Queuing Network using Job Scheduling using Transposition Cipher

[1]Dr.V.B.Kirubanand, [2]Dr.R.Sivakumar,
Associate Professor,
Department of Computer Science,
CHRIST [Deemed to be University],
Bengaluru-560029.

Abstract

Today, network carries huge volume of data across various applications and devices. Each application depends on some service which is served from a desired server. The client's request increase in number day to day and the demands of the user are high. Computer network is broadly classified into two categories as wired and wireless with the usage of various interface devices.The technical mechanism in each of such devices varies based on the users need. The performance of each device can be analyzed and can make use of it with more efficiency. The efficiency of the network can still be improved by managing the requests in a standard framework using queuing theory and Transposition Cipher method were used for protected data transmission.

Keywords *- Queuing Networkt, job scheduling, FCFC, SJF, Priority Scheduling, Round Robin Scheduling.*

I. INTRODUCTION

Queuing theory is the mathematical study of waiting lines, or queues. The theory enables mathematical analysis of several related processes, including arriving at the (back of the) queue, waiting in the queue (essentially a storage process), and being served at the front of the queue. The theory permits the derivation and calculation of several performance measures including the average waiting time in the queue of the system[1], the expected number waiting or receiving service, and the probability of encountering the system in certain states, such as empty, full, having an available server or having to wait a certain time to be served.

A. Queuing Network Modeling

A model is an abstraction of a system: an attempt to distill, from the mass of details that is the system itself, exactly those aspects that are essential to the system's behavior. Once a model has been defined through this abstraction process, it can be parameterized to reflect any of the alternatives under study, and then evaluated to determine its behavior under this alternative.[8] Using a model to investigate system behavior is less laborious and more flexible than experimentation, because the model is an abstraction that avoids unnecessary detail.

It is more reliable than intuition, because it is more methodical: each particular approach to modeling provides a framework for the definition, parameterization, and evaluation of models.[7] Experimentation is enhanced because the framework provided by each particular approach to modeling gives guidance as to which experiments are necessary in order to define and parameterize the model. Modeling, then, provides a framework for gathering, organizing, evaluating, and understanding information about a computer system.

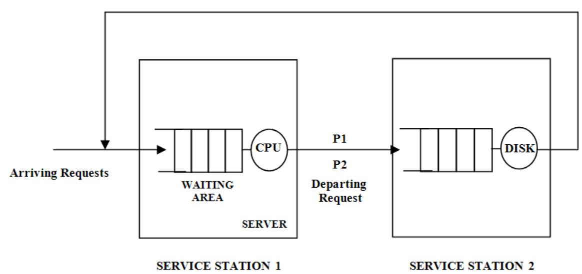


Fig. 1.1 A Typical Network Queue

Figure 1.1 shows a basic network with two queues, i.e. service stations. Arriving requests first visit service station 1, which has one server (representing CPU). After requests are served by the server, they move to service station 2 (representing a disk device) with probability p_1 or leave the network with probability p_2. Requests completing service at station 2 return back to station 1. The interconnection of queues in a network is described by the path requests, which are specified by routing probabilities. A request might visit a service station multiple times while it circulates through the network. The total amount of service time required, over all visits to the station, is called service demand of the request at the station.[2] Requests are usually grouped into classes with all requests in the same class having the same service demands. The algorithm which determines the order in which requests are served at a service station is called scheduling strategy (or scheduling/ discipline).

Queuing network modeling, the specific subject of this work, is a particular approach to computer system modeling in which the computer system is represented as a network of queues which is evaluated analytically. A network of queues is a collection of service centers, which represent system resources, and customers, which represent users or transactions. Analytic evaluation involves using software to solve efficiently a set of equations induced by the network of queues and its parameters: Some typical scheduling strategies are: FCFS, SJF, Round Robin and Priority Scheduling.

