Chapter 3
Traffic Flow Burstiness and Bottlenecks in Entrances: Modelling and Simulation Approach

ABSTRACT

Many different companies and institutions related to cargo transportation (such as logistics centers, manufacturing companies, shopping malls, etc.) face a major problem: bottlenecks. The purpose of the chapter is to introduce the framework of modeling traffic flow patterns in entrances of companies operating queuing managing system. Aiming to present effective solutions for congested traffic control and ensure high quality customer flow management, the authors present a framework of a traffic flow simulator. The simulator each and every modeling minute generates a stochastic flow of arriving vehicles meeting corresponding to the average values of the selected parameters. In the result the output characteristics—such as queues and traffic jams—are obtained in graphical form. The model has been designed using Visual Basic for Applications for the reason that non-standard parameter values of the above-mentioned model might be also inserted into the cells.

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INTRODUCTION

The very term "burstiness" mostly refers to "workload patterns of an application that cause serial correlations in the service demands placed at various system resources" (Casale, Kalbasi, Krishnamurthy, & Rolia, 2012). Furthermore, the authors also conclude that „burstiness in short scales can be caused by a number of different application, transport, and network mechanisms" (Jiang & Dovrolis, 2004) revealing the problematic spheres of its emerging: "modern computer, communication, and production line systems process complex workloads with random service demands (Bolch, Greiner, de Meer & Trivedi, 2006). Mostly these are "high-speed, distributed systems requiring support for the fluctuating and heterogeneous demands of individual users. The ability to characterize the behavior of the resulting aggregate network traffic can provide insight into how traffic should be scheduled to make efficient use of the network, and yet still deliver expected quality-of-service to end users" (Tinnakornsrisuphap, Feng & Philp, 2000). Also, „it has been frequently reported that the well-known problems in congestion control are caused by burstiness and unpredictability of traffic, and that burstiness and unpredictability of traffic are concerned with the characteristics of traffic itself" (Park & Chung, 2001). Several studies in „traffic characterization have concluded that network traffic is self-similar and therefore not readily amenable to statistical multiplexing", so "probabilistic and statistical methods are commonly employed for the purpose of performance and reliability evaluation" (Tinnakornsrisuphap, Feng & Philp, 2000)."Therefore much research on traffic engineering has been focused on building traffic models to efficiently adapt multimedia traffic to the Internet" (Park & Chung, 2001). However, the authors of the manuscript discovered the lack of traffic shaping in conventional congestion control algorithms suitable for transport sector. Despite the fact that the research presents a certain case study in detail the very problem analysed and methodology developed might serve for other different purposes: investigation of traffic dependence on seasonality, time of day, traffic composition and etc. These studies can also serve for evaluating of noise level in certain areas, forecast accident rate, take proper decisions of infrastructure development and etc. Traffic flow management feasibility studies are also required for the evaluation and implementation of traffic control systems; however physical continuous watch and fixation of the traffic as well as processing of the data received take long time and not necessarily provide the specific pattern of the flow analyzed. Many