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IMPLEMENTATION OF DIFFERENT QUEUE SCHEDULING WITH SEVERAL PERFORMANCE METRICS USING OPNET

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Abstract

In the world of internet Networks Packets come from different flows and their destination is only a switch or router for processing. A good scheduling technique treats the different flows in a fair and appropriate manner. Packets come from Different scheduling technique processes differently and it's affect the overall performance of network .Scheduling technique play the important role of overall performance also. Several scheduling techniques are designed to improve the quality of service. Like First-in, First-out (FIFO), Priority Queuing (PQ), Weighted Fair Queuing (WFQ).In this Research paper performed the execution of Database query Response Time, FTP Download Response Time, FTP Upload Response Time, Http Object Response Time, Http Page Response Time, Remote Login Response Time, Video End to End Delay, Jitter, Mos value, Voice Packet Delay, Voice End to End Delay characteristics over WiMAX (Worldwide Interoperability for Microwave Access)On different WIMAX based Network FIFO, PQ and WFQ queuing are implemented with the help of OPNET simulator.

Keywords: FIFO, PQ,WFQ,WIMAX,FTP,JITTER,OPNET.

1. Introduction

In computing, scheduling is the method by which work specified by some means is assigned to resources that complete the work. The work may be virtual computation elements such as threads, processes or data flows, which are in turn scheduled onto hardware resources such as processors, network links or expansion cards A scheduler is what carries out the scheduling activity. Schedulers are often implemented so they keep all computer resources busy (as in load balancing), allow multiple users to share system resources effectively, or to achieve a target quality of service. Scheduling is fundamental to

computation itself, and an intrinsic part of the execution model of a computer system; the concept of scheduling makes it possible to have computer multitasking with a single central processing unit (CPU).A scheduler may aim at one of many goals, for example, maximizing throughput (the total amount of work completed per time unit), minimizing response time (time from work becoming enabled until the first point it begins execution on resources), or minimizing latency (the time between work becoming enabled and its subsequent completion), maximizing fairness (equal CPU time to each process, or more generally appropriate times according to the priority and workload of each process).

2. WIMAX

WIMAX is one of the latest broadband wireless technologies all around today. WIMAX systems are expected to deliver broadband access services to residential and enterprise customers in an

economical way. WIMAX is a standardized wireless version of Ethernet intended primarily as an alternative to wire technologies (such as Cable Modems, DSL and T1/E1 links) to provide broadband access to customer premises .More strictly, WIMAX is an industry trade organization formed by leading communications, component, and equipment companies to promote and certify compatibility and interoperability of broadband wireless access equipment that conforms to the IEEE 802.16 and ETSI HIPERMAN standards. WIMAX would operate similar to Wi-Fi, but at higher speeds over greater distances and for a greater number of users. WIMAX has the ability to provide service even in areas that are difficult for wired infrastructure to reach and the ability to overcome the physical limitations of traditional wired infrastructure.

3. Scheduling Techniques

3.1FIFO Queuing

In first-in, first-out (FIFO) queuing, packets wait in a buffer (queue) until the node (router or switch) is ready to process them. If the average arrival rate is higher than the average processing rate, the queue will fill up and new packets will be discarded. A FIFO queue is familiar to those who have had to wait for a bus at a bus stop.

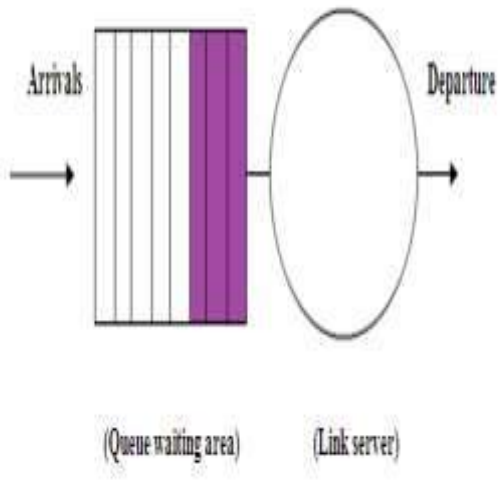

Figure 3.1 FIFO Queuing Model

First in, first out (FIFO), also known as first come, first served (FCFS), is the simplest scheduling algorithm. FIFO simply queues processes in the order that they arrive in the ready queue. This is commonly used for a task queue, for example as illustrated in this section.

3.2 Priority Queuing

In priority queuing, packets are first assigned to a priority class. Each priority class has its own queue. The packets in the highest-priority queue are processed first. Packets in the lowest-priority queue are processed last. Note that the system does not stop serving a queue until it is empty. In a priority queue can provide better QoS than the FIFO queue because higher priority traffic, such as multimedia, can reach the destination with less delay. However, there is a potential drawback. If there is a continuous flow in a high-priority queue, the packets in the lower-priority queues will never have a chance to be processed. This is a condition called starvation.

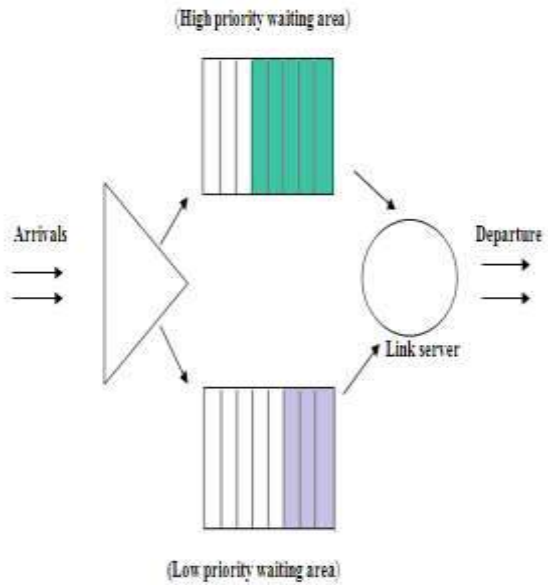

Figure: 3.2 Priority Queuing Model

Priority Queuing (PQ) is a Congestion Management technique. PQ schedules traffic such that the higher-priority queues "always" get serviced first. This can cause the traffic of other lower-priority queues to starve out. PQ use four queue. If the High queue has a packet waiting, the scheduler will service it first. If there is no packet in the High queue, the scheduler will look to service the Medium queue. It will take one packet from the Medium queue, and then again look for any packets waiting in the High queue. The Low queue only gets serviced if there are no packets waiting in High, Medium and Normal queues.

