CHAPTER SIX

CONCLUSION AND FUTURE WORK

6.1 Introduction

Achieved objectives of this thesis and possible future work will be summarized in this chapter. Two congestion control methods have been proposed, namely, GB and GBFL, to detect congestion at an early stage before the buffer overflows and to overcome the limitations of existing methods. The limitations are summarized as follows:

a) Sensitivity to parameter settings

b) Slow-to-congestion response shortage in existing methods

c) Inability to stabilize ql at specific values to prevent the buffer from overflowing, particularly when heavy traffic occurs

The research objectives that have been achieved are discussed in the next section.

6.2 Achievement of the Objectives

6.2.1 Research Objective 1

The first research objective is to propose an AQM method inspired by BLUE to avoid congestion and achieve more satisfactory performance measures. GB was proposed based on BLUE, in Chapter Three. It uses a dynamic mechanism to calculate DP based on the status of ql. This dynamic-based mechanism overcomes the slow-to-congestion response shortage in existing methods and provides improved management for the router buffer. The proposed method predicts congestion before it occurs and responds using dynamically updated values. DP is dynamically calculated based on ql and the remaining

buffer capacity. The simulation and implementation for the proposed method are discussed in Chapter Four. The performance measures of GB are collected after simulation is implemented, and the results are compared with those of the DGRED, BLUE, ERED, and adaptive max threshold methods in terms of mql, D, T, PL, and DP performance measures. The results, which are discussed in Chapter Five, indicate that the performance measure results of mql, D, T, and PL are the best for GB compared with those for the other methods when light or heavy congestion occurs. Moreover, the DP results for GB are higher than those for the other methods.

A discrete-time performance analysis of the GB method is conducted to evaluate the proposed method under bursty and correlated properties of Internet traffic. A new model for performance analysis under bursty and correlated traffic that uses two states of the MMBP arrival process as the traffic source (also called the MMBP-2 model) is established. GB–MMBP-2 is proposed and designed in Chapter Three. The proposed model is compared with GB, which uses BP as the source model (GB–BP), and the original BLUE, which uses BP (BLUE–BP) and MMBP (BLUE–MMBP-2) as source models. The simulation and implementation for the proposed method are discussed in Chapter Four. The methods are evaluated in terms of mql, D, T, PL, and DP. The results, which are discussed in Chapter Five, show that GB–MMBP-2 is better than the other methods. This finding implies that the GB algorithm provides the best performance results in terms of mql, D, T, PL, and DP compared with the other methods, particularly when heavy congestion occurs.

The validation of the proposed method based on a discrete-time analytical model. Accordingly, a discrete-time analytical model is established. The results

of the proposed model are compared with those of GB simulation and the analytical model to validate the results of our model. The GB analytical model is designed and the results are presented in Chapter Three. The results of the analytical model are compared with the results of the simulation to validate and prove that the simulation obtains correct results and is working correctly. The obtained results, which are discussed in Chapter Five, show that GB simulation and the GB analytical model provide similar performance measure results, thereby indicating that the simulation obtains correct results.

6.2.2 Research Objective 2

The second research objective is to propose a method that will reduce dependency on parameter setting in the congestion control approach of the proposed method for objective 1 using FL. The GBFL method is proposed based on the original GB using FL to enhance the performance results of the original GB method and reduce the number of parameter settings. In particular, the proposed method uses FIP. Accordingly, it adopts two input linguistic variables (ql and D) to calculate one output linguistic variable (DP). The simulation and implementation for the proposed method are discussed in Chapter Four. The proposed GBFL results are compared with those of GB, GREDFL, and REDD1. The results, which are discussed in Chapter Five, indicate that the GB and GBFL methods provide the best mql, D, and PL in light and heavy congestion cases. Furthermore, results show that all the compared methods present similar T results.

6.3 Future work

Following points are intended to be conducted in future:

1. Propose a new congestion control method based on FL that uses throughput and ql as input linguistic variables and DP as the single output linguistic variable.
2. Propose a new congestion control method based on FL that uses traffic load and ql as input linguistic variables and DP as the single output linguistic variable.
3. Propose an analytical model for the queuing network that can handle two queue nodes based on the priority policy using discrete time; another analytical model can also be developed to handle N-queue nodes.
4. Evaluate the performance of the proposed GB method in a wireless network environment.
5. Evaluate the performance of the proposed GBFL method in a wireless network environment.