Effectively Using a Network Simulation Tool to Enhance Students’ Understanding of Computer Networking Concepts

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Abstract

This chapter discusses the effective use of a simulation tool in the teaching of data communication concepts. Because such concepts can be abstract and therefore difficult to visualise and understand, simulation can help facilitate learning. In looking to develop a structured approach to optimally utilising a network simulator in teaching networking concepts, a series of targeted exercises were developed. These applied the principles of active
learning to the use of the simulator in practical exercises to encourage independent and analytical processes and facilitate deeper learning. The background to this, as well as the design and implementation of the exercises, is presented. Similarly, the features of an appropriate network simulator that can be effectively used in this context are discussed, and a brief overview of the simulation tool used, Packet Tracer, is given. To illustrate the methodology, examples are provided from the actual exercises given to students. The system was also evaluated through an experiment that measured the improvement in understanding of a particular topic, switched networks, after students participated in a practical on this topic using the exercises discussed. A clear increase in understanding was shown. The incorporation of the simulator in developing case studies to progressively integrate concepts learned as an ongoing, practical exercise is also presented. In addition, the use of simulation to learn troubleshooting skills and strategies by employing a simulated network containing deliberately created errors that need to be resolved is discussed.

**Learning Objectives**

After completing this chapter, you will be able to:

- Develop exercises using a network simulator to enhance the teaching and learning of data communications concepts in large classes.
- Apply the principles of active learning in a practical teaching environment.
- Utilise the methods detailed to encourage independent learning of such concepts as collisions, Internetworking, IP addressing, ping, protocols, and routing.
- Use the ideas outlined as a basis for innovation in the application of a simulator in teaching networking.
- Suggest further enhancements to the laboratory activities described in this chapter.

**Introduction**

The challenge of teaching data communications in depth to a large cohort of students is compounded by the fact that the subject material is inherently