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Reducing effect of delay in voice and data in integrated networks.

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Abstract

This paper introduces the importance of queuing in integrated networks. Our study will be included the defining, analysis and importance of M/M/1 model "markovian (i.e. Exponential)/markovian/number of server" in queuing. The analysis of M/M/1 model is presented and indicate that the importance of M/M/1 model in queuing but at a certain values of$\boldsymbol{\lambda}$ "arrival rate" &µ "service rate ".After making comparison between a previous study carried out and my self-study with different values of arrival rate ($\boldsymbol{\lambda}$) in integrated networks, indicate that traffic intensity "ρ" must be less than one "$\rho < 1$" ,with decreasing the values of " λ&µ " the values of waiting time in system and queuing are very high and with increasing the values of "$\boldsymbol{\lambda}$&µ" at condition $\boldsymbol{\lambda}$<µ can obtain the best parameters of L_s" mean number (length) of packet in the system ",L_q " mean number (length) of packet in the queue ",W_s" The total waiting time in system including service time" and W_q" mean time waiting spent in queue". These parameters is very important especially W_s,W_q as they are effects on a timming of queuing which in turns effects in reducing delay in voice and data in integrated networks.
Keywords: M/M/1 queuing model; probability distribution; Queuing theory; Poisson process; Numerical results and simulation for M/M/1 queuing model.

1. Introduction

The analysis of queuing system and its variables have been focus on many studies and researches for many decades. Traffic characteristics of integrated network (internet network) are influenced by various factor likes noise exited in line of mobile phone by ADSL service, the amount of the co-Speed, Hardware and cables for connecting the Internet, Router type, etc. Traffic congestion significantly effects on integrated network. It's found that the speed of internet is very slow at rush hours. it could be overcame this problem by slow speed of the Internet in prime time by browsing the back light and closing the automatic download of pictures and avoid watching video, etc. Traffic congestion on integrated network causes slow internet speed and slows to arrive any information. The traffic organization in integrated network is more serious day after day; it is based on queuing theory. In this model is constructed mean queue length, mean waiting time, customer mean service time and arrival rate and traffic intensity. Queuing systems may be characterized by complex input process, service time distribution, number of servers (or channels), buffer size (or waiting room) and queue disciplines [1]. In practice, such queuing processes and disciplines are often not amenable to analysis. Nevertheless, insight can be often gained using simpler queuing models. Modeling simplification is often made when the aim is to analyze a complex queuing system or network, such as the Internet, where packets on their ways to their destinations arrive at a router where they are stored and then forwarded according to addresses in their headers. One of the most fundamental elements in this process is the single-server queue (SSQ) [2].

2. Analysis of queuing models

2.1 Definition of a queuing system

It’s used to store traffic until it can be processed or serialized.

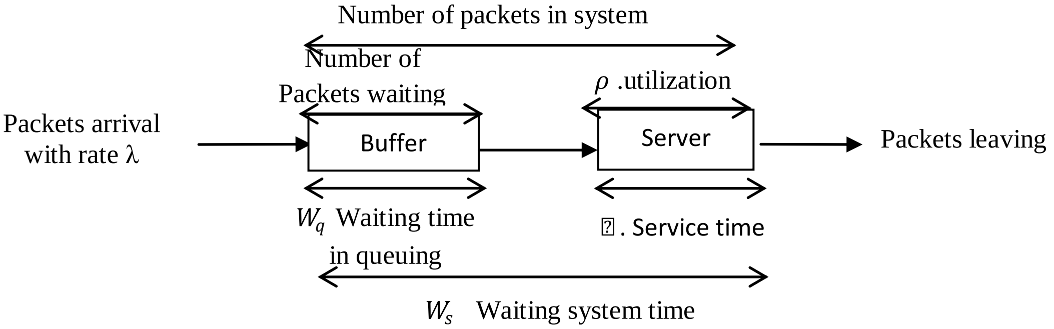

Figure 1Qeuing system diagram

A queuing system can be described as follow: "packets arrive for a given service, wait if the service cannot start immediately and leave after being served"

The term "packets" can be men, products, machines, message, and customers

2.1.1 Characteristics of simple queuing systems

Queuing systems can be characterized with several criteria:
packets arrival processes, Servicetime, Servicediscipline, Service capacity and Number of service stages [3].

