Analysis of Signals in Communication System under Buffer Handover Scheme: A Queuing Approach

Rohit[1] and Richa Sharma[2]
[1]Department of ECE, JK Lakshmipat University, Jaipur-302021 (India)
[2]Department of Mathematics, JK Lakshmipat University, Jaipur-302021 (India)
Email:[1]goyal3268@gmail.comand [2]aligarh.richa@gmail.com, richasharma@jklu.edu.in

Abstract - This study deals with the queuing of handoff signals (HS) and originating signals (OS) under buffer size having a number of data buses for the communication of signals. Service of signals is done according to first come first serve (FCFS) discipline. On the other hand, when a priority signal arrives then buffer hand overs that signal to data bus and interrupt the communication of on-going signals. Moreover, the buffer handover scheme (BHS) has taken into the consideration for dealing the communication model. Further, we employ Runge Kutta (RK) method for determining various performance measures of communication system such as blocking rate of priority signal, traffic of HS and OS in the system and many more. At last, conclusions are given.

Keywords: Priority signals, Handoff signals, Buffer, Data buses, Blocking, Service, R-K method.

1. Introduction

Communication system includes transfer of packets of data from one system to another system with the help of data buses. Mainly, there are two types of communication namely serial and parallel communication. Serial communication involves single data bus for communication of signals with packets of data and having low speed whereas parallel communication is having a number of data buses for communication of signals with high speed as compared to serial communication. In respect of this context, various researchers have proposed their theory in different frameworks**.**

Frequency analysis method in mobile communication signals has been studied by **Savas et al.** in (2012) which showed measurement of mobile communication signals accessed by users and the signal strength performances of GSM networks. Their research has proved that although the companies providing mobile communication services announce their widespread coverage area, the signal strength levels accessed by users show significant differences among the networks. Low frequency signals in communication architecture was investigated by **Mathew** in (2014) wherein a architecture was proposed with wideband multichannel transmission. In his study, signals could work with low energy and bandwidth for obtaining the results. Communication with wireless mesh networks (WMNs) was studied by **Shahdad et al.** in (2015). They concluded that each node is having a wireless network which maintains a reliable path from source to destination. Their study abled to enhance network life time, reduced number of packet loss during packet transmission and having significant reliability enhancement as compared to other routing algorithms. For digital signal processing, modified rounding based approximate multipliers was studied by **Suhasini and Selvakumar** in (2018). They have applied Xilinx ISE 14.7 where in conventional multiplier was modified for the accurate and exact results to the given inputs.

Queuing theory has wide application in communication networks, manufacturing systems, data processing and many more. It mainly deals with arrivals, servicing and blocking of units/items/calls/signals. Arrivals of signals can be treated as ***arrival pattern*** and their service as ***service pattern***. Therefore, communication of signals can be represented in terms of queuing theory as it deals with the probability of all queued which is to be serviced and blocked. Many researchers have given their prominent theories which combined both fields of communication and queuing approach. In fig. 1, we represent the pictorial view of communication for priority or originating signals using queuing approach.