II. SCHEDULING ALGORITHM

In computer science, scheduling is the method by which threads, processes or data flows are given access to system resources (e.g. processor time, communications bandwidth). This is usually done to load balance a system effectively or achieve a target quality of service. The need for a scheduling algorithm arises from the requirement for most modern systems to perform multitasking.

A. First Come First Served

First **C**ome, **F**irst **S**erved (FCFS), is the simplest scheduling algorithm, which simply processes the jobs in the order that they arrive in the queue. The implementation of the FCFS policy is easily managed with a FIFO queue. When a process enters the ready queue, its Process Control Block (PCB) is linked onto the tail of the queue.

B. Shortest Job First

In Shortest Job First strategy, the scheduler arranges processes with the least estimated processing time, remaining to be next in the queue. It is nonpreemptive scheduling discipline. When the CPU is available, it is assigned to the process that has the smallest next CPU burst. If the two or more processes have the same length next CPU burst, FCFS scheduling is used to break the tie.[12]

SJF favors shorts jobs or processes at the expense of longer ones. SJF selects the job for service in a manner that ensures next job will complete and leave the system as soon as possible. This tends to reduce the number of waiting jobs and also reduces the number of jobs waiting behind large jobs[13]. SJF can minimize the average waiting time jobs as they pass through the system.

C. Priority scheduling

A priority is associated with each process, and the CPU is allocated to the process with highest priority. Equal-priority processes are scheduled in FCFS order. Priorities can be defined either internally or externally. Internally defined priorities use some measurable quantity or quantities to compute the priority of a process.[9] External priorities are set by criteria that are external to the operating system, such as the importance of the process.

Priority scheduling (The maximum priority process will be allocated by the CPU) can be either preemptive or nonpreemptive. When a process arrives at the ready queue, its priority is compared with the priority of the currently running process. SJF is a unique of priority scheduling with priorities associated according to the number of CPU burst necessary by the processes. A major problem with priority scheduling algorithm is indefinite blocking[10] . A process that is ready to run but lacking the CPU can be considered blocked, waiting for the CPU. A priority scheduling algorithm can leave some low-priority processes waiting indefinitely for the CPU.

D. Round-robin scheduling

The round-robin scheduling algorithm is designed especially for time-sharing systems. It is similar to FCFS scheduling. It is essentially the preemptive version of FIFO. The process are dispatched FIFO but they are given in the CPU only for a limited amount of time. CPU time is divided into time-quantum. The ready processes are queued up in a circular queue. Round robin is commonly used to generate reasonable response time to interactive users.

E. Problem Definition

The above said scheduling algorithms in terms of operating systems have been considered for organizing the network queues by encapsulating the mechanisms in the interface devices. Performance of the existing algorithms is compared by adding a new parameter which measures the efficiency.

III. RELATED WORK

Network analysis mainly focuses on the traffic monitoring and the data loss. Many of the algorithms have been developed to manage the computer networks to transfer the data packets efficiently.[11] Few of such works were done on concentrating with the client waiting time and queuing mechanism.

Related work has been done by many of the researchers based on the Job Scheduling algorithms. The operating systems job scheduler organizes and processes the tasks and request from the applications[3]. Various kinds of algorithm are written to solve the problem of parallel processing and multi tasking.

Parallel applications can be executed using the idle computing capacity of workstation clusters. However, it remains unclear how to schedule the processors among different applications most effectively. Processor scheduling algorithms that were successful for shared-memory machines have proven to be inadequate for distributed memory environments due to the high costs of remote memory accesses and redistributing data.[4] The existing work investigates how knowledge of system load and application characteristics can be used in scheduling decisions. Algorithm based on adaptive equipartitioning, which, by properly exploiting both the information types above, performs better than other nonpreemptive scheduling rules, and nearly as well as idealized versions of preemptive rules (with free preemption) by Kumar and Meyn (1996).