3.3 Weighted Fair Queuing

A better scheduling method is weighted fair queuing. In this technique, the packets are still assigned to different classes and admitted to different queues. The queues, however, are weighted based on the priority of the queues; higher priority means a higher weight. The system processes packets in each queue in a round-robin fashion with the number of packets selected from each queue based on the corresponding weight. For example, if the weights are 3, 2, and 1, three packets are processed from the first queue, two from the second queue, and one from the third queue. If the system does not impose priority on the classes, all weights can be equal in this way, we have fair queuing with priority.

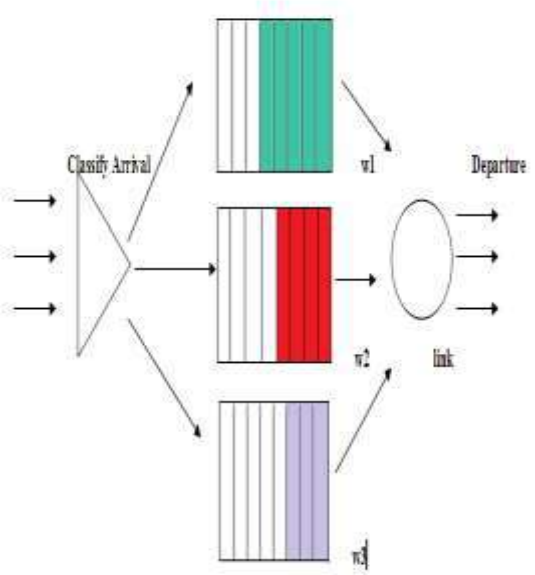

Figure 3.3Weighted Fair Queuing Model

The scheduler assigns a fixed time unit per process, and cycles through them. If process completes within that time-slice it got terminated otherwise it is rescheduled after giving a chance to all other processes.

RR scheduling involves extensive overhead, especially with a small time unit.

4.Literature Review

- **Yang (2013)** analyzed RPQ and several other schemes under different traffic conditions. Author found that RPQ provides a significant degree of fairness in his simulations. While not precisely matching the fairness benchmark of DRR, RPQ was comparable or superior to CSFQ, and it worked much better than DDE, CHOK and FIFO.
- **David et al.(2014)** proposed performance evaluation of WIMAX network based on transmission rate. By the simulation results, they concluded that the proposed scheme reduced the average delay and improves the average throughput. The Qualnet 6.1 Simulator was used to carry out the simulation.
- **Roy and Jain (2015)** had provided a comparative performance analysis of various routing protocols for WIMAX networks. From the result of studies, it can be concluded that, on an average OLSR and AODV perform better than DSR in respect to end to end delay. In case of DSR, throughput was higher than OLSR, but average end to end delay was higher. However in case of AODV throughput was the highest, but average end to end delay was more than OLSR and DSR .So concluded that for CBR application OLSR routing protocol was better than the other two protocols.
- **Yadav et al.(2014)** analyzed various speed of random way point mobility for two mobile WIMAX cell by using QUALNET simulator 6.1. WIMAX handover performance was analysed in terms of throughput, end to end delay, average jitter and total message received. Also different mobile node were used with different speed, due to variation of speed the performance of mobile handover was influenced. It was also concluded that the node having minimum speed would perform better than the node having maximum speed.

5.Proposed Methodology

5.1 OPNET

Optimized Network Engineering Tools (OPNET) modeller 14.5 has been used as a simulation environment. OPNET is a simulator built on top of discrete event system (DES) and it simulates the system behaviour by modelling each event in the system and processes it through user defined processes.