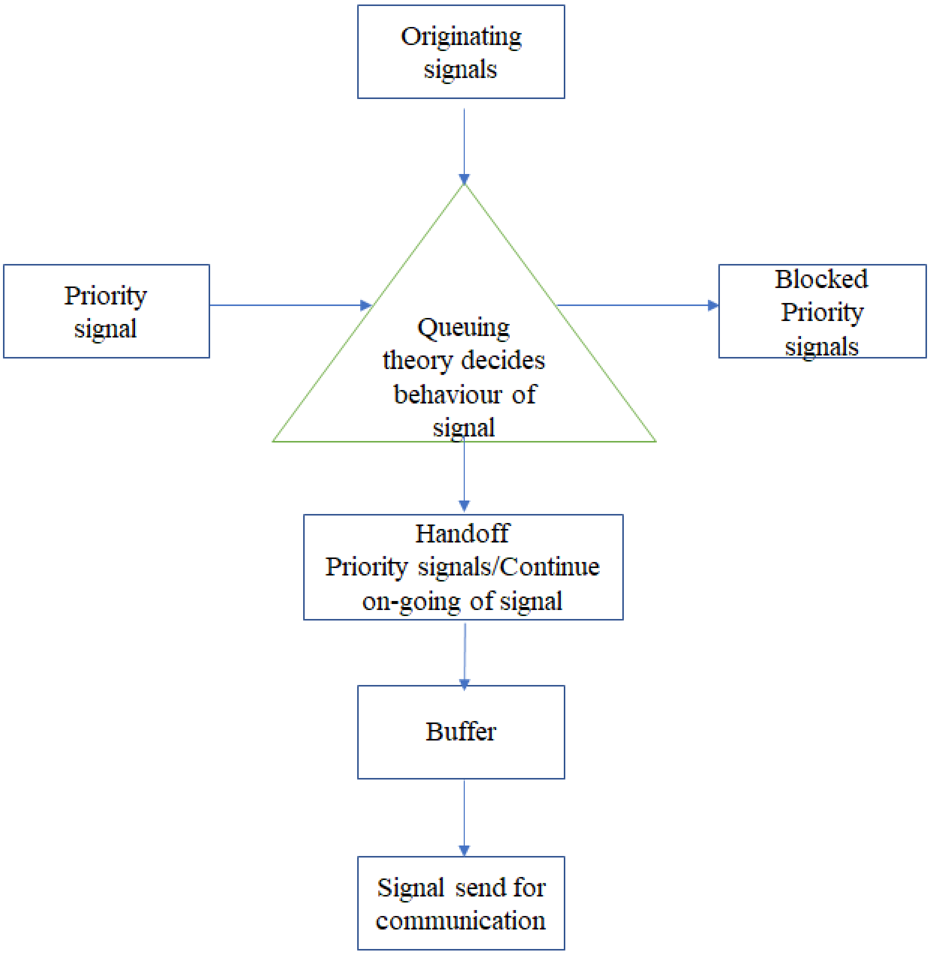

Fig. 1: Communication of various signals under queuing approach.

Wireless priority queueing system under a two-state Markov chainwas investigated by **Xie and Haenggi** in (2003). They concluded that a two-class prioritized system with a bounded delay (BD) dropping strategy can be utilised in determining delay-guaranteed sensor network. Low priority (LP) and high priority (HP) flow was analysed usingdelay and dropping statistics. Channels with no waiting line with queuing approach was studied by **Saglamand Zobu** in **(2013)**. Their study was having a new queuing model with two stations which were having their individual and independent servers. They observed thatat station 1, there is no restriction with optimized service time for customers at servers and at station 2, no queue is allowedTheories and application of queuing systems was studied by **Al-Matar** in (2016). Matar showed owners of different organizations analyzed the percent at which, customers wait for their services to be given to them and improve the percentage of services. Queuing systems of multiple access of communication channels with optimal design was studied by **Sonkin et al.** in (2016). They provided mathematical model of queuing systems for the communication network with multiple access under a heavy load condition. Queue model for oversaturated signal intersections was investigated by **Liu et al.** in (2018) showed consistency of the vertical and horizontal queue models. Quasi-real-time reconstruction of queueing profiles were used for signal intersections using very limited mobile sensing data.

This paper deals with multidisciplinary approach which involves serial communication, buffer, priority signals under queuing strategy. Buffer used to do service of originating signals but if in ongoing packets of data, suddenly a signal come which is to be send first then buffer which is having a number of data buses act it as a priority signal. All the signals which are under service routine are interrupted in that case. For finding the rate for which buffer has to either treat as priority and after how much time it has to be blocked is studied under the queuing approach. Section 2 depicts the model design and notations under different assumptions. In section 3, governing equations are given using state transition diagram. In section 4, performance indices are provided with different formulas for BHS. Section 5 contains all the numerical illustrations with different tables and graphs. Conclusions are given in section 6.

2. Model Description

In our study, we develop a mathematical model under BHS wherein HS or OS both arrive according to time dependent Poisson distribution. Fig.2 shows communication of signal in buffer which is having data buses. Communication of signals is done in buffer with help of multiplexer and de-multiplexer. If in on-going communication of signal, a priority signal arrives, then buffer hand overs that signal to data bus or blocked that signal according to the queuing theory. After passing through buffer all signals are served.

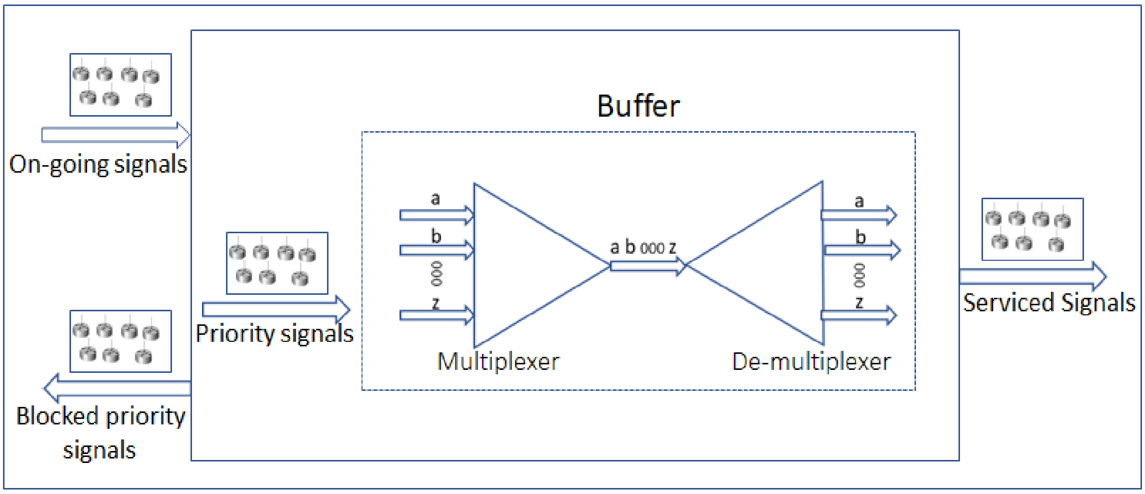

Fig.2: Communication of signals in buffer.