2.1.2 Notation of Kendall

There is a standard notation for classifying queuing systems into different types. Systems are described by the notation [4]:

T / X / C / K / P/Z

The following is a standard notation system of queuing systems
T/X/C/K/P/Z with

– T: probability distribution of inter-arrival times
– X: probability distribution of service times
– C: Number of servers
– K: Queue capacity
– P: Size of the population
– Z: service discipline

2.1.3 Customer arrival process

The Arrival Process is the first element of the queuing structure that relates to the information about the arrival of the number of customers in the system, whether they come individually or in groups. Also, at what time intervals people come and are there a finite number of customers
T/X/C/K/P/Z
T can take the following values:

– M:markovian (i.e. exponential)
– G: general distribution
– D: deterministic
– E_K : Erlang distribution

2.2 Queuing model:

2.2.1 M/M/1 Queuing model

The simplest queuing modal is M/M/1[5], where both the arrival time and service time is exponentially distributed .M/M/1 queuing system presume a Poisson arrival process and we will apply on a single server [6]. This assumption is very good approximation for arrival process in real systems that meet the following rules [7].

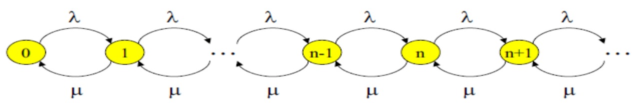

Figure 2 State Transition Diagram of M/M/1

I) The number of packets in the system is very large. The impact of the single packet for the performance of the system is very small, that is a single packet consumes a very small percentage of system resources.
II) All packets are independent. Their decisions to use the systems are independent of other users.
III) This probability density distribution equation for a Poisson process describes the probability of seeing n arrivals in a period from 0 to t.

$p_n(t)=\frac{(\lambda t)^n e^{-\lambda t}}{n!}$(1)

Where t :is used to define the interval 0 to t.

N - Total number of arrivals in the interval 0 to t.

λ- is the total average arrival rate in arrivals /second.

First we define the traffic intensity. It is define as the average arrival rateλ divided by the average service rate µ.For a stable system the average service rate should always be higher than the average arrival rate[8].

ρ - Should always be less than one. $\rho = \lambda/\mu$(2)

Mean number (length) of packet in the system can be found using the following equation.

$L_s=\lambda/\mu-\lambda$.(3)

Mean number (length) of packet in the queue

$L_q= \rho^2/1-\rho$. (4)

The total waiting time including service time

$W_s= 1/\mu-\lambda$.(5)

Mean time waiting spent in queue

$W_q= \rho/ \mu (1-\rho)$. (6)

3. Numerical results and simulation:

3.1Queuing values for M/M/1 model:

1. At values ρ=".65, .75, .8, .9"with decreasing the values of "λ & µ"

Table 1: Variation of ρ with W_q at different λ" with decreasing the values of "λ &µ"

λ=.2(per min)					
µ(per min)	ρ	L_s	L_q	W_s(min)	W_q(min)
0.3	0.65	1.86	1.2	9.5	6.2
0.27	0.75	3	2.25	14.8	11.11
0.25	0.8	4	3.2	20	16
0.22	0.9	9	8.1	45.5	40.9
λ=.1(per min)					
µ(per min)	ρ	L_s	L_q	W_s(min)	W_q(min)
0.15	0.65	1.86	1.2	19	12.4
0.13	0.75	3	2.25	30.76	23
.0125	0.8	4	3.2	40	32
0.11	0.9	9	8.1	90.9	81.8
λ=.05(per min)					
µ(per min)	ρ	L_s	L_q	W_s(min)	W_q(min)
.07	.65	1.86	1.2	40.8	26.5
.066	.75	3	2.25	60.6	45.5
.0625	.8	4	3.2	80	64
.055	.9	9	8.1	181.8	163.6
λ=.025(per min)					
µ(per min)	ρ	L_s	L_q	W_s(min)	W_q(min)
.038	.65	1.86	1.2	75.2	48.9
.033	.75	3	2.25	121.2	90.9
.03125	.8	4	3.2	160	128
.0277	.9	9	8.1	361	324.9
λ=.02(per min)					
µ(per min)	ρ	L_s	L_q	W_s(min)	W_q(min)
.03	.65	1.86	1.2	95.2	61.9
.026	.75	3	2.25	153.8	115.4
.025	.8	4	3.2	200	160
.022	.9	9	8.1	454.5	409

