Active Queue Management for Quality of Service in Heterogeneous Networks

Design of Active Queue Management for Access Routers

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Abstract

The Internet architecture is a packet switching technology that allows dynamic sharing of bandwidth among different flows within an IP network. Packets are stored and forwarded from one node to the next until reaching their destination. One of the major issues in this integration is congestion control and how to meet different quality of service requirements associated with various services. In other words, streaming media quality degrades with increased packet delay, jitter and packet drops caused by network congestion. In order to mitigate the impact of network congestion various techniques have been used to improve multimedia quality. One of those techniques is Active Queue Management (AQM). AQM algorithms deployed in heterogeneous wireless access networks needs to adapt to a multitude of network characteristics. In order to improve an adaptive AQM performance in heterogeneous wireless access networks, this dissertation proposes, describes and validates a new AQM algorithm, named the Adaptive AQM (AAQM). This thesis mainly focuses on design of the new Adaptive AQM for access points or access routers in order to eliminate buffer overflow by ensuring that the buffer size always covers the queue length adaptively with stability and precision. This method of adaptation is independent of traffic pattern changes because of its statistical nature and the large number of connections. This is contrary to the conventional control approaches that focus on constructing a controller by using Fuzzy Logic controller, as the model of the rate-based system the algorithm is able to update the drop or mark probability according to the packet arrival rate. Using the packet arrival rate for updating the drop or mark probability as a metric is beneficial and permits the maintenance of a low queue occupation. In order to achieve robustness the Fuzzy AAQM Controller (FAAQMC) maintains both resource provisioning and dimensioning performance under varying network conditions including variations in the number of flows, variation in round trip time, and link load**.** In order to achieve efficient queue utilization, the FAAQMC controls buffer size load of both time-varying packet arrival rate and packet departure rate. The FAAQMC algorithm performance congestion notification at a rate that maintains the aggregate transmission rates of the sources at or just below the queue clearance rate. The results obtained through the analysis and simulation show that the FAAQMC provides efficient queue utilization, ensures robustness, and regulates queuing delay.

Keywords: Access Router, Active Queue Management (AQM), Congestion Control, Wireless Heterogenous Network.