In our model, buffer access some rules, the assumptions and notations for same are given as under:

Assumptions:

- System is having fixed numbers of ‘s’ data buses and for statistical equilibrium the data rate for every bus is constant.
- If there are free data buses and the storage buffer is empty, then both OS and HS can be served by the system.
- A new HS is blocked only when the buffer is filled up.
- Buffer is having limiting capacity for communication which is termed as threshold for buffer.
- When one or more data buses are available, all queued HS are served before queued OS according to FCFS discipline.
- The rate of departure from the system changes with the addition of the rate of priority signal failures to the service rate.

Notations:

s: fixed number of data buses

$\lambda_{(i,j)}$: arrival rate of HSwhere ‘i’ $(1 \leq i \leq s+e)$ and ‘j’ $(1 \leq j \leq e)$

$\gamma_{(i,j)}$: arrival rate of OSwhere ‘i’ $(1 \leq i \leq s+e)$ and ‘j’ $(1 \leq j \leq e)$

$\mu_{(i,j)}$: service rate of HS and OS where ‘i’ $(1 \leq i \leq s+e)$ and ‘j’ $(1 \leq j \leq e)$

d: threshold of buffer

e: buffer size

h(n): rate of priority signals failures where ‘n’ $(1 \leq n \leq e)$

$P_{0,0}(t)$: probability at time ‘t’ when there is no signal in the system

$P_{i,j}(t)$: probability at time t when there are ‘i’$(1 \leq i \leq s+e)$ originating signal and ‘j’ $(1 \leq j \leq e)$handoff signal in the system

3. Governing Equations

This section contains governing equations of the model using Markov theory with help of state transition diagram provided in fig.3:

$$(\lambda_{0,0}+\gamma_{0,0})P_{0,0}(t)=\mu_{1,0}P_{1,0}(t) \quad (1)$$

$$(\lambda_{i,0}+\gamma_{i,0}+i\mu_{i,0})P_{i,0}(t)=(\lambda_{i-1,0}+\gamma_{i-1,0})P_{i-1,0}(t)+(i+1)\mu_{i+1,0}P_{i+1,0}(t)\,,\quad 1\le i\le s-1 \quad (2)$$

$$(\lambda_{s,0}+\gamma_{s,0}+s\mu_{s,0})P_{s,0}(t)=(\lambda_{s-1,0}+\gamma_{s-1,0})P_{s-1,0}(t)+s\mu_{s+1,0}P_{s+1,0}(t)+(s\mu_{s+1,1}+h(1))P_{s+1,1}(t) \quad (3)$$

$$(\lambda_{i,0}+\gamma_{i,0}+s\mu_{i,0})P_{i,0}(t)=\gamma_{i-1,0}P_{i-1,0}(t)+s\mu_{i+1,0}P_{i+1,0}(t)+(s\mu_{i+1,1}+h(1))P_{i+1,1}(t),\quad s+1\le i\le s+e-1 \quad (4)$$

$$\gamma_{s+e-1,0})P_{s+e-1,0}(t)=s\mu_{s+e,0}P_{s+e,0}(t) \quad (5)$$

$$(\lambda_{i,j}+\gamma_{i,j}+s\mu_{i,j}+h(j))P_{i,j}(t)=\lambda_{i-1,j-1}P_{i-1,j-1}+(s\mu_{i+1,j+1}+h(j+1))P_{i+1,j+1}(t),\quad s+1\le i\le s+d \text{ and } 1\le j\le d \quad (6)$$

$$(\lambda_{i,j}+\gamma_{i,j}+s\mu_{i,j}+h(j))P_{i,j}(t)=\lambda_{i-1,j-1}P_{i-1,j-1}(t)+(s\mu_{i+1,j+1}+h(j+1))P_{i+1,j+1}(t)+\gamma_{i-1,j}P_{i-1,j}(t),\quad s+2\le i\le s+d+1 \text{ and } 1\le j\le d \quad (7)$$

$$(\lambda_{i,j}+\gamma_{i,j}+s\mu_{i,j}+h(j))P_{i,j}(t)=\lambda_{i-1,j-1}P_{i-1,j-1}(t)+(s\mu_{i+1,j+1}+h(j+1))P_{i+1,j+1}(t)+\gamma_{i-1,j}P_{i-1,j}(t),\quad s+3\le i\le s+d+1 \text{ and } 1\le j\le d-1 \quad (8)$$

$$(\lambda_{i,j}+\gamma_{i,j}+s\mu_{i,j}+h(j))P_{i,j}(t)=\lambda_{i-1,j-1}P_{i-1,j-1}(t)+(s\mu_{i+1,j+1}+h(j+1))P_{i+1,j+1}(t)+\gamma_{i-1,j}P_{i-1,j}(t),\quad s+4\le i\le s+d+2 \text{ and } 1\le j\le d-1 \quad (9)$$