The wide availability of workstation networks and the rapid evolution of workstation technology is a motivation for investigating methods of harnessing the full power of such systems. Individual workstations are not usually effectively utilized by their owners. Owners may be willing to lend the processing power of their workstations if used in an unobtrusive way. The ability to effectively borrow the idle cycles of the workstations in a network and efficiently schedule parallel application programs concurrently onto those idle workstations is the topic of this work. In this work, a distributed[17] scheduling algorithm that will track the available workstations, i.e. workstations not used by their owners, in networks and act upon those workstations by scheduling processes of parallel applications onto them.

IV. PROPOSED METHODOLOGY

The aim of the work is to process the client's requests and organize with a multi-mechanism scheme so that the response from the server to various clients is on time and adequate.[6] Network devices are categorized on broad classifications as wired and wireless and furthermore these devices are analyzed and their performances are evaluated.

In continuation with the above, the next idea is to implement various CPU job scheduling schemes in the queue to organize the request processing.

In this work four job scheduling algorithms, FCFS, SJF, Priority Algorithm and Round Robin Mechanism are taken. For each of the above said scheduling method the following parameter are measured in a network:

- Arrival Time
- Service Time
- Waiting Time
- Total Waiting Time
- Average Waiting Time
- Turn Around Time
- Efficiency
- Average Turn Around Time
  Throughput

Scheduling objectives are minimizing the average Turn Around Time (TAT) of the scheduled applications and maintaining fairness among scheduled applications by granting each application all the resources it requires.[15] Moreover, scheduling solutions are narrowed to those that produce a responsive and scalable scheduling algorithm. A distributed computer system that consists of a set of heterogeneous host computers connected in an arbitrary fashion by a communications network is considered.[5] A general model is developed for such a distributed computer system, in which the host computers and the communications network are represented by product-form queuing networks. In this model, a job may be either processed at the host to which it arrives or transferred to another host.

In the latter case, a transferred job incurs a communication delay in addition to the queuing delay at the host on which the job is processed. It is assumed that the decision of transferring a job does not depend on the system state, and hence is static in nature. Performance is optimized by determining the load on each host that minimizes the mean job response time. [16].

V. RESULTS OBTAINED

The results are shown in the table 5.1 for the existing job scheduling algorithm by replacing all the jobs by client's request.

Table 5.1 : Scheduling Algorithm

Algorithms	C	AT	ST	WT	TWT	AWT	TAT	ATAT	T
FCFS	C1	1	24	0	46	15.333	24	26.33	11
	C2	2	3	22			25		
	C3	3	6	24			30		
SJF	C2	2	3	0	8	2.666	3	13.666	
	C3	3	6	0			6		

	C	AT	ST	WT	TWT	AWT	TAT	ATAT	T
	C1	1	24	8			32		
RR Quantum: 2	C1	1	24,22,20,18	32	68	22.660	31	17	
	C2	2	3,1,0	10			9		
	C3	3	6,4,2	26			11		
Priority	C3	3	6	0	12	4	6	15	

C : Clients ; AT : Arrival Time; ST: Service Time; WT: Waiting Time; TWT : Total Waiting Time; AWT: Average Waiting Time; TAT : Turn Around Time; ATAT : Average Turn Around Time; T : Throughput

Fig 5.2 Average Wait Time for Three Clients C1, C2, C3

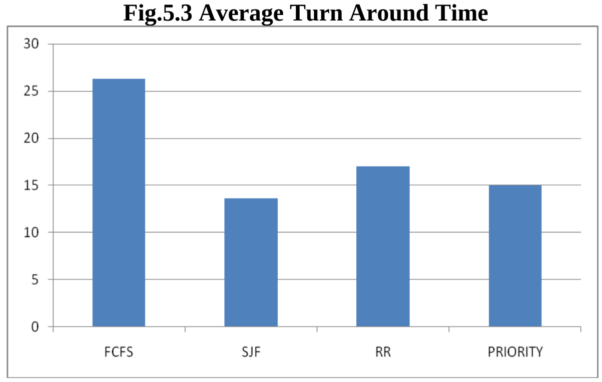
Table 5.2 shows the comparison of scheduling algorithms with a new parameter for efficiency. This method has been proposed and has been concluded to improve the queuing network scheduling mechanism with more efficiency.

