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A Comparative Analysis Of A Single Queue Anda Multiple Queue in A Multi-Server Model In BSNL Customer Service Centre

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ABSTRACT

In this paper a model M\M\N\S is studied where N stands for the number of queues that can be considered in particular situation and S stands for the number of servers. A comparison is done between a Multi-Server model with single queue and multiple queues. Data on the number of customers serviced within the stipulated time interval was obtained by direct observation.

KEY WORDS: Operations Research, Queuing Theory, M\M\N\S, Comparison, Multi server model with multiple queues.

I INTRODUCTION

Queues are a common sight in service Centres these days. Though the technology explosion has led to the increase in mobile banking and internet banking, people from the lower strata of life and many other elderly people / senior citizens still prefer to pay at the counters. So there arises a need for reducing the waiting time at the queues. This study conducted at a BSNL service Centre at Coimbatore (Tamil Nadu) has given a clear picture of the arrival and departure pattern followed in those queues. The comparative study done between a multi-server model with single and multiple queues prove to be effective and could be implemented to reduce the waiting time of the customers.

II METHODOLOGY OF STUDY

- Data was collected based on the arrivals and service times
- Parameters λ, the arrival rate and μ, the departure rate was estimated

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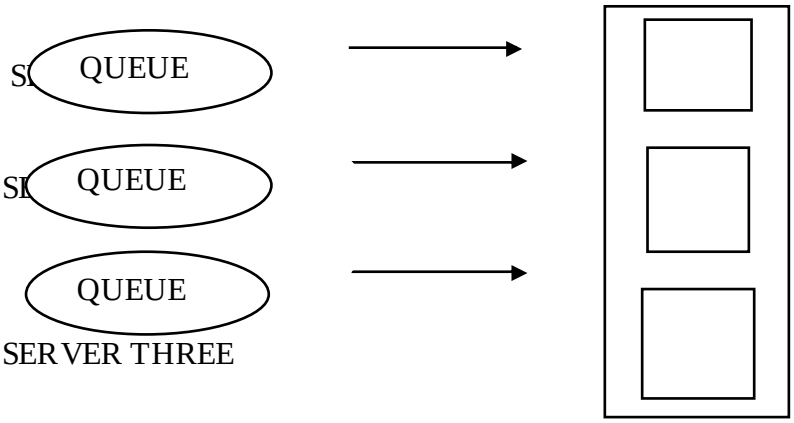
- Data distributions were tested for statistical conformity to the assumed theoretical probability distribution using the Chi-square tests for goodness of fit
- Analytical solutions were calculated using λ&μ
- Calculated values were used to compare a single queue multi servers & multi queues multi server models

III MODEL DESCRIPTION

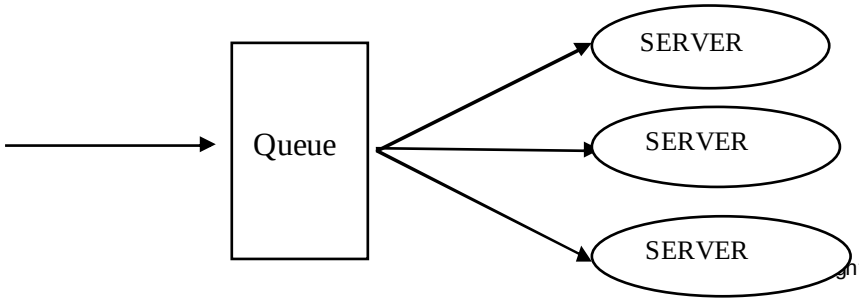
M\M\1 model where the arrivals follow Poisson distribution and the service time follows exponential distribution is considered for this study. The 3 queue 3 server model (M\M\3\3) and single queue with multi servers (M\M\1\3) were diagrammatically represented as follows:-

3.1 Three Queues with Three Server (M\M\3\3)



Here, in this system there is the multiple server with the multiple queue. This has the Poisson arrival and Poisson distribution with the three servers. We have represented these in (M/M/3/3).

3.2 Single Queue with Multiple Servers (M\M\1\3)



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Herein this system there is the multiple server with the single queue which has the Poisson arrival and Poisson distribution with the three servers. We have represented these in (M/M/1/3).

IV DATA ANALYSIS AND INTERPRETATION

Table:4.1

	BSNL	
Days	Total No. of arrivals	Total No. of service
1	61	51
2	58	52
3	62	53
4	67	54
5	65	55
6	59	56
7	63	55
8	71	53
9	70	57
10	68	54
Total	**644**	**540**

From the above table of collected data the parameters λ&μ were calculated. The other operating characteristics L_q, L_s , W_q and W_s were calculated by using the formulas given below and were tabulated.

For a (**M\M\3\3)** queue

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$$L(s) = \frac{\lambda}{(\mu-\lambda)}$$

$$L(q) = \frac{\lambda^2}{\mu(\mu-\lambda)}$$

$$W(s) = \frac{1}{(\mu-\lambda)}$$

$$W(q) = \frac{\lambda}{\mu(\mu-\lambda)}$$

For a (**M\M\1\3)** queue

$$p_0 = \left[\sum_{n=0}^{k-1}\frac{1}{n!}\left(\frac{\lambda}{\mu}\right)^n + \left(\frac{1}{k!}\right)\left(\frac{\lambda}{\mu}\right)^k\left(\frac{k\mu}{k\mu-\lambda}\right)\right]^{-1}$$

$$L(s) = \lambda\mu\left(\frac{\lambda}{\mu}\right)^k\frac{p_0}{(k-1)!(k\mu-\lambda)^2} + \left(\frac{\lambda}{\mu}\right)$$

$$L(q) = \mu\left(\frac{\lambda}{\mu}\right)^k\frac{p_0}{(k-1)!(k\mu-\lambda)^2}$$

$$W(s) = \frac{L(s)}{\lambda}$$

$$W(q) = \frac{L(q)}{\lambda}$$

Table:4.2

S.NO	Particulars	M/M/3/3	M/M/1/3
1	λ	0.0714	0.2143
2	μ	0.1552	0.1552
3	$\frac{\rho}{3}$	0.4603	0.4603
4	P_0	0.5400	0.2998

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5	L_q	0.3920	0.2078
6	L_s	0.8520	1.5886
7	W_q	5.4902	0.9697
8	W_s	11.9332	7.4131

V CONCLUSION

While comparing a single queue-multi server and a multi queue- multi server models for the existing situations, it is found that a single queue with multiple servers is better than a multiple queues with multiple servers. From the Table.4.2 when the customers to the 3 servers are fed from a single queue, the $W_s$and W_q reduces to a great extent, than the situation where all the three servers are fed from three different queues.

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