$$(\lambda_{i,j}+\gamma_{i,j}+s\mu_{i,j}+h(j))P_{i,j}(t)=\lambda_{i-1,j-1}P_{i-1,j-1}(t)+(s\mu_{i+1,j+1}+h(j+1))P_{i+1,j+1}(t)+\gamma_{i-1,j}P_{i-1,j}(t),\quad s+5\le i\le s+d+3 \text{ and } 1\le j\le d-1 \quad (10)$$

$$(\lambda_{i,j}+\gamma_{i,j}+s\mu_{i,j}+h(j))P_{i,j}(t)=\lambda_{i-1,j-1}P_{i-1,j-1}(t)+(s\mu_{i+1,j+1}+h(j+1))P_{i+1,j+1}(t)+\gamma_{i-1,j}P_{i-1,j}(t),\quad s+6\le i\le s+d+3 \text{ and } 1\le j\le d-2 \quad (11)$$

$$(\lambda_{i,j}+\gamma_{i,j}+s\mu_{i,j}+h(j))P_{i,j}(t)=\lambda_{i-1,j-1}P_{i-1,j-1}(t)+(s\mu_{i+1,j+1}+h(j+1))P_{i+1,j+1}(t)+\gamma_{i-1,j}P_{i-1,j}(t),\quad s+7\le i\le s+d+3 \text{ and } 1\le j\le d-3 \quad (12)$$

$$(\lambda_{s+8,1}+\gamma_{s+8,1}+s\mu_{s+8,1}+h(1))P_{s+8,1}(t)=\lambda_{s+7,0}P_{s+7,0}(t)+(s\mu_{s+9,2}h(2))P_{s+9,2}(t)+\gamma_{s+7,1}P_{s+7,1}(t) \quad (13)$$

$$(\lambda_{s+d-1,j}+\gamma_{s+d-1,j}+s\mu_{s+d-1,j}+h(j))P_{s+d-1,j}(t)=\lambda_{s+d-2,j-1}P_{s+d-2,j-1}(t)+\left(s\mu_{s+d,j+1}+h(j+1)\right)P_{s+d,j+1}(t)+\gamma_{s+d-2,j}P_{s+d-2,j}(t),\quad 1\le j\le d-1 \quad (14)$$

$$(s\mu_{s+d,j}+h(j))P_{s+d,j}(t)=\lambda_{s+d-1,j-1}P_{s+d-1,j-1}(t)+\gamma_{s+d-1,j}P_{s+d-1,j}(t),\quad 1\le j\le d \quad (15)$$

$$(\gamma_{i,d}+s\mu_{i.d}+h(d))P_{i,d}(t)=\lambda_{i-1,d-1}P_{i-1,d-1}(t)+\gamma_{i-1,d}P_{i-1,d}(t)\,,\quad s+2\le i\le s+d \quad (16)$$

$$(\lambda_{i,j}+s\mu_{i.j}+h(j))P_{i,j}(t)=\lambda_{i-1,j-1}P_{i-1,j-1}(t)+s\mu_{i+1,j+1}+h(j+1))P_{i+1,j+1}(t),\quad s+d+1\le i\le s+e-1 \text{ and } d+1\le j\le e-1 \quad (17)$$

$$(s\mu_{s+e,e}+h(e))P_{s+e,e}(t)=\lambda_{s+e-1,e-1}P_{s+e-1,e-1}(t) \quad (18)$$

$$(\lambda_{i,j}+s\mu_{i.j}+h(j))P_{i,j}(t)=\lambda_{i-1,j-1}P_{i-1,j-1}(t)+s\mu_{i+1,j+1}+h(j+1))P_{i+1,j+1}(t),\quad s+d+2\le i\le s+e-1 \text{ and } d+1\le j\le e-2 \quad (19)$$

$$(s\mu_{s+e,e-1}+h(e-1))P_{s+e,e-1}(t)=\lambda_{s+e-1,e-2}P_{s+e-1,e-2}(t) \quad (20)$$

