GPRS Simulation for Packet Sending

Ahir Divya[1] and Khatri Trushna[2]

Chhotubhai Gopalbhai Patel Institute of Technology, Bardoli, India
ahirds@gmail.com, trushna.khatri@utu.ac.in

Abstract. GPRS is part of the evolution path towards 3G. A fair queuing algorithm is used to minimize update delay and packet loss. In addition, we give priority to all the mobility management-related packets to ensure that all MM-related packets are processed and reach its destination with minimal delay. A simulator was developed to study the end-to-end behaviour of data transmission between a mobile client and a fixed server via GPRS and Internet. Simulation results show interruption in data delivery when MS executes a routing area update procedure. The obtained simulation results demonstrated that the used techniques give better routing area update performance than Priority based Deficit round robin service and the analysis results shows that the throughput is higher of fair queuing algorithm then the deficit round robin algorithm using same criteria.

Keywords: General Packet Radio Service, Fair Queuing, Deficit Round Robin.

1 Introduction

GPRS is designed to provide packet-based data service in a cellular system based on GSM. The General Packet Radio Service (GPRS) [1] is part of the evolution path towards third generation (3G) mobile system types of routing area updates. During a routing area update operation, the downstream and upstream packet transfer to and from Mobile Station is momentarily interrupted. The latency of packet delivery is increased due to these interruptions. In addition, packets could be miss-routed prior to routing area update completion, and these results in packet loss.

The simplest and most popular scheme for servicing packet, First in First out (FIFO), suffers from the drawback that some traffic might get an unfair share of resource at the expense of other users. In the case of Mobility Management (MM) in GPRS, MAP signalling messages in SGSN and GGSN might not get a fair share of resource. This is because the volume of LLC and GTP packets, carrying both data and signalling packets, out numbers MAP packets. To counter the unfairness, we propose a Fair Queuing algorithm that keeps separate queues for different types of packets. The queues are served in a round-robin manner; this ensures that MAP signalling messages get a fair share of resource as compared to LLC and GTP. In addition, to further speed up the routing area update procedures, we give priority to all the MM-related LLC and GTP packets. This ensures that all MM-related packets are processed and reach its destination with minimal delay. We compare the fair queuing algorithm with the priority based round robin algorithm and compare the both algorithm throughput.

A simulator was developed to study the end-to-end data transmission between a mobile client and a fixed Internet server connected via Internet and a GPRS network. The complete architecture of the GPRS was modelled. The analysis focuses on mobility management functionalities and data packet transmission, particularly in the IP layer. Simulation results are presented, showing interruption in data transmission in term of routing area update completion time, packet loss and ftp throughput when MS execute different types of Routing Area Update procedures. Furthermore, techniques based on service scheduling are implemented to improve the handoff performance in GRPS. We compared the disruption due to routing area updates under two queuing algorithms: Fair Queuing and Priority based round robin queuing for mobility management-related messages. Simulation results obtained show that the proposed techniques demonstrate better handoff performance.

2 METHODOLOGY

We implement two algorithm for GPRS simulation for packet sending. Fair queuing and priority based round robin algorithm for congestion control in GPRS network.

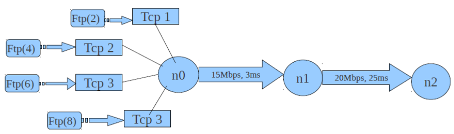


Fig. 1. Structure

We introduce fair queuing (FQ) in servicing the packets. The important feature of FQ is fair allocation of bandwidth among various users and the ability to control delay in delivery of packet. FQ protects the well-behaved users from the ill-behaved ones. In this case, the well-behaved users are the MAP packets while the ill-behaved ones are GTP and LLC packets. We propose a FQ algorithm that keeps separate queues for different types of packets to be incorporated in SGSNs and GGSN. These queues are served in a round-robin manner. This ensures that MAP signalling messages get a fair share of resource as compared to LLC and GTP packets which carry both data and signalling packets. That shows in Figure 3.1 the implementation of the fair queuing algorithm and priority based round robin algorithm.

