Global Advanced Research Journal of Management and Business Studies (ISSN: 2315-5086) Vol. Vol. 4(2) pp. 061-066, February, 2015
Available online http://garj.org/garjmbs/index.htm

Full Length Research Paper

Evaluating the Performance of Queues via Risk Measures

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Accepted 28 February 2015

This study aims to investigate and examine the performance of queues via risk measures. It is significant to notice that risk measures is one of the most integrated and credible techniques, which enable the network administrators to identify or determine potential errors and flaws, which are often occurred in network queues. Inconsistent and flawed network queues usually results in intensely high traffic at network nodes; hence results in devastatingly poor performance of the network. Therefore, it is essential to monitor and assess the performance as well as patterns of the queues, which are primarily developed by the transmission of data packets. This research study will commendably help in perceiving the notion of queues and risk measures. In addition to this, the paper will also play an indispensable and inevitable role in identifying the role of risk measures in evaluating the performance of queues.

Keywords: Queues, Risk Measures, Performance Evaluation

INTRODUCTION

The purpose of this paper is to examine and evaluate the performance of queues by using one of the most systematic and integrated techniques, called risk measures. It has been assessed from the analysis of researches and studies, which were carried out by Boucherie and Van Dijkthe (2011) that networks of queues are often utilized to model queuing and contention, when a set of resources is shared with other networks or systems. The entire concept of queuing can be categorized into two types, i.e., open queuing and closed queuing. In this regard, Delgado, et al, (2011) has asserted that open queuing networks are further divided into two types, i.e., open feedback queuing networks and open feed forwards queuing networks.

In contrast, closed queuing networks can be understood as the networks, which have closed loop structure and no signal can depart or enter into the network. It has been documented in the researches, which were conducted by Bertsimas, et al, (2011) that queuing networks can be utilized to model manufacturing

systems, communication systems, as well as computer systems. Therefore, it is essential to recognize the performance of queues (Guo, et al, 2011). In this account, Shah and Shin (2012) have proposed an idea that the technique of risk measures may play an inevitable role. The proceeding paper will help in examining the role of risk measures in evaluating the performance of queues.

Aim and Objectives of the Research

This study aims to inspect the performance of queues by using the technique of risk measures. The proceeding section incorporates different objectives, which will help in attaining the aim of this research. The objectives of the research are:

- To understand the core concept of queues;
- To examine the notion of risk measures;
- To inspect the role of risk measures in evaluating the performance of queues.

Scope of the Research

In accordance with the views and perceptions of Shah and Shin (2012) queuing is one most essential concepts of networking, which deals with the set of different packets of data, which are collectively waiting to be broadcasted by a network device. Boucherie and Van Dijkthe (2011) have supported this idea by claiming that queues are primarily comprised of large number of data packets. It has also been observed that these packets of data are bound to be routed or transmitted over the network. It is due to the fact that these packets of data are aligned in a sequential manner with varying trailer and header and are taken out of the queue for transmission (Bertsimas, et al, 2011). This transmission is usually carried out by a network device by using different algorithms of packet data processing. These algorithms may include LIFO (last in last out), FIFO (first in first out), etc. It has been assessed from the researches of Scaglione, et al, (2012) that network queues usually work in the same manner, which is being used in supermarkets or banks, where the consumers are treated or facilitated as per their arrival time.

In this account, Bertsimas, et al, (2011) has contended that the network administrators are responsible to review and monitor the performance of the queues, in order to eliminate potential risks and vulnerabilities, which are often occurred in networks. Delgado, et al, (2011) has supported this idea by declaring that malfunctioning of networks is usually caused due to inappropriate and discontinuous patterns of queues. Profound assessment of researches, which were presented by Wen and Zhuhave (2014), revealed the fact that the technique of risk measures enables the network administrators to monitor and examine the performance of queues. The technique of risk measure is used to recognize or identify the probability of different risks, which are associated with the performance of the queues (Guo, et al, 2011). Thereby, it can be stated that risk measures is one of the most appropriate approaches, which may help in evaluating potential risks and pitfalls in the operations and performance of the queues (Boucherie and Van Dijkthe, 2011).

