Advances in Computer Science and its Applications
Vol. 1, No. 1, March 2012

www.worldsciencepublisher.org


# A comparative study between combination of PQ and MWRR Queuing techniques in IP network based on OPNET

**Sajad Farhangi[1], Saeed Golmohammadi[2]**

[1] Department of Electronic Engineering, Islamic Azad University of Ahar, Ahar, Iran
[2] School of Engineering-Emerging Technologies, University of Tabriz, Tabriz, Iran

Email: Sajad.farhangi@gmail.com , Sgolmohammadi@tabrizu.ac.ir

**Abstract** – Today's Internet only provides best effort service and traffic is processed as quickly as possible, but there is no guarantee for the timely delivery of data. So, the ability to provide flow based quality of service (QoS) support has become very important for the design of modern switches and routers. With the development of the Internet network in recent years, a variety of novel Internet multimedia applications, such as voice over IP and videoconferencing, have been developed, which usually have different quality of service requirements. Priority Queuing (PQ) and Modified Weighted Round Robin (MWRR) Queuing have been proposed, because of their better performance for real-time applications traffic. In this paper, we investigate the combinations of queuing methods and study their impact on the performance network. We demonstrate that with combination of MWRR and PQ queuing techniques better results rather than single configuration of MWRR and PQ queuing in Ethernet delay, email download response time, ftp download response time, http object response time, end-to-end delay for voice traffic and IP Processing delay parameters.

**Keywords** – Qos; MWRR; PQ; Hybrid methods; OPNET

## 1. Introduction

With increasing real-time application traffic and demand for the use of its, providing Qos for the network must be considered. Without providing a Qos in today's Internet network problems such as jitter, delay and packet loss ratio occur and the performance of a network severely reduced. So, Qos for reliable and secure communication between users and between different service classes is used. Classes of service on the Internet network should be different priorities because in application such as Email, Ftp and Http the delay parameter is not important while the real-time application such as voice and videoconferencing, delay of several milliseconds would be effective of network performance [1]. To solve this problem, management queuing of traffic in router is used. Various mechanisms for implementing scheduling disciplines in the network router such as, First in First out (FIFO), Priority Queue (PQ), Custom Queue (CQ) and Modified Weighted Round Robin (MWRR) have been introduced [2]. The mechanism of FIFO [3], [4] is that the packet initially enters the router must is the first packet to be transmitted. This queuing mechanism is a simple mechanism that is now obsolete. PQ is a simple variation of the basic FIFO queuing. The idea is to mark each packet with a priority. The routers then implement multiple FIFO queues, one for each priority class. Within each priority, packets are still managed in a FIFO manner. This queuing discipline allows high priority packets to cut to the front of the line [5]. MWRR [1] is used in Cisco switches. A weight is assigned to each queue in MWRR. This technique uses variable sized packets to be serviced. Select the type of routing protocol is also important to improve performance of network parameters. For example, EIGRP (Enhanced Interior Gateway Routing Protocol) and OSPF (Open Shortest Path First) have been proposed, because of their better performance for real-time applications traffic [6]. In selecting the type of routing protocol for the network, select a combination of protocols, rather than selecting a single protocol has been consistently better performance [7]-[9]. So, in this paper we studied the combination of queuing mechanisms and its performance compared to the single queuing mechanisms.

## 2. Survey of Related Works

Comparison between the different types of queuing mechanism that single configuration in network has been considered [1], [2], [5], [10], [11] and [12]. In reference [1], comparative study of PQ, DWRR, MWRR and WFQ mechanisms have been reviewed and PQ and MWRR mechanisms rather than other mechanisms premier have been introduced. Other comparison for VoIP traffic based on FIFO, CQ, MWRR and PQ mechanism have been done in reference [2]. In reference [2] PQ mechanism in packet end-to-end delay and packet delay variation parameter of VoIP has minimum value and better performance rather than other mechanisms. Also, in reference [5], simulation-based comparative analysis of FIFO, PQ, WFQ and DWRR mechanism have been considered and in real-time application parameter, PQ are the minimum value rather than the other mechanisms.

According to reference [13], the comparison between the single queues, with a combination of two queues technique has been examined for the same network. That network with a combination of two queues has demonstrated better performance rather than the network configured under the single queues in most parameters. In this paper, comparative analysis between combination of PQ and MWRR with only

PQ and only MWRR will be studied.

## 3. System model

Fig. 1 is illustrated the comparative study of network which presented in this paper. The network which illustrated in Fig. 1 is a simple and example network for demonstrate of an internet network. In the network that demonstrated in Fig.1, we have applied the Ftp, Http, Email, and voice and videoconferencing application. Traffic rate is applied to the entire network is given in Table 1.