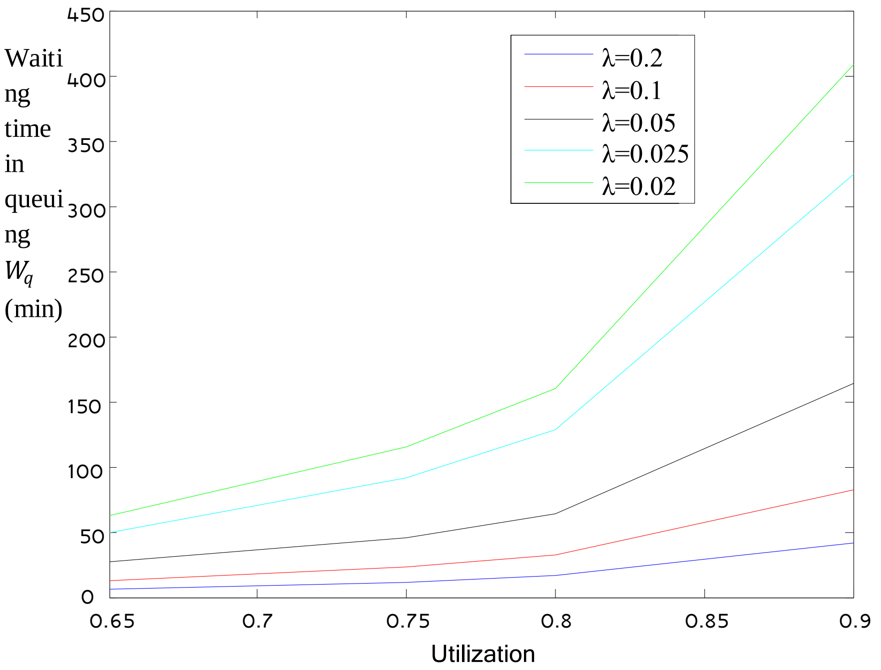

Figure 3 with decreasing the values of "λ"

In this case of decreasing the values of arrival rate "λ", indicate that no changes at the parameters "L_s , L_q" but only changes at the parameters "W_s , W_q".This comparison indicate that with decreasing the values of λ the values of parameters "W_s , W_q"increase.

Waiting time in queuing W_q (min)

2. At values ρ=".56, .7, .79, .83, .88"with increasing the values of "λ&μ" .

Table 2:Variation of ρ with W_q at different λ" with increasing the values of "λ&μ"

λ=15(per min)					
μ(per min)	ρ	L_s	L_q	W_s(min)	W_q(min)
26.8	.56	1.27	.71	.08	0.05
21.4	.7	2.33	1.6	0.16	0.1
19	.79	3.8	2.9	0.3	0.2
18	.83	4.9	4	0.32	0.3
17	.88	7.33	6.5	0.49	0.43
λ=17(per min)					
μ(per min)	ρ	L_s	L_q	W_s(min)	W_q(min)
30.4	.56	1.27	.71	0.07	0.04
24.3	.7	2.33	1.6	0.13	0.09
21.5	.79	3.8	2.9	0.22	0.17
20.5	.83	4.9	4	0.28	0.24
19.3	.88	7.33	6.5	0.43	0.4
λ=20(per min)					
μ(per min)	ρ	L_s	L_q	W_s(min)	W_q(min)
35.7	.56	1.27	.71	0.06	0.03
28.6	.7	2.33	1.6	0.11	0.08
25.3	.79	3.8	2.9	0.2	0.15
24	.83	4.9	4	0.25	0.2
22.72	.88	7.33	6.5	0.4	0.32
λ=23 (per min)					
μ(per min)	ρ	L_s	L_q	W_s(min)	W_q(min)
41	.56	1.27	.71	0.05	0.03
32.9	.7	2.33	1.6	0.1	0.07
29.1	.79	3.8	2.9	0.16	0.13
27.7	.83	4.9	4	0.2	0.17
26.1	.88	7.33	6.5	0.31	0.28
λ =26 (per min)					
μ(per min)	ρ	L_s	L_q	W_s(min)	W_q(min)
46.4	.56	1.27	.71	0.04	0.02
37.1	.7	2.33	1.6	0.08	0.06
32.9	.79	3.8	2.9	0.14	0.11
31.3	.83	4.9	4	0.18	0.15
29.5	.88	7.33	6.5	0.28	0.24