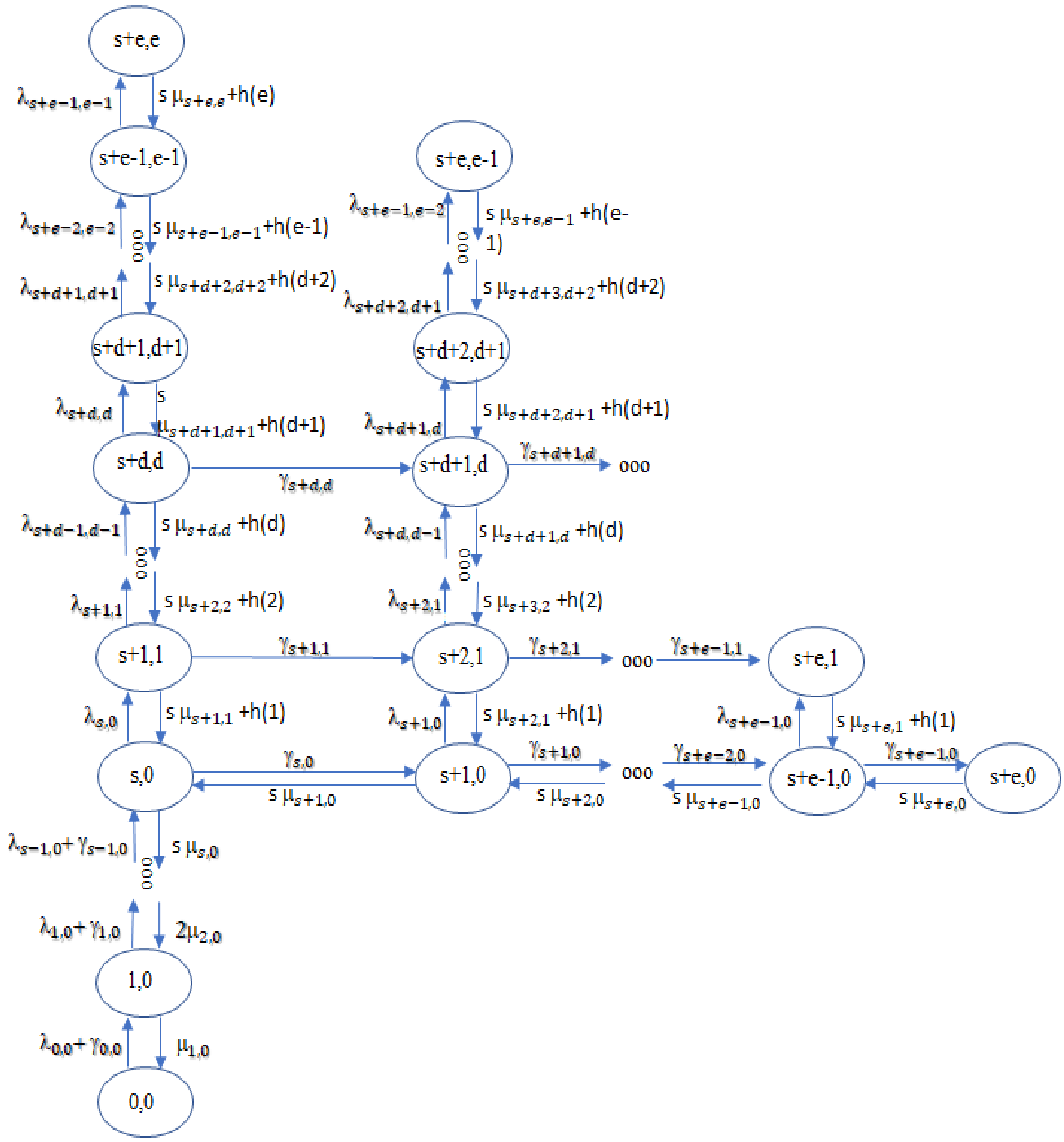

Fig. 3: State transition diagram for communication of signals under BHS.

Equations (1)-(20) are solved using Runge Kutta method. RK method is type of implicit and explicit iterative method used for numerical analysis of time dependent probability parameters in our study.

4. Performance Indices

This section contains various performance measures for BHC. Probability of interested performance parameter of buffer with different signal are as follows:

- Blocking Probability of OS

  $P_{BOS}(t)=\sum_{i=d+1}^{e} P_{s+i,i}(t)+\sum_{i=0}^{d} P_{s+e,i}(t)$ (21)

- Blocking Probability of HS

  $P_{BHS}(t)=\sum_{i=0}^{d} P_{s+e,d-i}(t)$ (22)

- OS Traffic in the system

  $T_{OS}(t)=\left(\sum_{i=0}^{s+e-1}\left[\frac{\lambda_{i,0}}{\mu_{i,0}}\right]+\sum_{j=1}^{e-1}\sum_{i=s+j}^{s+e-1}\left[\frac{\lambda_{i,j}}{\mu_{i,j}}\right]\right)(1-P_{BOS}(t))$ (23)

- HS Traffic in the system

  $T_{HS}(t)=\left(\sum_{i=0}^{s+e-1}\left[\frac{\gamma_{i,0}}{\mu_{i,0}}\right]+\sum_{j=1}^{e-1}\sum_{i=s+j}^{s+e-1}\left[\frac{\gamma_{i,j}}{\mu_{i,j}}\right]\right)(1-P_{BHS}(t))$ (24)

- Expected number of OS in queue

$$Q_{OS}=\left(\sum_{i=0}^{s+e-1}\left[\frac{\lambda_{i,0}}{\mu_{i,0}}\right]+\sum_{j=1}^{e-1}\sum_{i=s+j}^{s+e-1}\left[\frac{\lambda_{i,j}}{\mu_{i,j}}\right]\right)^{e+2}\left[\frac{1}{T_{OS}(t)}\right] \tag{25}$$

- Expected number of HS in queue

$$Q_{HS}=\left(\sum_{i=0}^{s+e-1}\left[\frac{\gamma_{i,0}}{\mu_{i,0}}\right]+\sum_{j=1}^{e-1}\sum_{i=s+j}^{s+e-1}\left[\frac{\gamma_{i,j}}{\mu_{i,j}}\right]\right)^{e+2}\left[\frac{1}{T_{HS}(t)}\right] \tag{26}$$