Our simulation involved three scenarios for the networks are illustrated in Fig. 1. In the PQ-MWRR scenario, E-J routers are configured by MWRR and A-D routers are configured by PQ. In the PQ scenario and the MWRR scenarios of the network, whole routers configured with PQ and MWRR techniques, respectively.

### *3.1. Simulation result and Analysis*

In this section, we have analyzed network performance under simulation scenarios from the view of six initial parameters which are mentioned below.

#### *3.1.1 Ethernet Delay*

This statistic represents the end-to-end delay of all packets received by all the stations. For Internet network, Ethernet delay is a key point and however this parameter may contain a small amount, the network performance will be better. In Fig. 2, the Ethernet delay parameter is shown for the three scenarios that simulated. It can be seen from Fig. 2, the PQ-MWRR scenario has minimal value in Ethernet delay time.

#### *3.1.2 Email Download Response Time*

This parameter indicates the time elapsed between sending request for emails and receiving emails from email server in the network. This time includes signalling delay for the connection setup. In Fig. 3, the email download response time parameter is shown for the three scenarios that simulated. It can be seen from last Figure, the PQ-MWRR scenario has minimal value in this time and better performance rather than the other scenarios.

Table 1. Type of the network traffic

| Traffic | Optional rates |
|---|---|
| Voice | PCM Quality and silence Suppressed |
| Videoconferencing | High Resolution Video |
| Email | Medium load |
| Ftp | High load |
| Http | Heavy browsing |

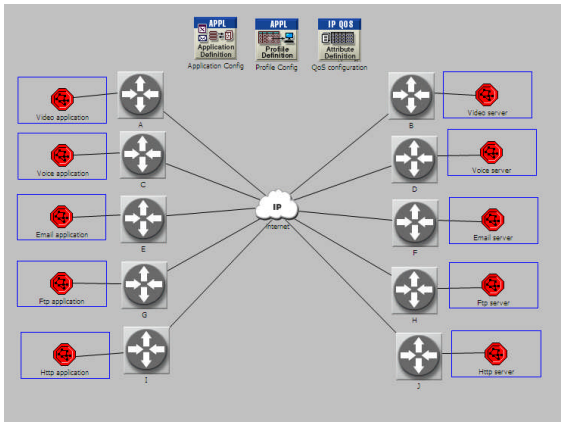


Figure 1. A view of the network simulation in OPNET

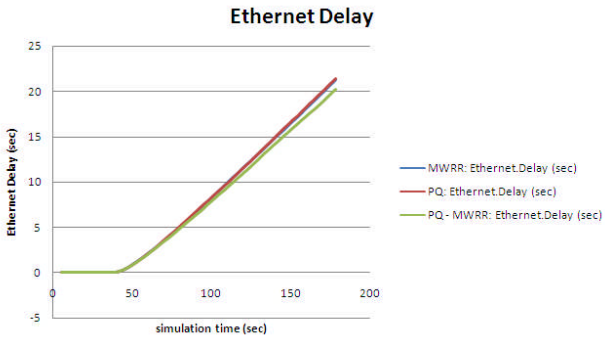


Figure 2. Ethernet delay parameter - the PQ-MWRR scenario has a minimum value among of the other scenarios

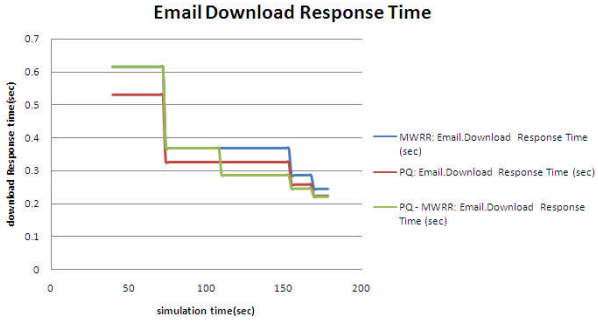


Figure 3. Email download response time parameter - the PQ-MWRR scenario has a minimum value in the average among of the other scenarios

#### *3.1.3 FTP Download Response Time*

This parameter indicates the time elapsed between sending a request and receiving the response packet. Every response packet sent from a server to an FTP application is included in this statistic. Fig. 4, illustrate the download response time parameter for Ftp traffic. As shown in fig. 4, it can be seen PQ-MWRR scenario has lower value rather than the other scenarios.

#### *3.1.4 HTTP Object Response Time*

This parameter indicates that specifies response time for each inline object from the HTML page .The HTTP object response time parameter is shown in Fig. 5. Given this figure

is considerably PQ-MWRR scenario is minimal value in comparison of the other scenarios.