METHODOLOGY OF THE RESEARCH

This research study has adopted secondary qualitative research method, in order to accumulate ample amount of pertinent and relevant information, about the given topic of research. It is significant to notice that the chosen method of research has played a commendable role in the accomplishment and attainment of research objectives. While conducting this research study, various online libraries, as well as private and public libraries have been accessed, in order to have credible and authentic information. Some of the most prominent online libraries, which have been accessed during this research, include EBSCO Host, Jstor, IEEE, ACM digital, and Phoenix. All of these resources are found to be highly persistent in providing high quality and pertinent information. It is due to the fact that all of these online resources possess up-to-date, trustworthy, and credible information on the given topic of research. Apart from this, different other resources have also contributed in the successful accomplishment of this research study. In this regard, different text books, already published articles and researches, as well as analysis of different survey findings have also played a notice worthy role in the completion of this study.

Literature Review

Queues – The Concept

It has been inspected from the analysis of researches and studies, which were conducted by Gabrel, et al, (2013) that queues are referred as the waiting lines that usually established by adding elements to its end and contracts by eliminating elements from the front. The exact concept of queues can be understood as an approach, which is being used in the waiting lines of food counters, banks, and supermarkets, i.e., first come, first served (Boucherie and Van Dijkthe, 2011). In more

technical terms, queues can be understood as the data structure, which is built on one of the most intelligent paradigm, which is, FIFO (first in first out) (Wen and Zhuhave, 2014). Diagrammatical representation of this phenomenon is presented as follows:

In accordance with the approaches, which were proposed by Scaglione, et al, (2012) that queues are one of those abstract and integrated data types in which the entities, within the collection of data packets, are kept in systematic order. In this regard, Bertsimas, et al, (2011) has presented a pertinent approach, according to which these packets of data are usually arranged in a rare terminal position, called *enqueue*. In contrast, these entities are usually removed from the front terminal position, which is commonly known as *dequeue* (Boucherie and Van Dijkthe, 2011). This entire cycle eventually makes a popular data structure, which is FIFO (first in first out). The notion of FIFO is presented in below mentioned diagram.hjk

In accordance with the studies, which were accomplished by Huang and Senguptain (2012) FIFO data paradigm, the most initial element of the queue is removed on preliminary or initial basis. This succession is similar to the requirement that the initial element (packet of data) has to be removed, before the addition of new element in the queue. In addition to this, it has also been recognized that the first element, which is going to be added in the queue, will have to be removed from the queue, initially (Boucherie and Van Dijkthe, 2011). It is one of the most appreciable and notice-worthy aspects of the queuing concept that it has widely been utilized in different areas of research. Some of the most prominent areas of its application include operations and more specifically computer science (Wen and Zhuhave, 2014). One of the major reasons behind adopting this technique in all of these areas is its capability to process and hold different types of events, objects, data, etc.

It has been affirmed by Gabrel, et al, (2013) that queues are also capable to perform or carry out the functions of a buffer. In accordance with the views of Boucherie and Van Dijkthe (2011), the concept of queues is famous in such programs of the computer, where they are implemented as data structures. These data structures are usually coupled with different programming routines, specifically access routines, as an object oriented languages or abstract data structure as classes (Guo, et al, 2011). Some of the most common implementations may include linked lists and circular buffers (Wen and Zhuhave, 2014). It has been assessed that the performance of the queues can be easily compared by below mentioned chart.

It has been contended by Bertsimas, et al, (2011) that queuing networks are found to be both unstable and stable in nature, in terms of their performance and functionality. In this account, Scaglione, et al, (2012) has stated that stable queuing networks are the one, which possess finite, fixed, and predetermined performance measures. In contrast, unstable networks can be considered as the networks, which possess considerably large amount of data packets, when the time goes to infinity. Therefore, it is considered as the utmost responsibility of the IT personnel and network administrators to recognize and reevaluate the performance of the queues, by adopting suitable tools, model or paradigms (Boucherie and Van Dijkthe, 2011). The proceeding section incorporates the in-depth and profound analysis of the technique, i.e., risk measures, which plays an indispensable and inevitable role in evaluating and reviewing the performance of queues.

Risk Measures – The Concept

It has been established from the evaluation of researches, which were carried out by Huang and Senguptain (2012), that a risk measure is found to be the greatest and most plausible technique which helps in assessing the performance of the queuing networks or simply queues. It is due to the fact that the approach aims to highlight or draw the attention of the network administrators towards uncertain and improbable exit times of the data packets (Boucherie and Van Dijkthe, 2011). In accord with the studies, carried out by Gabrel, et al, (2013) the technique of risk measure can also be termed as the analysis of absolute deviation (from the mean or predefined frame of time).