5. Numerical Illustration

In this section, we have demonstrated the considered system with the help of MATLAB software. The coding has been done in MATLAB software. For analysis purpose, the defaults parameters are considered as:

$\lambda_{0,0}=\lambda_{1,0}=\lambda_{2,0}=\lambda_{3,0}=\lambda_{4,0}=\lambda_{5,0}=\lambda_{6,0}=\lambda_{7,0}=\lambda_{8,0}=\lambda_{9,0}=\lambda_{10,0}=\lambda_{11,0}=\lambda_{12,0}=\lambda_{13,0}=\lambda_{14,0}=\lambda_{15,0}=\lambda_{16,0}=\lambda_{17,0}=\lambda_{18,0}=\lambda_{19,0}=\lambda_{20,0}=\lambda_{21,0}=\lambda_{22,0}=\lambda_{23,0}=\lambda_{24,0}=\lambda_{25,0}=\lambda_{26,0}=\lambda_{27,0}=\lambda_{28,0}=\lambda_{29,0}=\lambda_{30,0}=\lambda_{31,0}=\lambda_{32,0}=\lambda_{33,0}=\lambda_{34,0}=\lambda_{35,0}=\lambda_{26,1}=\lambda_{27,1}=\lambda_{28,1}=\lambda_{29,1}=\lambda_{30,1}=\lambda_{31,1}=\lambda_{32,1}=\lambda_{33,1}=\lambda_{34,1}=\lambda_{35,1}=\lambda_{27,2}=\lambda_{28,2}=\lambda_{29,2}=\lambda_{30,2}=\lambda_{31,2}=\lambda_{32,2}=\lambda_{33,2}=\lambda_{34,2}=\lambda_{35,2}=\lambda_{28,3}=\lambda_{29,3}=\lambda_{30,3}=\lambda_{31,3}=\lambda_{32,3}=\lambda_{33,3}=\lambda_{34,3}=\lambda_{35,3}=\lambda_{29,4}=\lambda_{30,4}=\lambda_{31,4}=\lambda_{32,4}=\lambda_{33,4}=\lambda_{34,4}=\lambda_{35,4}=\lambda_{30,5}=\lambda_{31,5}=\lambda_{32,5}=\lambda_{33,5}=\lambda_{34,5}=\lambda_{35,5}=\lambda_{31,6}=\lambda_{32,6}=\lambda_{32,7}=\lambda_{33,7}=\lambda_{33,8}=\lambda_{34,8}=\lambda_{34,9}=\lambda_{35,9}=\lambda_{35,10}=1.2$units, $\gamma_{0,0}=\gamma_{1,0}=\gamma_{2,0}=\gamma_{3,0}=\gamma_{4,0}=\gamma_{5,0}=\gamma_{6,0}=\gamma_{7,0}=\gamma_{8,0}=\gamma_{9,0}=\gamma_{10,0}=\gamma_{11,0}=\gamma_{12,0}=\gamma_{13,0}=\gamma_{14,0}=\gamma_{15,0}=\gamma_{16,0}=\gamma_{17,0}=\gamma_{18,0}=\gamma_{19,0}=\gamma_{20,0}=\gamma_{21,0}=\gamma_{22,0}=\gamma_{23,0}=\gamma_{24,0}=\gamma_{25,0}=\gamma_{26,0}=\gamma_{27,0}=\gamma_{28,0}=\gamma_{29,0}=\gamma_{30,0}=\gamma_{31,0}=\gamma_{32,0}=\gamma_{33,0}=\gamma_{34,0}=\gamma_{35,0}=\gamma_{26,1}=\gamma_{27,1}=\gamma_{28,1}=\gamma_{29,1}=\gamma_{30,1}=\gamma_{31,1}=\gamma_{32,1}=\gamma_{33,1}=\gamma_{34,1}=\gamma_{35,1}=\gamma_{27,2}=\gamma_{28,2}=\gamma_{29,2}=\gamma_{30,2}=\gamma_{31,2}=\gamma_{32,2}=\gamma_{33,2}=\gamma_{34,2}=\gamma_{35,2}=\gamma_{28,3}=\gamma_{29,3}=\gamma_{30,3}=\gamma_{31,3}=\gamma_{32,3}=\gamma_{33,3}=\gamma_{34,3}=\gamma_{35,3}=\gamma_{29,4}=\gamma_{30,4}=\gamma_{31,4}=\gamma_{32,4}=\gamma_{33,4}=\gamma_{34,4}=\gamma_{35,4}=\gamma_{30,5}=\gamma_{31,5}=\gamma_{32,5}=\gamma_{33,5}=\gamma_{34,5}=\gamma_{35,5}=\gamma_{31,6}=\gamma_{32,6}=\gamma_{32,7}=\gamma_{33,7}=\gamma_{33,8}=\gamma_{34,8}=\gamma_{34,9}=\gamma_{35,9}=\gamma_{35,10}=1$units, $\mu_{0,0}=\mu_{1,0}=\mu_{2,0}=\mu_{3,0}=\mu_{4,0}=\mu_{5,0}=\mu_{6,0}=\mu_{7,0}=\mu_{8,0}=\mu_{9,0}=\mu_{10,0}=\mu_{11,0}=\mu_{12,0}=\mu_{13,0}=\mu_{14,0}=\mu_{15,0}=\mu_{16,0}=\mu_{17,0}=\mu_{18,0}=\mu_{19,0}=\mu_{20,0}=\mu_{21,0}=\mu_{22,0}=\mu_{23,0}=\mu_{24,0}=\mu_{25,0}=\mu_{26,0}=\mu_{27,0}=\mu_{28,0}=\mu_{29,0}=\mu_{30,0}=\mu_{31,0}=\mu_{32,0}=\mu_{33,0}=\mu_{34,0}=\mu_{35,0}=\mu_{26,1}=\mu_{27,1}=\mu_{28,1}=\mu_{29,1}=\mu_{30,1}=\mu_{31,1}=\mu_{32,1}=\mu_{33,1}=\mu_{34,1}=\mu_{35,1}=\mu_{27,2}=\mu_{28,2}=\mu_{29,2}=\mu_{30,2}=\mu_{31,2}=\mu_{32,2}=\mu_{33,2}=\mu_{34,2}=\mu_{35,2}=\mu_{28,3}=\mu_{29,3}=\mu_{30,3}=\mu_{31,3}=\mu_{32,3}=\mu_{33,3}=\mu_{34,3}=\mu_{35,3}=\mu_{29,4}=\mu_{30,4}=\mu_{31,4}=\mu_{32,4}=\mu_{33,4}=\mu_{34,4}=\mu_{35,4}=\mu_{30,5}=\mu_{31,5}=\mu_{32,5}=\mu_{33,5}=\mu_{34,5}=\mu_{35,5}=\mu_{31,6}=\mu_{32,6}=\mu_{32,7}=\mu_{33,7}=\mu_{33,8}=\mu_{34,8}=\mu_{34,9}=\mu_{35,9}=\mu_{35,10}=2.5$units, h(1)=0.01, h(2)=0.02, h(3)=0.03, h(4)=0.04, h(5)=0.05, h(6)=0.06, h(7)=0.07, h(8)=0.08, h(9)=0.09, h(10)=0.1units, s=25, d=5 and e=10.
The results are summarized in table 1 and figures (4-5).