Deficit Round Robin (DRR), also Deficit Weighted Round Robin (DWRR), is a scheduling algorithm for the network scheduler. DRR is a modified weighted round robin and was proposed by M. Shreedhar and G. Varghese in 1995. It can handle packets of variable size without knowing their mean size. A maximum packet size number is subtracted from the packet length, and packets that exceed that number are held back until the next visit of the scheduler.

WRR serves every non-empty queue whereas DRR serves packets at the head of every non-empty queue whose deficit counter is greater than the packet's size at the head of the queue (HoQ). If the deficit counter is lower, then the queue is skipped (HoQ packet is not served) and its credit is increased by some given value called quantum. This increased value is used to calculate the deficit counter the next time around when the scheduler examines this queue for serving its head-of-line packet. If the queue is served, then the Credit is decremented by the size of packet being served.

Compared with Fair queuing (FQ) scheduler that has complexity of O(log(n)) (n is the number of active flows), the complexity of DRR is O(1). In the implementation criteria the three nodes is used for the simulation. The one node is initial and other two nodes are connected via 15 mbps, 3 MS and other connected via 20 mbps, 25 MS using TCP link. The TCP connection provides the acknowledgments of receives packets to the particular nodes or the clients. The four queues are used.

3 RESULTS AND DISCUSSION

In this figure 2 shows that the in queue the different types of the packets are arrived and in the fair allocation of the packets using Fair Queuing algorithm transmission will be done the different scenario of the Fair Queuing algorithm has shown in the figure. Due to the fair allocation of the packets the packet loss probability is none and the number of packet generation is higher.

Fig. 2. Fair Queuing Transmission

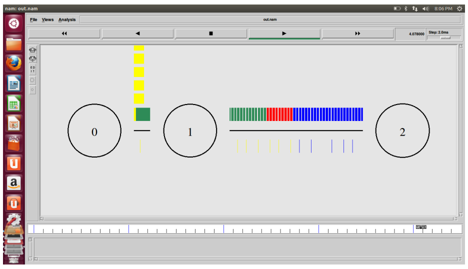


Fig. 3. Deficit Round Robin

In the Deficit round robin algorithm the first serve the same bandwidth or the same size of the packets to the clients and all the packets are stored in the queue. If the packets are more then the queue size the packet will be loss. This scenario shown in figure 3.

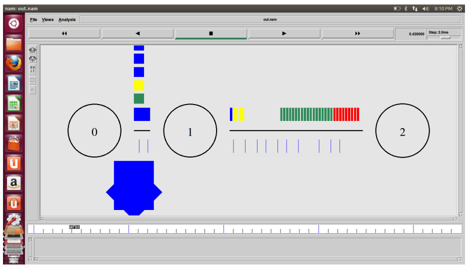


Fig. 4. Deficit Round Robin Packet Loss Scenario

In the Deficit round robin algorithm transmission of packets are in round ronbin manners. And the all packets are store in the queue and then the serve packets according to the priority based so that the packet loss probability is higher then the fair queuing and the number of packet generation is also low.

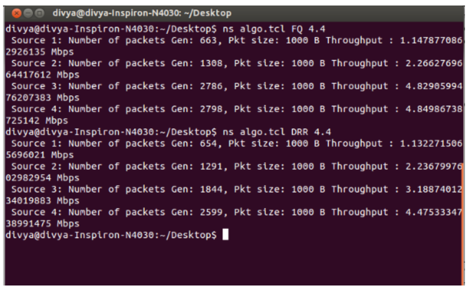


Fig. 5. Throughput

In this figure 5 shows the Number of packet generation, packet size and throughput of the Fair queuing algorithm and Deficit round robin algorithm. And the simulation results show that the fair queuing provides higher throughput then the priority based Deficit round robin algorithm.