It is significant to notice that the entire function or process of analyzing deviated timeframes eventually results in the identification of the linear programming issue, which has been occurred in the targeted network or model. An idea has been presented by Guo, et al, (2011), according to which the concept of risk measure can be termed as the worst possible of predetermined risks, when the set or collection of probability measures is more likely to occur.

Studies, which have been conducted by Bertsimas, et al, (2011) have revealed the fact that risk measures can be classified in accordance with different risk metric, which is supported by risk measures. Most prominent types of risk measure may include measures of delta and measures of duration. In order to support this approach, Delgado, et al, (2011) has proposed an idea that risk measures can never be characterized in accordance with the operations that are entailed or carried out by them. However, they can be only classified on the basis of risk metric. It has been explored from the evaluation of

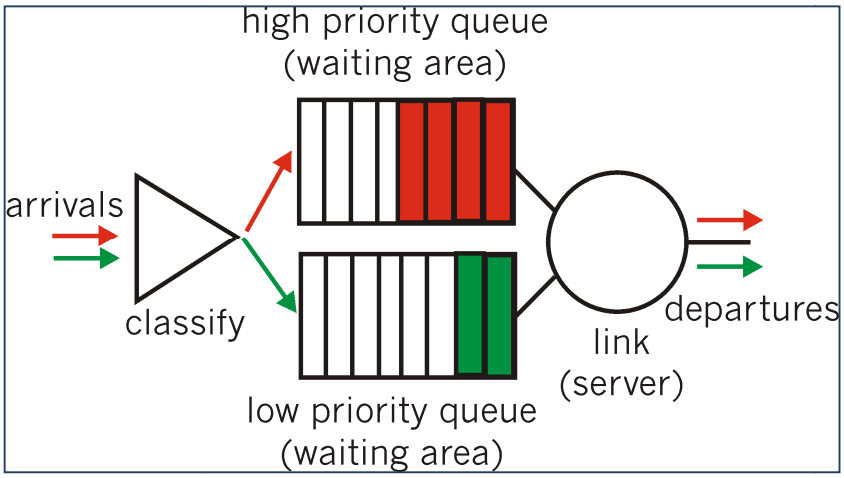

Figure 1: Queuing (Boucherie & Van Dijkthe, 2011)

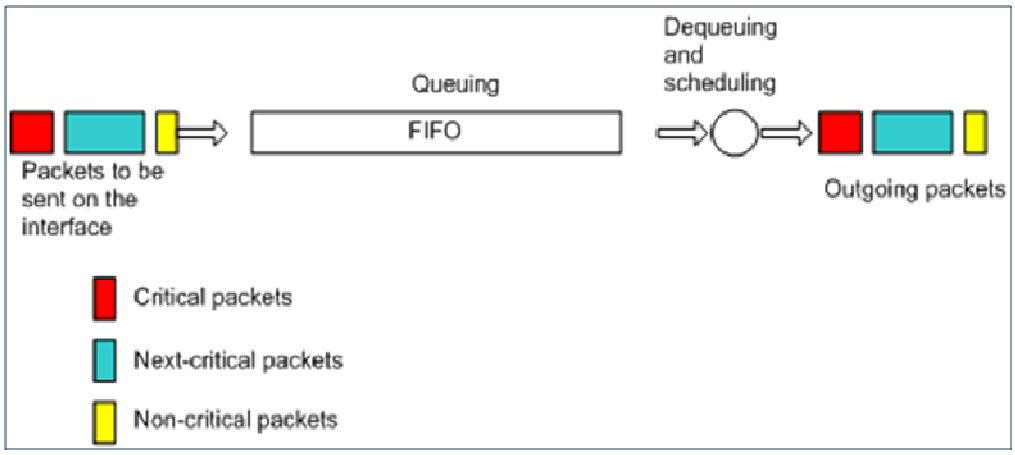

Figure 2: FIFO (Bertsimas, et al, 2011)

researches, which were conducted by Huang and Senguptain (2012) that risk metrics are nothing more than attribute or a characteristic of the risk, which is being considered.