5.2 Work Flow

5.2.1 FIFO

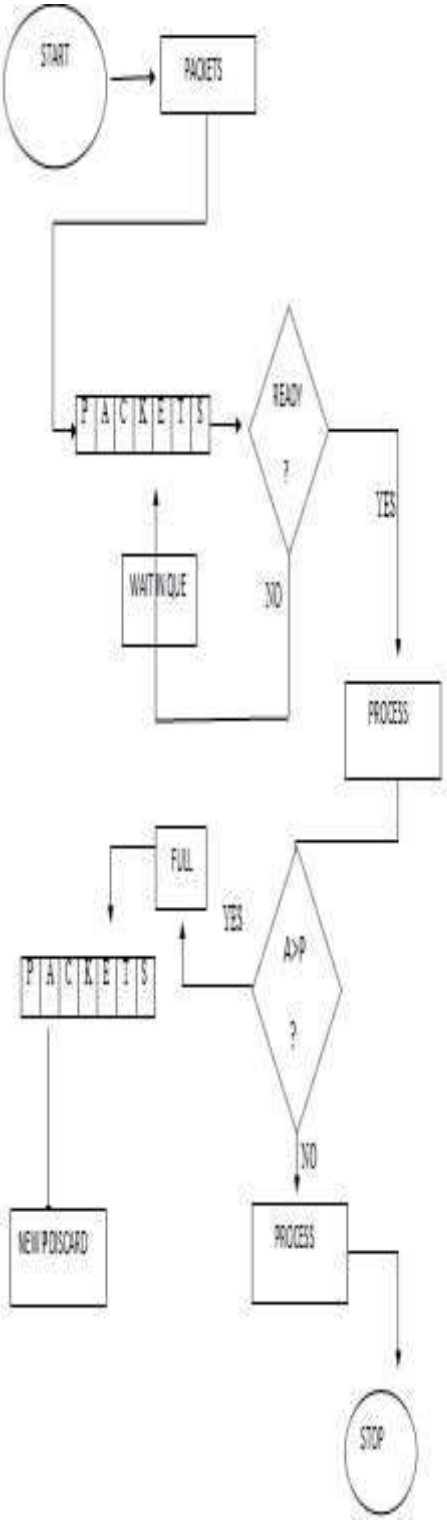

Figure 5.1 FIFO WORK FLOW

5.2.2 PQ

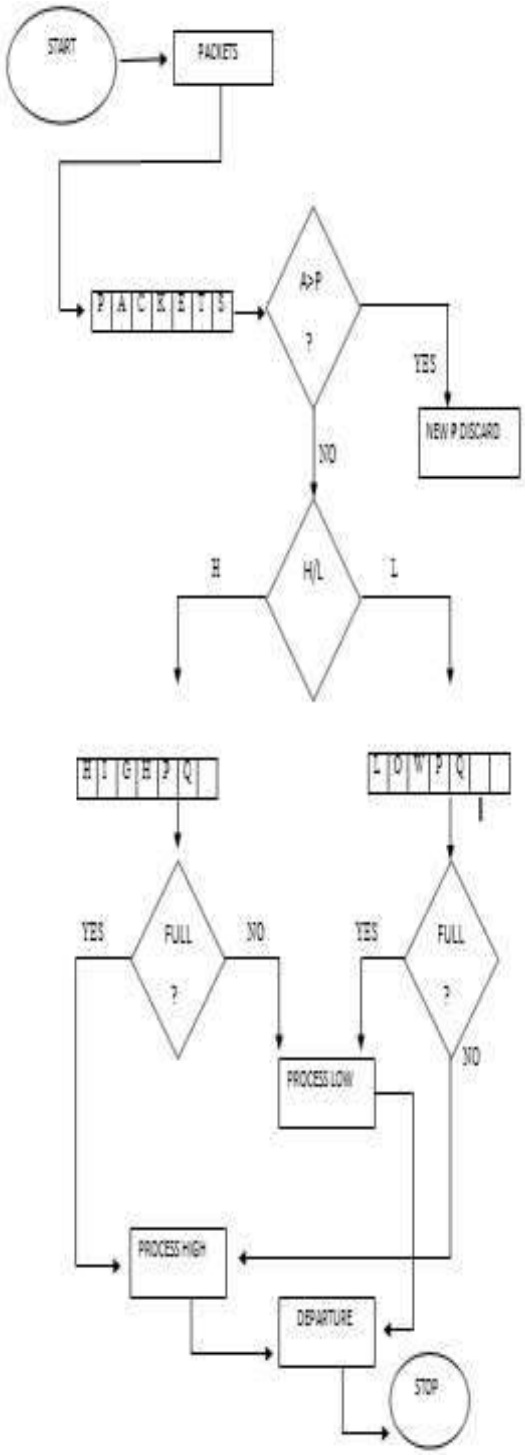

Figure 5.2 P.Q WORK FLOW

5.2.3 WFQ

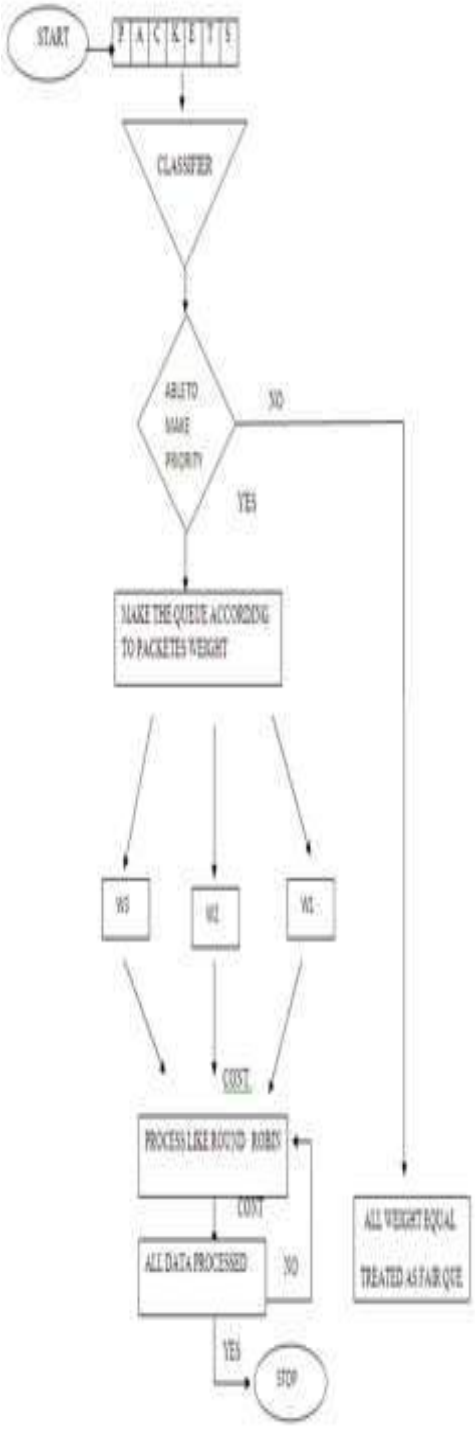

Figure 5.3 WFQ WORK FLOW

6. Results and Discussion

6.1 FIFO Scenario

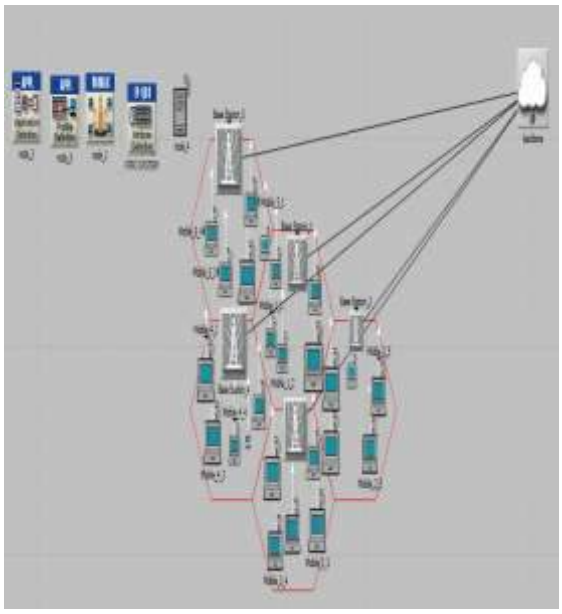

Figure 6.1 Network configured with FIFO

6.2 PQ Scenario

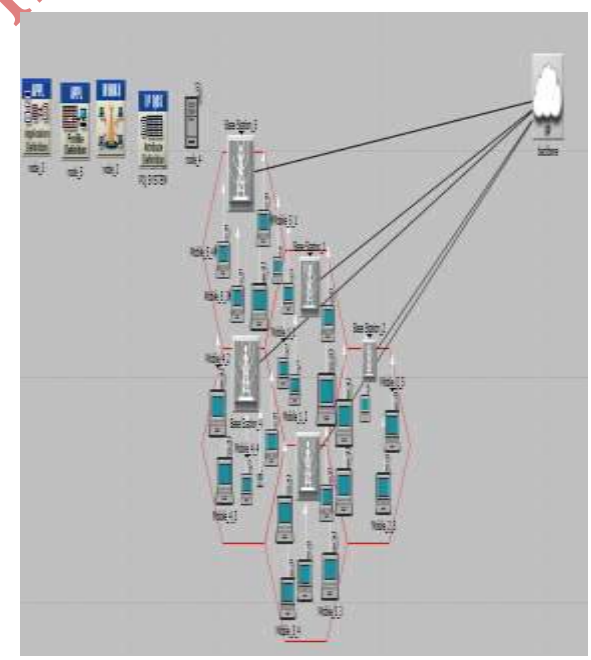

Figure 6.2 Network configured with PQ

6.3 WFQ Scenario

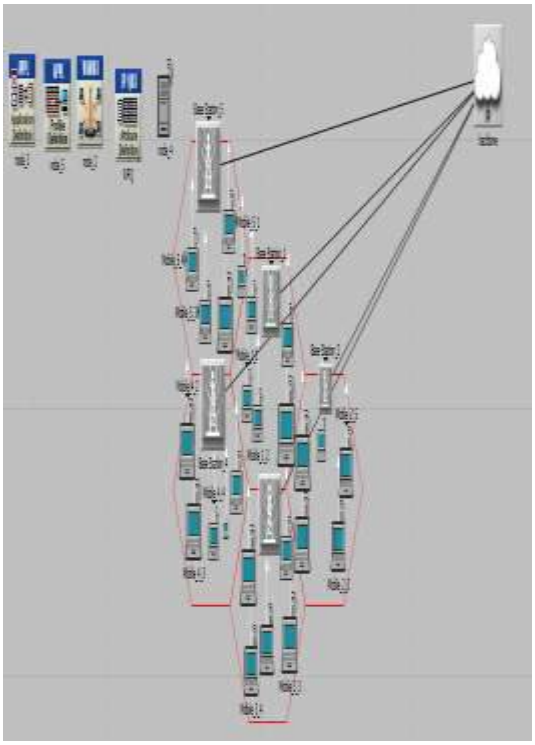

Figure 6.3 Network configured with WFQ

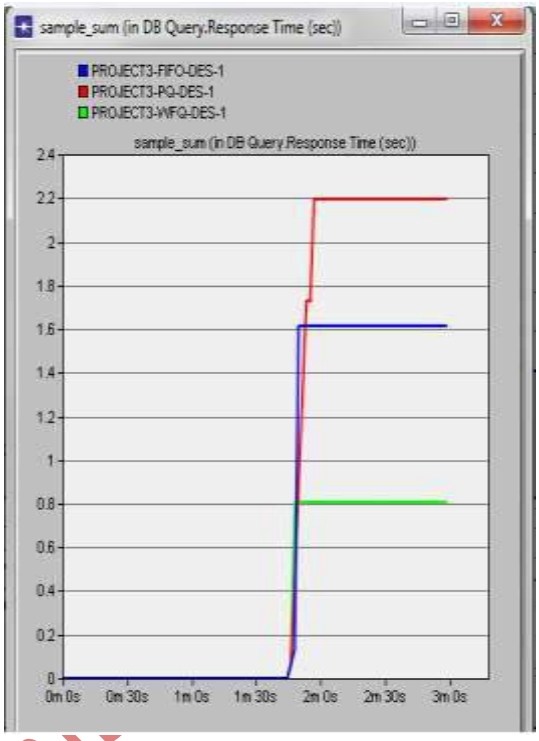

Figure 6.4Database Query Response Time .

The performance with the respective parameter Queue system of FIFO, PQ and WFQ with performance metrics like Database Query Response Time, FTP Download Response Time, FTP upload Response Time, Http Object Response Time , Http Page Response Time, Remote Login Response time, Video End to End Delay, Voice Jitter, Voice End to End Delay, MOS value ,Voice Packet Delay, and Voice End to End Delay are shown below

6.4 Database Query Response time:

Time elapsed between sending a Request and Receiving the Response Packet Measured from the Time when the Database Query Application sends a Request to the Server to the time it receives a Response Packet Every Response Packet sent from a Server to a Database Query application is included in the statistic. In this part it is shown the Performance of each queue system with Database Query Response Time .

According to simulation, as we can see in Fig. 6.4, Database Query Response time Performance metric has been shown of First in First out (FiFO) Priority Queue (PQ) & Weighted Fair Queue (WFQ) . In the above figure red, blue, and green colors used to represent First in First out (FIFO),Priority Queue (PQ) & Weighted Fair Queue (WFQ) . in Database Query Response time Performance we can say that Weighted Fair Queue (WFQ) Is best queue.