Table 1: Different Flow Rates

Flow Id	**Generation rate**	**DRR Throughput**	**FQ Throughput**
1	2 Mbps	1.132 Mbps	1.479 Mbps
2	4 Mbps	2.236 Mbps	2.266 Mbps
3	6 Mbps	3.188 Mbps	4.829 Mbps
4	8 Mbps	4.475 Mbps	4.849 Mbps

DRR throughput rates, in case of varying flow rates, are in proportion to the generation rate of the TCP source. FQ throughput rates are closer to the max-min fair allocation rates. When flows generate at a uniform rate, FQ allocates bandwidth slightly more uniformly than DRR for small time durations. The total throughput (of the entire node n0) is marginally higher when FQ is used for scheduling than when DRR scheduling is used. When simulation is run for a longer duration DRR and FQ more or less seem to be allocating a similar ratio of the bandwidth for non-uniform generating sources. For longer simulation times and uniform generation, DRR and FQ both equal share to all their flows. But here again, over throughput is higher when using FQ than when using DRR.

Table 2: Large Simulation Duration

Flow Id	**Generation rate**	**DRR Throughput**	**FQ Throughput**
1	13.74 Mbps	2.920 Mbps	3.428 Mbps
2	13.74 Mbps	2.970 Mbps	3.4276 Mbps
3	13.74 Mbps	2.862 Mbps	3.4273 Mbps
4	13.74 Mbps	2.752 Mbps	3.4271 Mbps

The results of this work will be very useful in order to improve the performance in the case of user mobility. Simulating the movement of users within a cell will yield a range of users with varying coding schemes. By choosing the best algorithm or combination of algorithms for a certain configuration of coding schemes will enable network operators to optimize their network performance. Further work is to be done in order to consider more criteria for user priority and to correlate priory and precedence levels. Admission control will deal with the problems that are closer to the application level and all together (admission control and transmission control) will bring to the Quality of Service over GPRS. Our results with the problem of transmission control will be an important part of the general problem of QoS over GPRS.

4 CONCLUSION

We presented a simulation environment for performance analysis of packet delivery in GRPS with different parameter settings. The effects of mobility or Routing area update on packet data delivery in GPRS were analyzed. The disruption on packet delivery during RAU, particularly during an inter-SGSN RAU could be very high as traffic load increases. A simple mechanism based on service scheduling was proposed and implemented to improve the performance of mobility management in GPRS by reducing the RAU completion time.

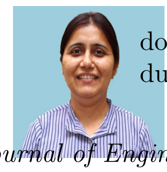
FQ provides a fairer allocation of bandwidth. The Fair queuing algorithm provides better performance than the priority based Deficit round robin algorithm.

References

1. Rexhepi, Wireless Internet QoS, Master Thesis, University of Twente, Department of Computer Science and Electrical Engineering, September 2000.
2. Doru Todinca, Philip Perry and John Murphy, Performance Engineering Laboratory, School of Electronic EngineeringDublin City University.
3. D.Raghupathikumar and Dr K.Bommanna Raja, IEEE A Comparison of Queue Management Schemes in Highperformance Input-Queued Switches IEEE/ICCCI - 2012.
4. Hemant M. Chaskar and Upamanyu Madhow, IEEE Fair Scheduling With Tunable Latency: A Round-Robin Approach IEEE, August 2003.
5. Hemant M. Chaskar and Upamanyu Madhow, IEEE Fair Scheduling With Tunable Latency: A Round-Robin Approach IEEE, August 2003.
6. karann chew, rahim tafazolli, Performance analysis for GPRS with prioritized and non-prioritized mobility management procedures university of surrey, united kingdom, November 2000.
7. ETSI, 2001, Digital Cellular Telecommunications System (Phase 2+); General Packet Radio Service; Service Description; Stage 2,GSM 03.60.
8. ETSI, 2001, Digital Cellular Telecommunications System (Phase 2+); General Packet Radio Service; Overall Description of the GPRS Radio Interface; Stage 2, GSM 03.64.
9. V. P. Kumar, T. V. Lakshman, and D. Stiliadis, Beyond best effort: Router architectures for the differentiated services of tomorrows Internet, IEEE Commun. Mag., vol. 36, pp. 152164, May 1998.

About Authors

Ms. Ahir Divya has completed her M.Tech in Computer Engineering fron CGPIT, Bardoli in year 2013 - 2015.



Ms. Trushna Khatri is an Assistant Professor at CGPIT, Bardoli. She has 8 years of teaching experience and 1.10 year of Industrial experience.