost in the sense that they leave the current service provider for another.] While the blocking probability is an important performance measure in typical queuing systems, a more important performance measure in DMP systems is the percentage of customers that are lost. The wide-
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