

Chapter 6 Conclusion

The development of the NewReno in TCP with IP simulator components has provided several valuable insights into the methodology of network simulations, as the development process has been a journey of discovery and exploration. This chapter will begin with the discussion of the objective achieved during the development process followed by a discussion on the goals achieved for the project.

The third section will discuss the development outcome. This section will detail the strengths and the limitation of the NewReno in TCP with IP simulator. It is then followed by a discussion on future enhancements for the TCP with IP simulator. This section will describe some of the new functions that can be implemented for future purposes.

6.1 Objective Achieved

After nine months of analysis and development, the final product has been produced. This section will briefly discuss the objective achieved during the development process.

The first objective was the acquisition of knowledge. During the development process, different kinds of experiences and knowledge were gained. A whole survey was carried out on most of the available literature on the subject of the TCP with IP networking technologies such as Tahoe, Reno, NewReno and SACK. These lead to a good understanding of these network technologies. The understanding of the core nature of these technologies is most suitable even before the first step was undertaken to simulate the operation of these technologies within an artificial environment.

The second objective achieved was understanding the whole concept of network simulation. An indepth study was made on most of the current network simulators in order to gain a better insight into the workings of a network simulator. This provided the solution to the problem of simulation and the development of the network

simulator. In addition, the experience gained in solving problems during the design, implementation and testing of the simulator is invaluable.

The third objective achieved was the complete development of the NewReno in TCP with IP simulator based on the object-oriented approach. The object-oriented approach endows the simulator design with flexibility, modularity, extensibility and reusability. In addition, the NewReno in TCP with IP simulator has unique features that give it strength not seen in the UMJaNetSim v0.5 network simulator.

All of these objectives, both knowledge-oriented and development has been achieved. The development process has provided many opportunities for the study of the NewReno. It has also given the chance to prove the ability to create a simulator with all the desired features that were put forward right from the beginning.

6.2 Development Outcome

The development process has produced an end system that contains the system strength and the system limitation. This section will discuss about the development outcome of the TCP with IP simulation.

6.2.1 System Strength

The end system possesses a variety of strengths as compared to other simulator products. The major strengths of the simulator are listed below:

- Platform independent

The developed simulator using Java Programming Language enables it to be platform independent. So, the simulator works well in Windows, UNIX or Linux environment.

- **Simplicity**

The GUI and the user-friendly environment allow the users to create different network topology on the workspace. Besides that, the TCP with IP component can be configured easily by using the guidelines provided by the simulator.

- **Object Oriented**

The simulator is fully developed in an object-oriented environment. All methods and modules are built in classes therefore creation or modification of components can be done easily.

- **Analysis of Simulation results**

The end system provides the log file and run-time diagram for simulation process. This lets the user analyze the result of different network topologies after the simulation. These methods enable the user to perform further analyses.

6.2.2 System Limitation

The limitation of the simulator components that were developed during this project was due to the limited scope of the project. Beside that the development process needed to be simplified in order to meet the time and effort constraints. The system limitation are listed below:

- The simulator works based on Java application, so it is not web-enabled yet.
- The simulator requires large resources to simulate.
- The simulator only supports the common functions of the TCP version.

6.3 Future Enhancement

The open-ended nature of the UMJaNetSim allows much space for improvements. It is foreseeable that further work can be put into the simulator development to add more

features to increase its usefulness. The following are some of the future enhancements for the simulator:

- Development of further visualization components to enhance the usefulness of the simulator, both as an education and a research tool.
- Addition of other TCP version such as SACK and Vegas.

6.4 Chapter Summary

To summarize the entire project, the development process of this project has been a journey of discovery and experience. This project managed to achieve the overall project objectives and requirements as a TCP with IP network simulator, as determined during the system analysis. The simulator-testing phase has proved that the project was implemented successfully and managed to support the common type of topology.

This project also showed that the object-oriented approach using Java programming language to network simulation is an extremely beneficial approach to the development of network simulators.