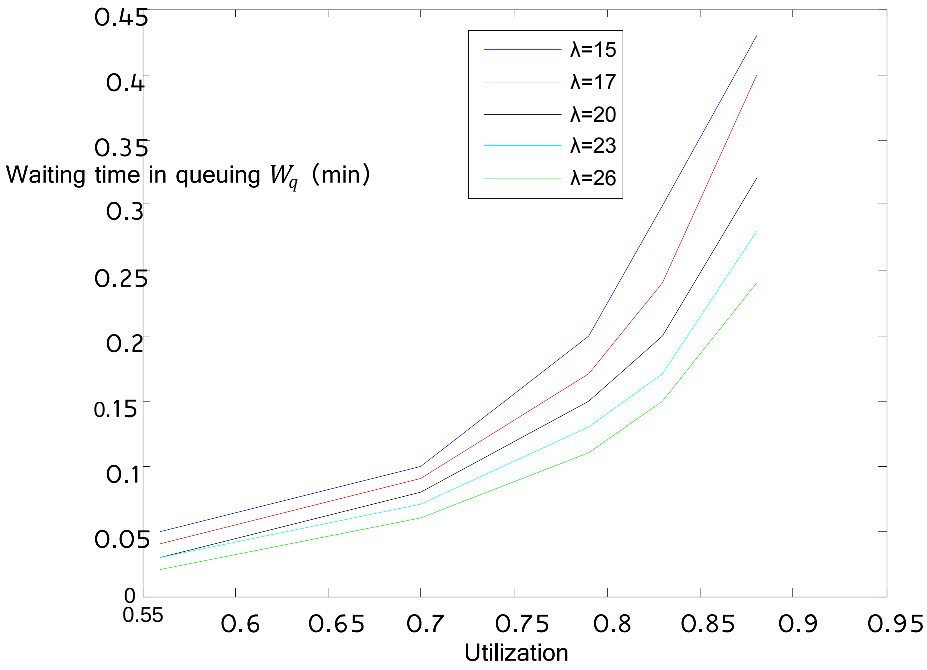

Figure4 with increasing the values of " λ "

In this case of increasing the values of arrival rate "λ", indicate that no changes at the parameters "L_s , L_q" but only changes at the parameters "W_s , W_q".This comparison indicate that with increasing the values of λ the values of parameters "W_s , W_q"decrease. From these result can obtain the best parameters "W_s , W_q"to reducing the effect of delay in voice and data in integrated networks.

A previous study carried out in work [8] for, M/M/1 model but in this work another parameter used at different ranges. This comparison confirms that M/M/1 model can be used in reducing the effect of delay in voice and data in integrated networks but at a certain range of (λ &μ). The result confirmed by increasing the value of (λ&μ) at a condition of $\lambda<\mu$, suitable parameters "L_s , L_q , W_s , W_q"can obtained.

4.Conclusion

Analysis of M/M/1 model is presented. A comparison is made between a previous study carried out in work [8] and my self-study for M/M/1 only. This comparison confirms that with increasing the values of arrival rate "λ" at a condition of $\lambda<\mu$, suitable parameters "L_s , L_q , W_s , W_q"can obtain.

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