### *3.1.5 End-to-End Delay*

When the packet transmitted via a network from source to destination then end-to-end delay time has been considered. When it takes too much time to arrive the packet to the receiver, it causing delays in the whole process and therefore has a critical effect on performance of a communication network. Networks with large values of end-to-end delay, the packet can be effectively destroyed. Packet losses due to large end-to-end delay will have impact on the quality of both audio and video traffic on the receiver. The end-to-end delay parameter for voice and videoconferencing traffic is shown in Fig. 5 and 6, respectively. According to these figures, PQ-MWRR scenario has minimum end-to-end delay in comparison with other scenarios in Voice application and the MWRR scenario has minimum end-to-end delay value in videoconferencing application.

### *3.1.6 IP Processing Delay*

Delay experienced by an IP datagram though the IP layer (i.e., the delay from the time when the packet arrives at the IP layer to the time it dispatched) called IP processing delay. This delay includes:

1. Queuing delay
2. Processing delay

The IP Processing delay parameter is shown in Fig.7. According to this figure, PQ-MWRR scenario has minimum delay in comparison with other scenarios.

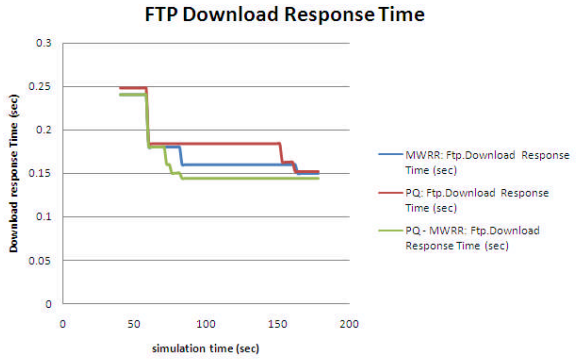


Figure 4. FTP download response time parameter - the PQ-MWRR scenario has a minimum value in the average among of the other scenarios

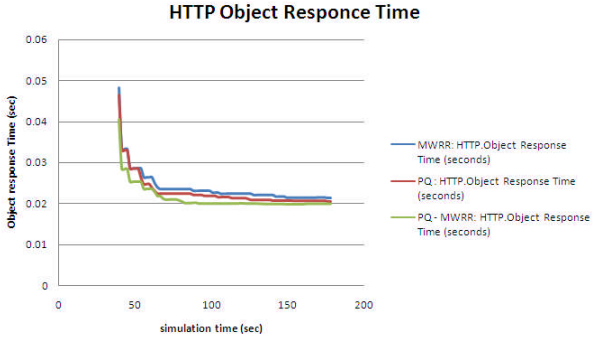


Figure 5. Http object response time parameter - the PQ-MWRR scenario has a minimum value in the average among of the other scenarios

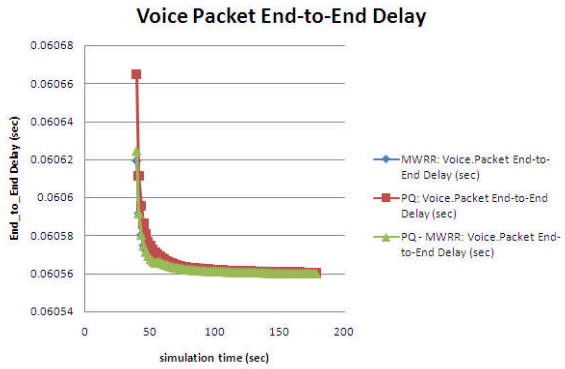


Figure 6. Voice packet end-to-end delay parameter - the PQ-MWRR scenario has a minimum value in the average among of the other scenarios

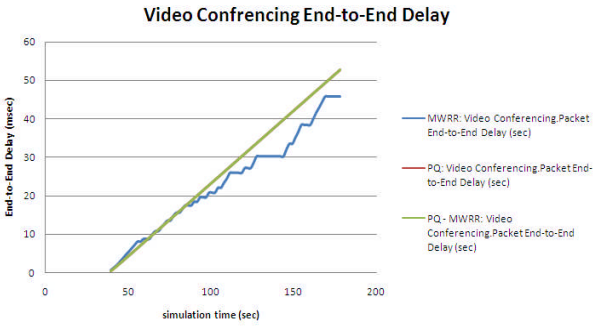


Figure 7. Videoconferencing end-to-end delay parameter - the MWRR scenario has a minimum value in the average among of the other scenarios