6.5 FTP Download Response time:

Time elapsed between sending a Request and Receiving the Response Packet Measured from the Time a client application sends a request to the server to the time it receives a Response Packet Every Response Packet sent from a Server to a FTP application is included in the statistic. In this part it is shown the Performance of each queue system with FTP Download Response time

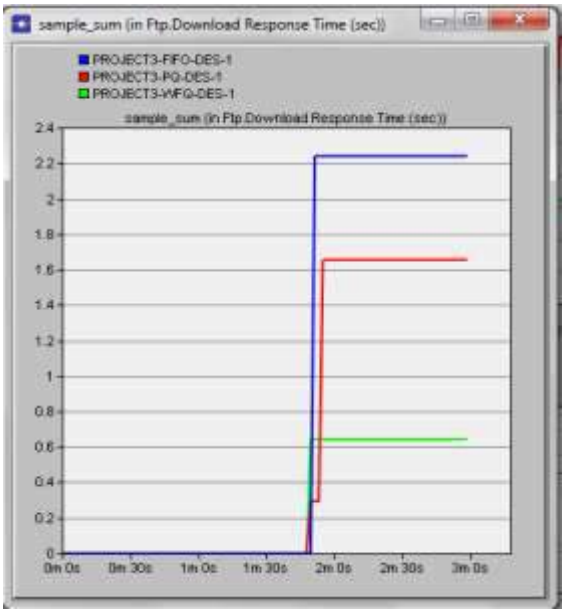

Figure 6. 5 FTP Download Response time

According to simulation, as we can see in Fig. 6.5, FTP Download Response time Performance metric has been shown of First in First out (FIFO) Priority Queue (PQ) & Weighted Fair Queue (WFQ). In the above figure red, blue, and green colors used to represent First in First out (FIFO), Priority Queue (PQ) & Weighted Fair Queue (WFQ). in, FTP Download Response time Performance we can say that Weighted Fair Queue (WFQ) Is best queue.

6.6 FTP Upload Response time:

Time elapsed between sending a File and receiving the Response .The Response time for responses sent from any Server to an FTP application is included in this statistic.

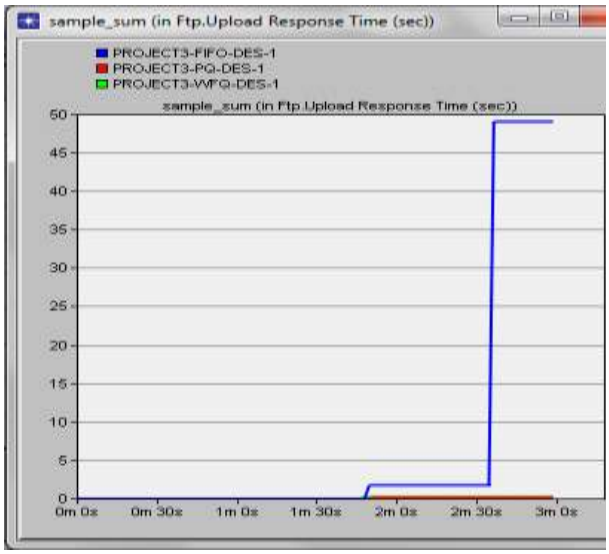

Figure 6.6FTP Upload Response time

According to simulation, as we can see in Fig. 6.6, FTP Upload Response time Performance metric has been shown of First in First out (FIFO) Priority Queue (PQ) & Weighted Fair Queue (WFQ). In the above figure red, blue, and green colors used to represent First in First out (FIFO), Priority Queue (PQ) & Weighted Fair Queue (WFQ in, FTP Upload Response time Performance we can say that Is Priority Queue (PQ) best queue.

6.7 Http Object Response time:

Http Object Response time define as Specifies Response time for each inlined oblects from the HTML page.

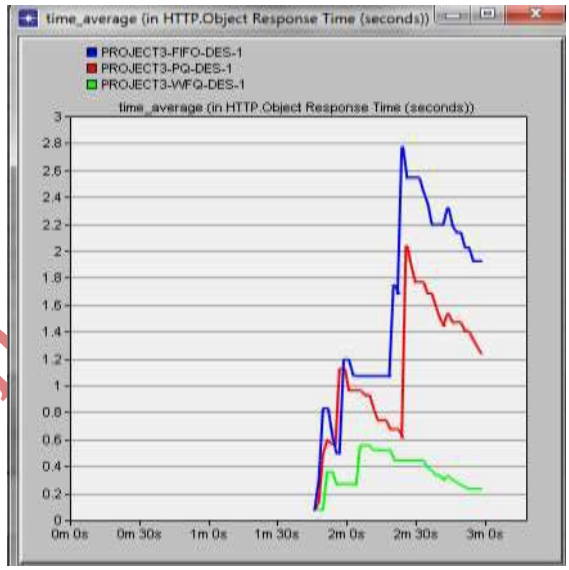

Figure 6.7.Http Object Response time

According to simulation, as we can see in Fig. 6.7, Http Object Response time Performance metric has been shown of First in First out (FIFO) Priority Queue (PQ) & Weighted Fair Queue (WFQ). In the above figure red, blue, and green colors used to represent First in First out (FIFO), Priority Queue (PQ) & Weighted Fair Queue (WFQ). in, Http Object Response time Performance we can say that Weighted Fair Queue (WFQ) Is best queue.

6.8 Http Page Response time:

Http Page Response time define Specifies time Reqirued to Retrieve the Entire page with all the contained inline oblects.

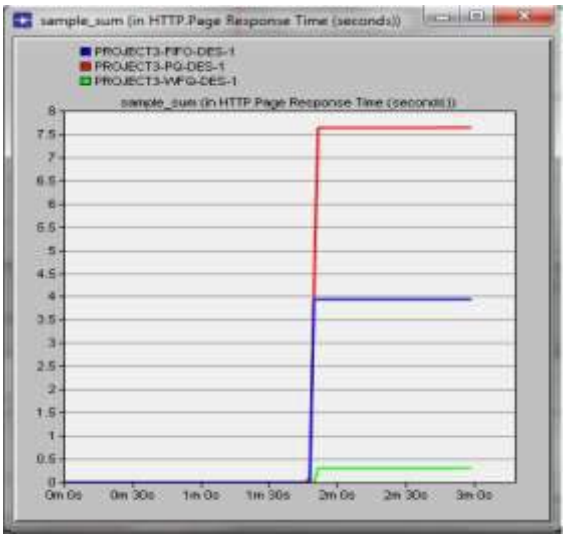

Figure 6.8Http Page Response time

According to simulation, as we can see in Fig. 6.8, Http Page Response time Performance metric has been shown of First in First out (FIFO) Priority Queue (PQ) & Weighted Fair Queue (WFQ). In the above figure red, blue, and green colors used to represent First in First out (FIFO), Priority Queue (PQ) & Weighted Fair Queue (WFQ in, Http Page Response time Performance we can say that Weighted Fair Queue (WFQ) Is best queue.