In table 1, it can be seen that as time takes the higher values, the blocking probability OS and HS decreases gradually. Also, OS and HS traffic in the system decreases for increasing values of ‘t’. From figures (4)-(5), it can be observed that expected number of OS and HS in queue increase as per increment of time which is quite obvious. On the other hand, Q_{OS} and Q_{HS} shows the decreasing trend as arrival rate increase.

Table 1: Various performance measures for communication system with varying time.

t	$P_{BOS}(t)$	$P_{BHS}(t)$	$T_{OS}(t)$	$T_{HS}(t)$
5	1.7381E+109	1.18E+110	8.34E+108	4.70E+109
6	1.7258E+147	1.14E+148	8.28E+146	4.56E+147
7	1.6745E+185	1.10E+186	8.04E+184	4.41E+185
8	1.6191E+223	1.07E+224	7.77E+222	4.27E+223
9	1.5647E+261	1.03E+262	7.51E+260	4.12E+261

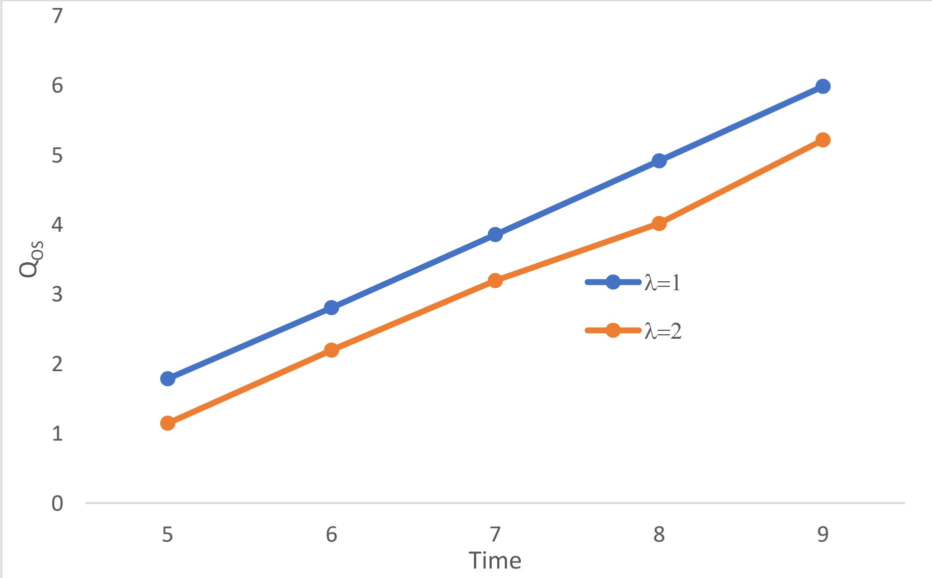

Fig. 4: Expected number of Q_{OS} vs. arrival rate with varying time.