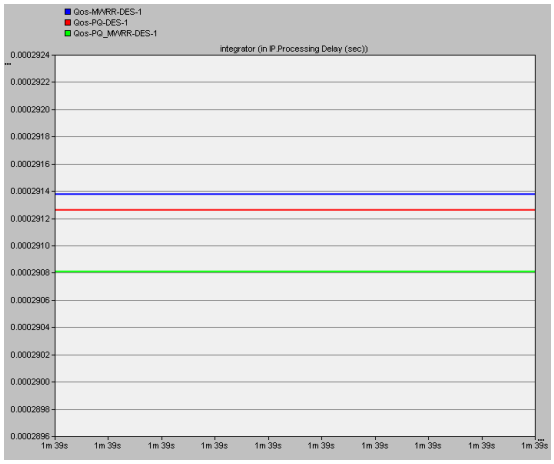


Figure 8. IP processing delay parameter - the PQ-MWRR scenario has a minimum value in the average among of the other scenarios

## 4. Conclusion

In this paper compares the performance of PQ, MWRR and combination of PQ and MWRR for the simple network. We conducted simulations to examine the behavior of these queuing techniques using the parameters of Ethernet delay, email download response time, ftp download response time, http object response time, end-to-end delay and IP processing delay. Our results show that the best results in the combination of two queuing techniques of PQ and MWRR, achieved for all considered parameters except videoconferencing end-to-end delay. Whereas, end-to-end delay for videoconferencing of MWRR queuing is better than other queuing techniques.

Considering the results of the simulation can be concluded that, combination of PQ and MWRR queuing technique are better than the network configuration in single PQ or MWRR technique in more traffics of Internet network.

## References


[1] Subash, T. and S. Indiragandhi, "Performance Analysis of Scheduling Disciplines in Optical Networks", in Proceedings of IEEE's WOCN Third International Conference on Wireless and Optical Communication Networks, APR 11-13, 2006.

[2] Ahmad Karim, "VoIP Performance Over different service Classes under Various Scheduling Techniques", Australian Journal of Basic and Applied Sciences, 5(11): 1416-1422-CC, 2011.

[3] A. Demers, S. Kasha, and S. Shankar, "Analysis and Simulation of a Fair Queuing Algorithm", Proceedings of the ACM SIGCOMM, Austin, TX, pp. 1-12, 1989.

[4] J. Bennett and H. Zhang, "WF2Q: Worst-case Fair Weighted Fair Queuing", IEEE INFOCOM´96, San Francisco, pp. 120-128, 1996.

[5] T.Velmurugan; Himanshu Chandra; S.Balaji, "Comparison of Queuing Disciplines for Differentiated Services using OPNET", IEEE Computer Society, International Conference on Advances in Recent Technologies in Communication and Computing, 2009.

[6] Mohammad Nazrul Islam; Md. Ahsan Ullah Ashique, "Simulation-Based Comparative Study of EIGRP and OSPF for Real-Time Applications", Master Thesis Electrical Engineering, Blekinge Tekniska Hogskolan, Thesis no: MEE 10:53, September 2010.

[7] Shravan K. Narisetty; Santosh K. Balsu, "Performance Comparison of EIGRP and ISIS/RIP Protocols", International Journal of Research and Reviews in Ad Hoc Networks (IJRRAN), March 2011.

[8] E. Lemma; S. Hussain; W. Anjelo, "Performance Comparison of EIGRP/IS-IS and OSPF/IS-IS", Master Thesis Electrical Engineering, Blekinge Tekniska Hogskolan, Thesis no: MEE 09:77, November 2009.

[9] Sapna, Manju Sharma, "Design and Implement the Hybrid Network for Different IP Routing Protocols and Comparative Study Thereof", Information Assurance and Security Letters 1, 2010.

[10] A. Ghaffar Pour Rahbar; Oliver Yang, "LGRR: A new packet scheduling algorithm for differentiated services packet-switched networks", computer communications, 32, 2009.

[11] Yaser Miaji; Suhaidi Hassan, "Comparative Simulation of Scheduling Mechanism in Packet Switching Network" , IEEE Computer Society, Second International Conference on Network Applications, Protocols and Services, 2010.

[12] Shammi Akhtar, Emdad Ahmed, Aloke kumar Saha, and Kazi Shamsul Arefin, "Performance Analysis of Integrated Service over Differentiated Service for Next Generation Internet" , JCIT, VOLUME 01, ISSUE 01, 2010.

[13] Sasa Klampfer, Joze Mohorko, Zarko Cucej, "Impact of hybrid queuing disciplines on the VoIP traffic delay", Elektrotehniski vestnik 76(3), 2009.