6.9 Voice Jitter

Voice Jitter is define as if two consequetive packets leave the source node with time stamps t1 & t2 and are played back at the destination node at time t3 & t4 ,then jitter =(t4 - t3) – (t2 – t1) Negative Jitter indicates that the time difference between the packets at the destination node was less than that at source node.

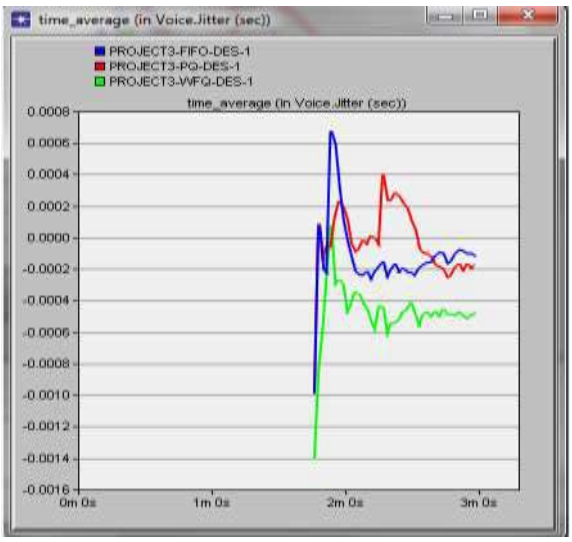

Figure 6.9Voice Jitter

According to simulation, as we can see in Fig. 6.9, JitterPerformance metric has been shown of First in First out (FIFO) Priority Queue (PQ) & Weighted Fair Queue (WFQ). In the above figure red, blue, and green colors used to represent First in First out (FIFO), Priority Queue (PQ) & Weighted Fair Queue (WFQ). in, Jitter Performance we can say that Weighted Fair Queue (WFQ) Is best queue.

6.10 Voice MOS (Mean Opinion Score)

What is Mean Opinion Score?

In voice and video communication, quality usually dictates whether the experience is a good or bad one. Besides the qualitative description we hear, like 'quite good' or 'very bad', there is a numerical method of expressing voice and video quality. It is called Mean Opinion Score (MOS). MOS gives a numerical indication of the perceived quality of the media received after being transmitted and eventually compressed

MOS is expressed in one number, from 1 to 5, 1 being the worst and 5 the best. MOS is quite subjective, as it is based figures that result from what is perceived by people during tests. However, there are software applications that measure MOS on networks, as we see below.

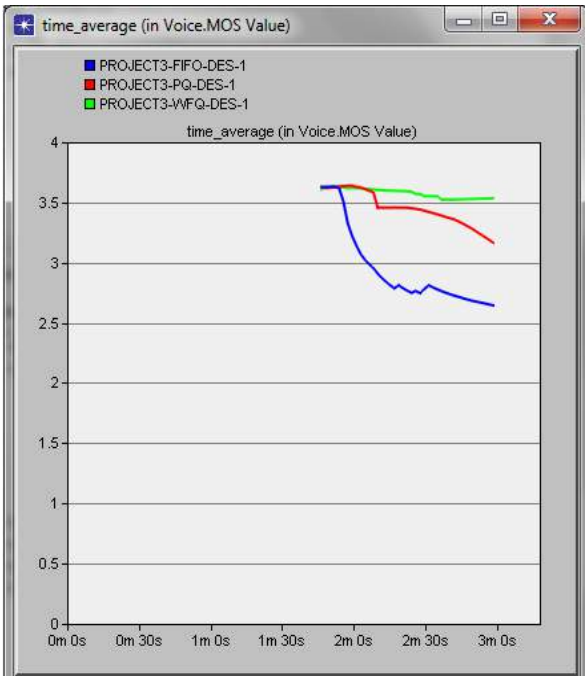

Figure 6.10 Voice MOS

According to simulation, as we can see in Fig. 6.10, MOS Performance metric has been shown of First

in First out (FIFO) Priority Queue (PQ) & Weighted Fair Queue (WFQ). In the above figure red, blue, and green colors used to represent First in First out (FIFO), Priority Queue (PQ) & Weighted Fair Queue (WFQ). .so in, MOS Performance we can say that Weighted Fair Queue (WFQ) Is best queue.

6.11 Voice Packet Delay

Delay is caused when packets of data (voice) take more time than expected to reach their destination. This causes some disruption is the voice quality.

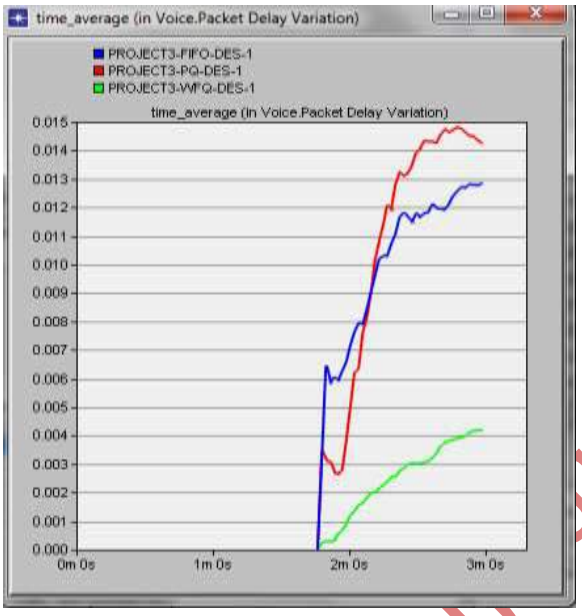

Figure 6.11 Voice Packet Delay

According to simulation, as we can see in Fig. 6.11, Voice Packet Delay Performance metric has been shown of First in First out (FIFO) Priority Queue (PQ) & Weighted Fair Queue (WFQ). In the above figure red, blue, and green colors used to represent First in First out (FIFO), Priority Queue (PQ) & Weighted Fair Queue (WFQ). so in, Voice Packet Delay Performance we can say that Weighted Fair Queue (WFQ) Is best queue.