Role of Risk Measures in Evaluating the Performance of Queues

The preceding section has encapsulated the analysis of two most important notions, including queues and risk measures. The entire analysis has played an appreciable role in presenting an idea that queues possess undeniable importance in the field networking and telecommunication (Wen and Zhu, 2014). It is due to the fact that inappropriate queues may devastatingly harm the integrity as well as credibility of the network. It has been established from the profound assessment of researches, which were conducted by Gabrel, et al, (2013) that because of having appreciable modeling power, queuing networks are widely being used in the areas of modeling communication systems, computer systems, and manufacturing systems. In order to ensure the functionality and operations of queues, in all of these areas, the researchers have discovered the technique of risk measures, which is one of the most adequate and appropriate techniques of verifying the appropriateness of the queues (Bertsimas, et al, 2011).

The notion of risk measures help in identifying the problematic and faulty patterns of the queues, which are

Table 1. Chart to Compare Queue Performance (Boucherie & Van Dijkthe, 2011)

	Data Structure	Sorting	Bounds	Nulls?
PriorityQueue	Priority heap	Sorted	Unbounded	No
ArrayDeque	Array	FIFO	Unbounded	No
LinkedList	Linked list	FIFO	Unbounded	Yes
ConcurrentLinkedQueue	Linked list	FIFO	Unbounded	No
ArrayBlockingQueue	Array	FIFO	Bounded	No
PriorityBlockingQueue	Priority heap	Sorted	Unbounded	No
SynchronousQueue	none!	N/A	0	No
DelayQueue	Priority heap	Delayed order	Unbounded	No
LinkedBlockingQueue	Linked list	FIFO	(Un)bounded	No
LinkedBlockingDeque	Linked list	FIFO	(Un)bounded	No

often, takes place during the transmission of data packets from one network to another (Huang and Senguptain, 2012). It is due to the fact that risk measures evaluate and examine each and every parameter of the queue, including item population, discipline or pattern of dispatching (basically dispatching of data packets), as well as the size of the queue. Highly integrated framework of risk measures intensely evaluate all of these constraints of the queues, in order to recognize or determine the potential flaws and unusual patterns, which are often occurred in the queuing of data packets.

It has been contended by Boucherie and Van Dijkthe (2011) that the technique of risk measures also plays an appreciable role in examining various important variables, which are associated with the performance of queues. Most importantly, risk measures enable the administrators of the network to monitor and examine the arrival rate of the data packet (Wen and Zhu, 2014). This analysis plays a significant role in assessing whether or not the queuing operations are smooth and flawless (Huang and Senguptain, 2012). Apart from the arrival rate, service time can also be estimated by the help of risk measures technique. In addition to this, network administrators can also recognized the total number of items (data packets), which are waiting in the queue (White, 2012).

Unsuitable and prolong waiting time, identified by the technique of risk measures, usually presents an idea that queues are not operating adequately; hence needs special measures to fix the problem (Gabrel, et al, 2013).

It has also been observed that risk measures may also plays an undeniable role in estimating the total number of data packets or items, which are in the residence or in a queue. This feature ultimately assists in exploring and understanding the intensity of the traffic, which is usually occurred due to the transmission or broadcasting of data packets, over the network (White, 2012).

It has been documented in the researches of Bertsimas, et al, (2011) that the analysis of this traffic usually helps the network administrators to examine the required capacity of the network. In other words, this evaluation often helps the administrators of the network to recognize the number of servers, which are required for the smooth and faultless transmission of data packets (Guo, et al, 2011). Therefore, it can be asserted that the performance of the queues can be easily measured or estimated by the help of risk measures.

CONCLUSION

From the aforementioned discussion, it can be concluded that the performance and reliability of the queues can be easily measured or evaluated by adopting the technique of risk measures as risk measures allow the network administrators to assess and evaluate the performance of queues, at each instant. This instantaneous and continual analysis eventually results in the identification of unusual performance and malfunctioning, which is often occurred in queues. The preceding paper has critically inspected

and appraised the core concept of queues. More so, the paper has also presented profound and comprehensive analysis of the technique, which is being used in examining the performance of queues, i.e., risk measures. Finally, the paper has concisely discussed an idea, which is associated with assessment of queues' performance, by utilizing risk measures.

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