Table 5.2 Proposed Scheduling Algorithm Comparisons (Efficiency Result Obtained)

Algorithms	C	AT	ST	WT	TWT	AWT	TAT	E	AE	T
FCFS	C1	1	24	0	46	15.333	24	0.042	0.0383	11
	C2	2	3	22			25	0.040		
	C3	3	6	24			30	0.033		
SJF	C2	2	3	0	8	2.666	3	0.33	0.176	
	C3	3	6	0			6	0.17		
	C1	1	24	8			32	0.03		
RR Quantum: 2	C1	1	24,22,20,18	32	68	22.660	31	0.03	0.076	
	C2	2	3,1,0	10			9	0.11		
	C3	3	6,4,2	26			11	0.09		
Priority	C3	3	6	0	12	4	6	0.17	0.113	
	C2	2	3	4			7	0.14		
	C1	1	24	8			32	0.03		

C : Clients; AT : Arrival Time; ST: Service Time; WT: Waiting Time; TWT : Total Waiting Time; AWT: Average Waiting Time; TAT : Turn Around Time; E : Efficiency; ATAT : Average Turn Around Time; T : Throughput.

Fig.5.3 Average Turn Around Time



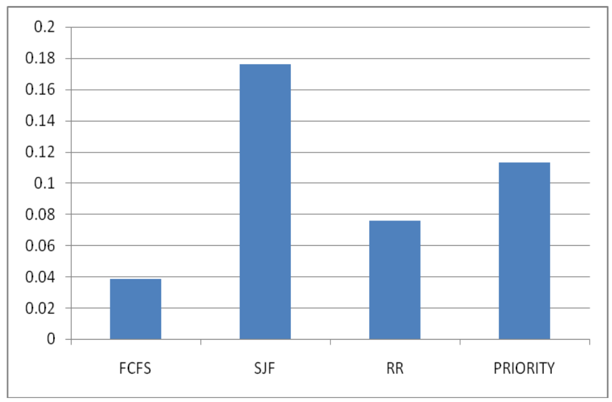


Fig. 5.4 Average Efficiency of Client C1,C2,C3

VI. TRANSPOSITION CIPHER

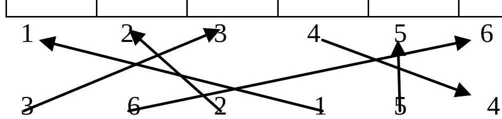
In Cryptography a Transposition Cipher is a method of encryption by which the positions held by units of plaintext are shifted according to regular system, so that the cipher text constitutes a permutation of the plaintext.

Technique:
KEY: 6 Character 3 6 2 1 5 4

Plaintext: 6 Characters : GODDAY

PLAIN TEXT

G	O	D	D	A	Y



Replaced and it shows:

CIPHER TEXT

D	Y	O	G	A	D

The Data have converted into cipher text no there is a secure for data while accessing from Queuing Network architecture through Transaction devices.

VII. CONCLUSION

The existing Queuing network mechanism works well if the processes and requests have equally load balanced. In the proposed methodology, various job scheduling algorithms like FCFS, SJF, RR and Priority Scheduling are considered.
The above said job scheduling algorithms are already proven mechanism in CPU scheduling. Here the processes are replaced by client requests and sample of 3 clients are taken. The performance results and the efficiency are shown for Arrival Time, Service Time, Waiting Time, Total Waiting Time, Average Waiting Time, Turn around Time, Efficiency, Average Efficiency, Average Turn around Time and Throughput.

These mechanisms are individually analyzed in terms of their process parameters and also the efficiency of each results were obtained. The main idea behind the analysis of these scheduling mechanisms is that it can be additionally used in the existing queuing network. But still, the data transmissions will be inefficient with wait time when a bulk request is sent to the server. Hence, the waiting processes may be collided due to time delay. This has been considered with the implementation of queuing petri net in future enhancement, where the waiting time is disabled.