6. 12 Remote Login Response time:

Time elapsed between sending a Request and Receiving the response packet Measured from the time a client application sends a request to the server to the time it receives a response packet .Every resposne packet sent from a server to a romote login application is included in the statistic

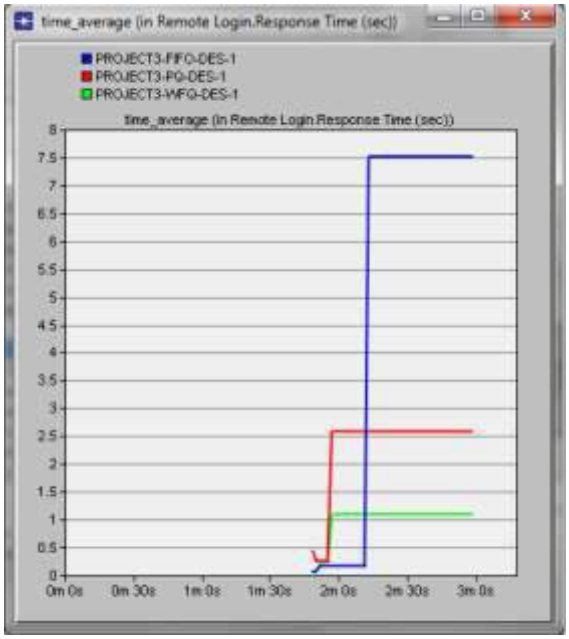

Figure 6.12Remote Login Response time

According to simulation, as we can see in Fig. 6.12Remote Login Response time Performance metric has been shown of First in First out (FIFO) Priority Queue (PQ) & Weighted Fair Queue (WFQ). In the above figure red, blue, and green colors used to represent First in First out (FIFO), Priority Queue (PQ) & Weighted Fair Queue (WFQ). in which we can see that Remote Login Response time of First in First out (FIFO), is worst that is 7.5, after that Priority Queue (PQ) is providing that in 2.5 second, but all of them, Remote Login Response time Weighted Fair Queue (WFQ) is best that is 1.9 second simulation time was set to 180 seconds .so in, Remote Login Response time Performance we can say that Weighted Fair Queue (WFQ) Is best queue.

6.13 Video End to End Delay

Variance among end to end delays for video packets .End to End Delay for video packets is measured from the time it is created to the time it is received

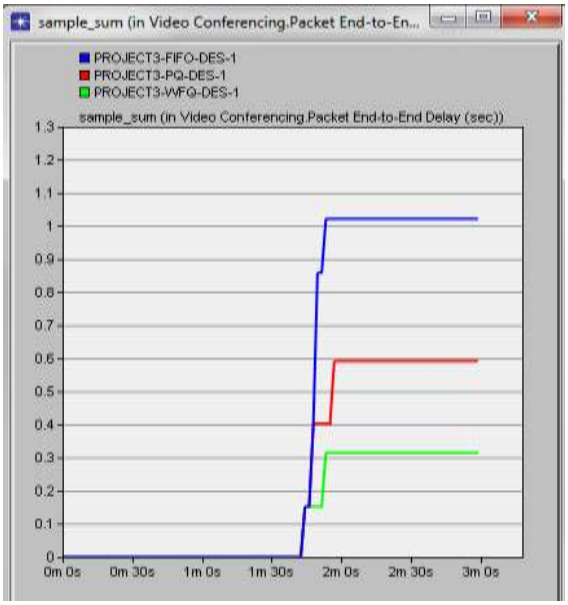

Figure 6.13Video End to End Delay

According to simulation, as we can see in Fig. 6.13, Video End to End Delay Performance metric has been shown of First in First out (FIFO) Priority Queue (PQ) & Weighted Fair Queue (WFQ). In the above figure red, blue, and green colors used to represent First in First out (FIFO), Priority Queue (PQ) & Weighted Fair Queue (WFQ). so in, Video End to End Delay Performance we can say that Weighted Fair Queue (WFQ) is best queue.

6.14 voice End to End Delay:

Avearge number of Packets per second submitted to the transport layers by all voice application in the network

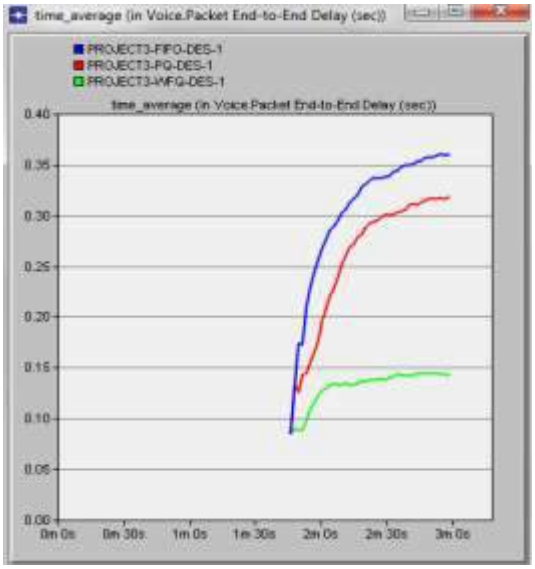

Figure 6.14 voice End to End Delay:

According to simulation, as we can see in Fig. 6.14, Voice End to End Delay Performance metric has been shown of First in First out (FIFO) Priority Queue (PQ) & Weighted Fair Queue (WFQ). In the above figure red, blue, and green colors used to represent First in First out (FIFO), Priority Queue (PQ) & Weighted Fair Queue (WFQ). so in, Voice End to End Delay Performance we can say that Weighted Fair Queue (WFQ) Is best queue.

7. PerformanceChart: The performance Analysis of all Queue scheduling has been described here in the form of graph. In which the blue, red and green colors used to represent First in First out (FIFO),Priority Queue (PQ) & Weighted Fair Queue (WFQ). Only in FTP upload (PQ) is slightly better than (WFQ), in all others Performance matrices Graph shows clearly that WFQ provides best results rather than others.

