Chapter 28
Open Source Software Usage in Education and Research:
Network Traffic Analysis as an Example

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ABSTRACT

Information technology and telecommunication is considered a new and quickly evolving branch of science. New technologies and services in IT and telecommunications impose successive changes and updates on related engineering majors, especially in practical qualification that includes using software facilities. This chapter aims to join the efforts to spread the use of open source software in academic education. The chapter consists of two main sections. The first presents the trend of using open source software in higher education and discusses pros and cons of using open source software in engineering education. The second section presents network traffic analysis as an example of recent effective research topics and provides a set of open source tools to perform the research's practical steps. The research example with the suggested tools is valid as practical lab work for telecommunication and IT-related majors.

OPEN SOURCE SOFTWARE IN EDUCATION AND RESEARCH

Tendency to Use Open Source Software in Higher Education

By definition, open source software (OSS) is software that is available to everyone, including the source code, along with the copyright license that permits using, studying, modifying, or redistributing the software (Beal, 2008). OSS covers a wide range of user needs, ranging from simple programs such as

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editing utilities, to very advanced software such as operating systems. The most famous successes in OSS are the operating systems Linux and Android.

Using OSS in education is a current tendency in some of the leading universities around the world, including the USA and Europe (Wilson, 2013; Roach, 2016). Some of these universities, such as MIT and Stanford, effectively participate in developing open source projects through their dedicated research labs. The main reasons for choosing OSS in many educational institutions are the cost, which plays a key role especially in limited-budget educational systems; its high effectiveness and success with some important educational platform systems such as Moodle (Cole & Foster, 2008); and better suitability than closed software for research environments in higher education. Nowadays, there is a tendency in some countries to share information and make education available to everyone (e.g., the #GoOpen campaign in the USA) (Office of Educational Technology, 2016). Open source and open education complement each other, and both focus on transparency and sharing information. The next section presents pros and cons of using OSS in engineering education.

Pros and Cons of Using OSS in Engineering Education

Due to the particularity of the learning activities in engineering education, specifically in IT and telecommunications engineering, the advantages and drawbacks of using OSS are not the same as in other domains. In engineering institutions, the students and professors use the software as an educational tool, and, at the same time, they may develop it as a part of practical training. Table 1 shows a summary comparison of using OSS and closed software in engineering education.

Table 1 shows that OSS is better than closed software with respect to cost, fitting lab needs, possibility of using the software as a common platform for joint projects, interoperability with other systems,

Table 1. Comparison between OSS and closed software in engineering education

Criteria	OSS	Closed Software
The cost	-OSS is free -No limitation on usage duration or number of copies	-Not free of change -Limited number of copies -Could be for limited duration
Cooperation between Academic Institutions	-Valid to be used as a common platform for joint projects	-Less likely to be used for joint projects
Interoperability with other Systems	-Possibility to compile different versions for different OSs -Possibility to change the source code and the input/output format	-Software is intended to work on specific OS -Limited or fixed input/output format
Fit Lab Needs	-Predefined options and scenarios -Possibility to change the source code to adapt lab needs	-Predefined options and scenarios
Availability for Specific Research Purposes	-Many OSS has been developed in academic institutions for specific research purposes	-Closed software development is based on market needs
Support	-Support depends on contributors (not guaranteed) -Lack of documents and materials	-the software companies support their products -Availability of documents, help, and support materials
User Interface Quality	-In general, has a poor GUI quality, especially in the old versions (command line only)	-Most commercial software has a good GUI quality