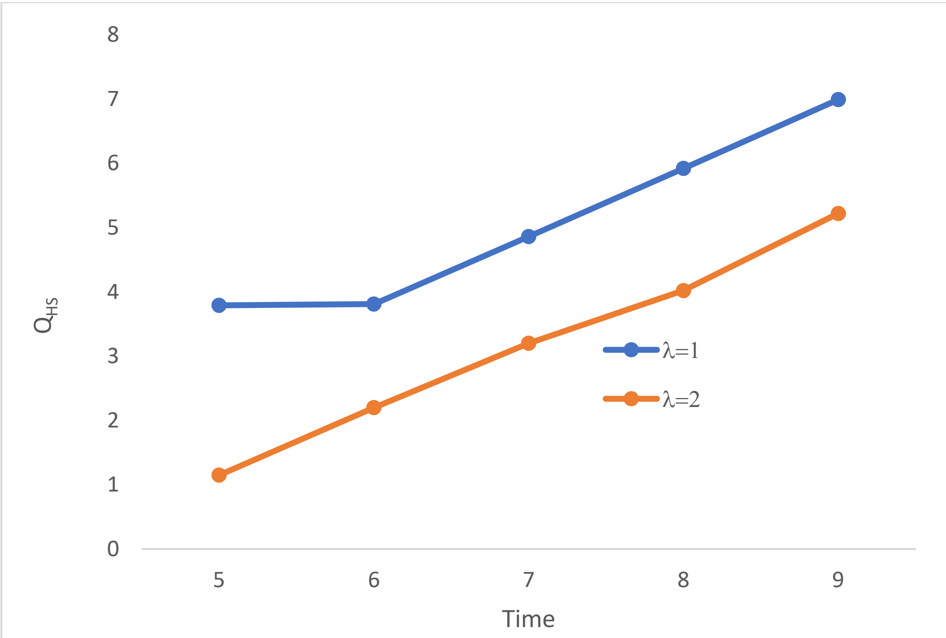

Fig. 5: Expected number of Q_{HS} vs. arrival rate with varying time.

Overall, we can conclude that the buffer size can be controlled if we focus on sensitive parameter like arrival rate.

6. Conclusions

Our study concluded queuing of handoff signals (HS) and originating signals (OS) in communication system of signal with fixed number of data buses in buffer. FCFS discipline and BHS has been adopted for servicing of signals. Communication of on-going signals is interrupted when a buffer hand overs priority signal to data bus. Performance measures such as blocking rate of priority signal, traffic of HS and OS in the system and many more has been determined for our communication model. In our study, the buffer size can be controlled by improving the service rate of the signals. Our investigation can be further extended by taking the assumptions of bulk arrival signal which make the analysis more cumbersome.

References

[1] Al-Matar, N. (2017) 'Theories and applications related to queuing systems' International Journal of Advances in Electronics and Computer Science, vol. 4, no. 2, pp. 14-17.

[2] Liu, Y., Guo, J. and Yibing Wang, Y. (2018) 'Vertical and horizontal queue models for oversaturated signal intersections with quasi-real-time reconstruction of deterministic and shock wave queueing profiles using limited mobile sensing data' Journal of Advanced Transportation, vol. 2018, pp. 19.

[3] Mathew, K., Issac, B. and Eng, T. C. (2014) 'A communication architecture using low frequency signals' International Conference on Data Science & Engineering (ICDSE), pp. 188-194.
[4] Pentum Suhasini, P. and Selvakumar, J.(2018) 'Modified rounding based approximate multiplier (MROBA) and MAC unit design for digital signal processing' International Journal of Pure and Applied Mathematics, vol. 118, no. 18, pp.1539-1545.
[5] Saglam,V. and Zobu, M. (2013)'A two-stage model queueing with no waiting line between channels' Mathematical Problems in Engineering , vol. 2013, pp. 1-5.
[6] Savas, S., Topaloglu, N. and Ciylan, B. (2012) 'Analysis of mobile communication signals with frequency analysis method' Gazi University Journal of Science, vol. 25, no. 2, pp. 447-454.
[7] Shahdad, S. Y., Amin, G. and Makhdoomi, S.S. (2015) 'A reliable and trusted routing scheme in wireless mesh network' International Journal of Technology Enhancements and Emerging Engineering Research, vol. 3, no. 4, pp. 135-140.
[8] Sonkin, D.M., Nazarov, A.A. ,Khrul, S.A.and Kudryashova, A.V. (2017) 'Optimal design of queueing systems for using communication channels with multiple access' International Conference on Information Technologies in Business and Industry, pp. 1-8.
[9] Xie, M. and Haenggi, M. (2003) 'Performance analysis of a priority queueing system over rayleigh fading channels' in Proc. Of Annual Allerton Conference on Communication, Control, and Computing.