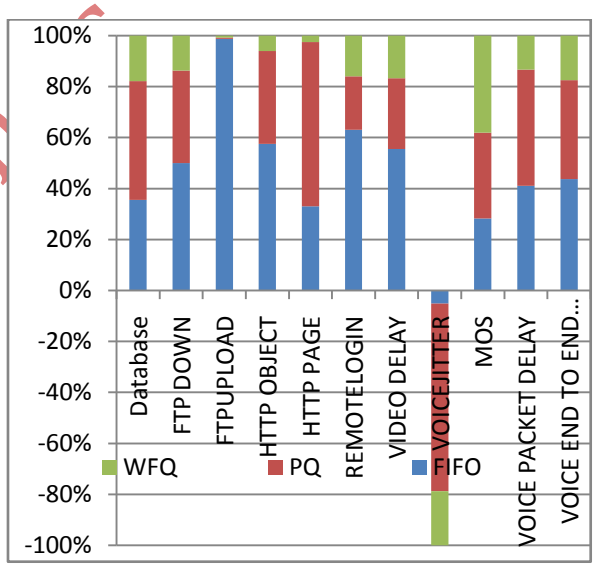

Figure 7.1Performance Chart

8Conclusion and Future work

8.1 Conclusion

In this Researchpaper concluded mainly two types of studies; one is analytical and second is Practical which is based on OPNET Simulator. Analytic Study concluded the behavior of each Queue System like FIFO,PQ,&WFQ All the Network Performance has depended on its Queue System Different Queue System have different processing Mechanism according to their environmental

scenarios. From Simulator aspects we concluded that which is major factor that can affect the performance of Network that is Network size. Some Protocol may be best in small or medium but may not be best in large network. some may be provide best results on medium or large but may be give worst response on small network .so simulator point of view network size can play important role in the performance of Routing Protocol. In this Paper , we have presented Three different WIMAX Network which are based on different Queue System such as FIFO,PQ,WFQ. To Obtain the Performance of WIMAX Network different setup of some related devices has been configured. To fulfil the objectives of this thesis we have created three different scenarios in which we took 25 WIMAX nodes ,each for different Network .so on the behave of each different Network three different Network has been configured . The comparative analysis has been done respectively with FIFO, PQ, WFQ for real time applications. Performance has been measured on the basis of some parameters that aimed to figure out the effects of routing protocols. Respective Performance MetricsDatabase query Response Time, FTP Download Response Time, FTP Upload Response Time, Http Object Response Time, Http Page Response Time, Remote Login Response Time, Video End to End Delay, Jitter, Mos value, Voice Packet Delay, Voice End to End Delay. The simulation Run time processing Time is set to 180 seconds for each Network. To check the Performance each Network we have taken different Eleven Performance metric, In Ten of Eleven Performance metrics WFQ is providing best Results These Performances metrics are Database query Response Time, FTP Download Response Time, Http Object Response Time, Http Page Response Time, Remote Login Response Time, Video End to End Delay, Jitter, MOS value, Voice Packet Delay, Voice End to End Delay. Only in FTP Upload Response Time, PQ is best. so on the behave of our simulation study WFQ is providing us best Results .

8.2 Future Scope

So in the last we can concluded that in WIMAX Queue System Network WFQ is Providing best . In future, research work can be done on the Another's Queue System and some others Performance metrics also can be taken.

9REFERNCES

[1] Ali Nawaz Naqvi, Ash Mohammad Abbas, Tofik Ali Chouhan, "Performance Evaluation of Fixed and Mobile WIMAX Networks for UDP Traffic", (ali nawaz naqvi, oct 2012) Vol. 1, Issue 8, October 2012.

[2] Ajay Roy, A K Jain , "(Ajay Roy, 2015)",International Journal of Computing and Network Technology 2015.

[3] AshishShukla, Rajeev PaulusÀ , A.K.Jaiswal and Mayur Kumar (ashish shukla, 2014)", International Journal of Current Engineering and Technology 2014.

[4] Adhicandra "(adhicandra, april 2010)" Journal of telecommunications, Volume 2, Issue 1, April 2010

[5] A. Kaushik, (A.Kaushik, 2012), International Journal of Electronics and Computer ScienceEngineering (IJECSE, ISSN: 2277-1956), 2012, pp. 07–14.

[6] B.K Mishra ,S.K.Singh, Kalpana Patel , " (B.K Mishra, 2012)", International Journal of Advanced Computer Science and Applications (IJACSA) 2012.

[7] C. Kolias, G. Kambourakis, S. Gritzalis, (C.Kolias, 2013): Analysis and assessment (2013)

[8] E. Onyekachi and E. Elias "(E.Onyekachi, 2013)" Computer Engineering and Intelligent Systems Vol.4, No.5, 2013.

[9] (H. Yang, 2006), Securing a wireless world,Proceedings of the IEEE , 2006,pp. 442–454.

[10] A (A H.Rashwan, 2009)H. Rashwan, H. M. El-Badawy and H. H. Ali "Comparative Assessments for Different WiMAX Scheduling Algorithms".Proceedings of the World Congress on Engineering and Computer Science Vol I. WCECS, San Francisco, USA, 2009.

[11] H.S Mewara and Dhanwanti Manghnani "(H.S Mewara, 2015) ",IEEE International Conference on Computational Intelligence & Communication Technology 2015.

[12] Hesham N. Elmahdy , Mohamed H. N. Taha , " (Hesham N.Elmahdy, january 2009)", Paper in ICGST-CNIR Journal, Volume 8, Issue 2,January 2009 , Faculty of Computers and Information , Cairo University, Giza, Egypt .

[13] J. Cao, M. Ma, M. A. B. Ariff, (J.Cao, 2011), 4th IEEE International Conference on Broadband

Network and Multimedia Technology (ICBNMT), IEEE, 2011, pp. 572–578.

[14] J. Hamodi, R. Thool, K. Salah , A. Alsagaf and Y. Holba"(J.Hamodi, 2014)". scientific research. Int. J. Communications, Network and System Sciences, vol.7, 10-21, 2014.

[15] J. Qayyum, M. Lal, F. Khan, M. Imad, (J.Qayyum, 2011)International Journsal of Video & Image Processing and Network Security 11 (2011) 36–47.