The main purpose of this paper is to get the subsequent parameters with the usage of Queuing network with job scheduling, with Transposition method in a high protected manner for any Transaction.

REFERENCES

[1] Andrew D. Ker "Steg-analysis of Embedding in Two Least-Significant Bits" IEEE Transactions on Information Forensics and Security, Vol. 2, pp 662-672, 2007

[2] Arora K.L. "Two client server bulk service queuing processes Opns.,Vol. 12, PP 286 - 294, 1964.

[3] Chobrolu. S, A. Abraham, P. Johnson, feature detection and ensemble design of intrusion detection systems, Elsevier, Computer and Security ,Vol. 24, pp. 195 – 207, 2005.

[4] Denteneer, T.J.J., J.S.H. van Leeuwaarden, J.A.C. Resing ,"Bounds for a discrete-time multi ervervueue with an application to cablenetworks", In proceedings of ITC 18, Elsevier, Berlin pp. 601-612, 2003.

[5] Dimitris C. Psichogios and Lyle H. Ungar "A Hybrid Neural Network- First Principles Approach to Process Modeling"

[6] Gabor Imre, Agnes Bogardi-Meszoly, Hassan Charaf "Measuring and Modelling the Effect of the application tuning parameters on performance" 4th Slovakian-Hungarian Joint Symposium on Applied Machine Intelligence, 2006.

[7] Gohain, R. and Borthakur, A. "On difference equation technique applied to bulk service queue with the server", Pure and Applied Mathematics Science: X(1-2) PP 42-461979

[8] Lee H.W., Chung, D.L., Lee, S.S and chae, K.C (1997), "client server unavailability reduces mean waiting time in some batch service queuing systems", Computer and Ops. Res., Vol. 24, pp. 559-567.

[9] Mohammed Ali Bani Younes, Aman Jantan, A new Stegonagraphy Approach for image encryption exchange by using the LSB insertion, Integration Journal of Computer Science and Network Security, Vol 8. No.6 , pp 247-254. 2008.

[10] Ramaraj. E and S. Karthikeyan, "A New Type of Network Security Protocol Using Hybrid Encryption in Virtual Private Networking" Journal of Computer Science, 2: PP 672-675,2006.

[11] Ross. J. Anderson, Fabian A.P. Petitcolas, On the Limits of stegonography, IEEE Journal of Selected Areas in communication 16(4),pp.474-481, 1998.

[12] Samuel Kounev, Alejandro Buchman "Performance Modelling of Distrubuted E-Business Applications using Queuing Perti Nets" IEEE International, 2003

[13] Stamatelopoulos F., Roussopoulos N. and Maglaris B. "Using a DBMS for Hierarchical Network Management" 1995.

[14] V.B.Kirubanand,S.Palaniammal, Performance Modeling in cloud computing architecture network comparison of Hub,Switch and Bluetooth Technology using Markov Algorithm and Queuing petrinets with the securityof steganography .International journal of advanced networking and applications.Volume: 01,Issue:05,pages:331-336.March-April 2010.

[15] V.B.Kirubanand,S.Palaniammal, Performance Modeling in Comparison of Switch andBluetooth Technology by using Markov Algorithm and Queuing Petrinets with the security of Steganography, Far East Journal of Experimental and Theorwetical Artificial Intelligence. Volume 4, No:1, 2009, pages:33-43, March 2009.

[16] V.B.Kirubanand, S.Palaniammal, A Hybrid model in comparing the performance of wired nd Wireless Technologies by using the Markov algorithm and Queuing Petrinets, International journal of computer application, No:4 Article-1, Pub: Foundation of computer Science, 2010.

[17] V.B.Kirubanand, S.Palaniammal, Performance Modeling of Cloud computing architecture with Mobile-Fi Application Using Queuing Petri nets by Markov Algorithm with Security of Cryptography, International Journal Network and Computer Engineering ISSN 0975-6485 Volume 1 Number 1(2010) pp. 1-9, 2010.