Priority Scheduling Schemes in Mobile Ad-Hoc Networks

Abstract: Delay is a major Quality of Service (QoS) metric in mission critical applications like health, vehicle and inspection safety applications. Some of such applications run on Mobile Ad-Hoc Network (MANET) set ups which comes with transmission challenges arising from the size of traffic packets and environmental conditions. These challenges cause transmission delays, packet loss and hence a degraded network performance. In this thesis we study the performance of (1) Earliest Deadline First (EDF), (2) Low Latency Queueing (LLQ) and (3) Weighted Round Robin (WRR) scheduling algorithms in MANETs. Abhaya proposed a classical pre-emptive EDF scheduler. The goal of the EDF scheduler was to favour higher priority packets thereby reducing their waiting times. Accordingly, favouring higher priority queues ends up increasing the waiting times of lower priority queues. We improve and adopt it to the MANETs environment and formulate our EEDF-I and EEDF-II algorithms. We numerically study the performance of the EEDF-I and improved EEDF-II models for different packet queues. The results show that the EEDF-II model shortens the waiting times of packets of the different queues at various system loads compared with to the EEDF=I model. There exists an Improved LLQ packet scheduling algorithm modelled that was proposed to schedule video and voice packets. One limitation with the scheduling algorithm is that it penalized video packets at the expense of voice packets especially at high system load. We adopted and improved the existing model to LLQ algorithm in the M/G/1 queue system. The improved algorithm was proposed based on the adopted LLQ and utilizes the technique of splitting video packets while receiving service where one part of the video packet is transmitted along-side with the voice packets. A comparative performance analysis of the adopted and proposed LLQ algorithms under the exponential and Bounded Pareto (BP) distributions is carried out experimentally and the numerical results reveal that the proposed algorithm performs better than the adopted in transmitting video packets. This study extends further the proposed LLQ algorithm to formulate the Extended Low Latency Queuing algorithm (ELLQ). It investigated the performance variation of the ELLQ scheduling algorithm with three queues (voice, video and text) under different loads. For the purposes of improving delay performance, piggy backing of video packets on voice transmission is used. We investigate the performance variation of the LLQ in an M/G/1 queue under different scenarios and under the exponential and Bounded Pareto (BP) distributions. The numerical results when voice packet is delayed once revealed that the video packets experienced the least conditional mean response time and conditional mean slowdown. Voice packets followed by text packets experienced the worst performance in terms of conditional mean response time and conditional mean slowdown. When voice packet is delayed only if there is a partial video packet being transmitted, it was observed that voice packets experienced the least conditional mean response time and conditional mean slowdown, followed by video packets and then text packets in that order under LLQ algorithm. Lastly, we studied the WRR Strategy that prioritizes voice queue packets. However, by giving priority to voice queue packets, there is a likelihood of starvation of low priority queues (mainly video packets) depending on the service distribution. We enhanced and studied the Existing Weighted Round Robin (EWRR) service strategy; and then proposed an Improved Weighted Round Robin (IWRR) model in the M/G/1 queue system under varying workloads distributions. The study proposed the IWRR algorithm based on EWRR algorithm and utilizes the technique of computing the partial average waiting times of the small/large voice/video packets. The numerical results show that the video packets perform poorly compared to voice packets in the EWRR algorithm. The numerical results revealed that the IWRR exhibited superior performance while transmitting video packet.

 Mukakanya Abel Muwumba Reg No: 2019/HD05/31234U