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DESIGN AND INVESTIGATION OF A WEB APPLICATION ENVIRONMENT WITH FINITE CAPACITY REGION

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Abstract- One of the widespread use of the Internet in business is e-commerce. The e-commerce is the activity of buying or selling products on online services over the Internet. The web-based application plays a vital role in the business organization to promote and manage business activities. The system based on web applications streamline their operations, increase efficiency, and reduce costs. Web traffic is the volume of data transmitted and acquired by the customer to a web application server and depends upon the number of requests. The e-commerce business also involved activities, e.g., sales, purchase, marketing, and payment. Balanced web traffic is an essential requirement for e-commerce. The finite capacity system is the requirement of a web application for a failure-free environment. In the present study involved in the design and investigation of a web application system for which has a finite capacity.
Keyword: Queuing model, Web application, Finite capacity, Drop rule

1. INTRODUCTION

1.1 Web Application environment

Web applications are client server-based software applications that utilize the web browser of the client's computer and perform over the Internet. Web applications are browser supported software, build using a programming language such as JavaScript, VBScript with HTML. The web application requires a web-server to handle requests from the client computer. Some time application servers, database servers also required for the building web application systems along with web servers.

A webs-server is a computing device with specific software that uses HTTP to serve the files that form web pages to client computers, in response to their requests. A database server is a server that uses a database application that provides database services to web-server. The web-application system is a category of a 3-tier client-server system.

Figure-1 Web application environment

1.2 Queuing Theory

A queue represents a facility for service. Queuing theory uses mathematical tools used to study the behavior of queuing based systems. A queuing system consists of a stream of arriving requests, a queue, and a service stage. Jackson network is a network of queues, To calculate the inter-arrival rate of a queue used Jackson formula. The job request arrival rate of a queue can be calculated as an open Jackson network rule (Bose Sanjay Kumar, 2001). Performance modeling of the different servers, Jackson network also used in different studies. (R. S. Rajput & Anjali Pant, 2018. and R. S. Rajput, Dinesh Goyal & S. B. Singh, 2018).$\lambda_i = \gamma_i + \sum_{k=1}^{m} \delta_{ki} \lambda_k$ (1)

λi: Calculated job request arrival rate at queue i
γi: External job request arrival rate at queue i
δki: Probability a job request from queue k goes to queue i

2. METHODOLOGY

2.1 Analytical model

The model has two M/M/1 queues, first is represents web-server and second database-server, the web-server is a server for receiving requests, generates web pages as per request, and performs response operation. Service requests can be a form of

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HTTP or HTTPS. If data required on a web page, web server fetched data from the database server. Figure-2 is a block diagram of the study environment. The request arrives according to a Poisson process with rate λ to web-server. The arrival rate of the web-server and database-server are λ1 and λ2, respectively. Routing probabilities from a web-server to the database-server is δ1, and database-server to web-server is δ2. Swarup K. et al. (1996) and Panneerselvam R (2011) described the calculation of the average number of jobs in a queue.

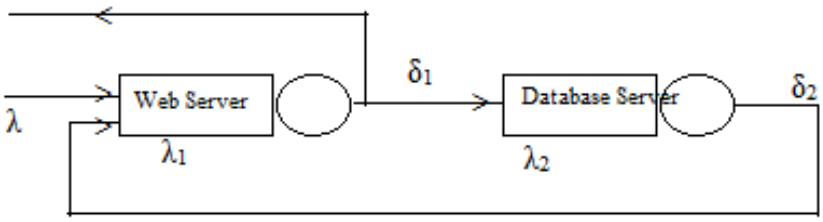

Figure-2 Block diagram of a web application environment

Request Arrival rate at web-server

$$\lambda_1 = \lambda + \delta_2\lambda_2 \quad (2)$$

The request arrival rate at the database-server.

$$\lambda_2 = \delta_1\lambda \quad (3)$$

The average number of jobs requests in web server under waiting and receiving service

$$N_1 = \frac{\lambda_1}{\mu_1 - \lambda_1} \quad (4)$$

The average number of jobs requests in the database server under waiting and receiving service

$$N_2 = \frac{\lambda_2}{\mu_2 - \lambda_2} \quad (5)$$

3. RESULTS AND DISCUSSION

Since the system is a queue of queues in serial, if the number of requests in any one station is large than the service time of station, that is the case of dropping requests. Drop rule 1 and 2 based on this phenomenon. If the number of requests in the whole environment is more substantial than a pre-defined threshold value, i.e., the finite capacity of the region, that is another case of dropping requests. Drop Rules are as given.

Drop rule 1: The μ1 is the average service time of web-server, λ1 is the arrival rate of web-server, if λ1 > μ1 system will be dropped.

Drop rule 2: The μ2 is the average service time of database-server, λ2 is the arrival rate of database-server if λ2 > μ2 system will be dropped.

Drop rule 3: F is the finite capacity of an environment, μ1, μ2 are service time of web-server and database-server respectively, λ1, λ2 are arrival rate of the web-server and database server. The system will be dropped if

$$\left(\frac{\lambda_1}{\mu_1 - \lambda_1} + \frac{\lambda_2}{\mu_2 - \lambda_2}\right) > F$$

In the present study, assume the service time of stations is the same, routing probabilities δ1=0.5,δ2=1. Figure-3 graph of output a simulation program based on equation 2,3,4,5, and drop rules.

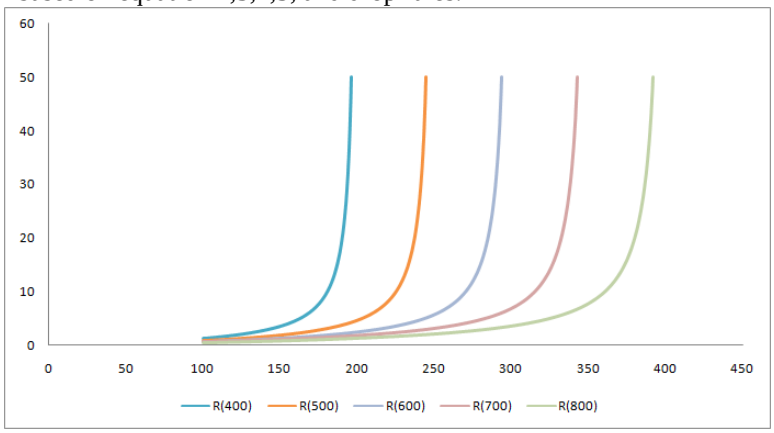

Figure-3 Number of request and arrival rate with different service time (F=50)

The number of requests under waiting and receiving service increases as it increases the arrival rate of requests in a system, the changes are following an exponential increasing pattern. At a certain amount of arrival rate, the number of requests increases very quickly and looking like a line y=constant. The quick changes are shown; the system is going to be dropped.

4. CONCLUSION

Based on the present study, after a critical examination of results, we concluded the following points.

The number of requests under waiting and receiving service increases as it increases the arrival rate of requests in a web-server as an exponential increasing pattern. At a certain amount of arrival rate, number requests under waiting and receiving service are vast, and that time the system in the state of dropped. Some drop rules also are discussed in the present study. The study is helpful for a design capacity of e-commerce applications

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