Chapter 9

Conclusions and Future Work

9.1 Summary of Contributions

This thesis describes a study focusing on IPv6 Anycast routing protocol. This work encompasses detailed study and research of the subject matter, development of a simulation environment, proposal of an anycast routing protocol enhancement and the evaluation of the existing and the proposed anycast routing schemes through simulation.

This thesis begins by a detailed study on the IPv6 architecture, including the formats and functions, and the addressing architecture as well. Basic understanding of the IPv6 architecture is required as anycasting is included in this new version of Internet Protocol. Next, the multicast trees models are presented, as the proposed anycast routing protocol is an extension of the existing multicast tree. An extension to the multicast tree is preferred in this thesis because with the use of the multicast tree, a loop-free environment is available and traffic load-balancing is more viable. Later, the fuzzy set theory and fuzzy logic control are presented and fuzzy logic is used to fuzzify one of the load-balancing scheme, the shortest-path method. Next, works on anycasting were surveyed and the issues of anycasting were discussed.

The design, implementation and testing of the simulation environment for the anycast routing protocol using the JaNetSim network simulator is detailed in Chapter 7. The

simulation environment provides a platform for evaluating RIPng extension, PIM-SM extension, nearest PIM-SM extension and the three load-balancing schemes – shortest-path, round robin and fuzzy shortest-path.

The proposed nearest PIM-SM extension for anycast routing is detailed in Chapter 6. The proposed scheme exploits the use of shortest-path for off-tree hits and applies load-balancing schemes for on-tree hits in order to improve the performance and reliability of the anycast routing. Using the simulation environment for anycast routing, the effectiveness of the proposed nearest PIM-SM extension over the RIPng extension and PIM-SM extension was demonstrated through simulation results, where improvements in end-to-end delay and packet loss percentage were observed.

9.2 Suggestions for Future Research

There are still many unavoidable issues related to this work that require further research. Building an efficient anycast routing protocol without sacrificing its reliability is an uphill task. The proposed nearest PIM-SM extension is able to eliminate some of the problems but not all.

The number of load-balancing schemes available here is still not extensive. Possible load-balancing schemes for future research include fuzzy round robin, weighted random selection and fuzzy weighted random selection. As servers are increasingly becoming more powerful, the implementation of fuzzy logic control becomes more feasible.

Future research on anycasting may use the Open Shortest-Path First (OSPF) for IPv6 as the underlying unicast routing protocol. The implementation of OSPF for IPv6 will allow simulations of a bigger network topology. The simulations in this thesis are limited to the scope defined by the RIPng.

The simulation environment can be further improved by having additional, more extensive sets of randomly generated network topologies. These topologies will help in analyzing the performance of the anycast routing schemes in different topologies.