

Free Software and Open Source in Education: Geoinformatics at the CTU in Prague

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Free Software and Open Source (FOSS) plays an important role at Faculty of Civil Engineering, Czech Technical University (CTU) in Prague, study branch Geodesy, Cartography and Geoinformatics. There are several courses where the students learn how to use different Free Software and Open Source tools. These practical courses cover basic topics as introduction into database management systems, programming, and GIS-oriented subjects. Thanks to Professor Cepek Free Software and Open Source tools have been used at the CTU in Prague, study branch Geodesy, Cartography and Geoinformatics for several years.

In the first semester the students learn how to effectively use GNU/Linux operating system including some advanced topics like scripting in Bash or UNIX administrator-related issues. After introduction into GNU/Linux OS the students learn basics of SQL (Structured Query Language) which is a standard language for accessing object-relational databases. The assignments for Introduction into Database Systems course is developed with PostgreSQL as a widely used open-source object-relational database management system. For course evaluation is used GNU SQLTutor as a web based interactive tutorial of SQL. GNU SQLTutor [1] has been developed at the CTU in Prague by Professor Cepek in 2007. Later in 2010 have been added several geospatial datasets for interactive learning of spatial SQL [2] based on PostGIS geodatabase. In the third semester the students learn basics

of programming in C++. In this case the assignments were developed with QT framework. The basic programming course is focused on developing simple graphical-based applications using QT graphical library and QT framework for C++ programmers. In other semesters the students have also possibility to learn programming in Java using open-source development environment called Eclipse. The students also learn other FOSS tools as Octave for computations, R in statistics, LaTeX for writing technical reports or GNU Gama which is dedicated to adjustment of geodetic networks. The GNU Gama [3] is a project founded by Professor Cepek, and the most of contributors to this project are former or current students from the CTU in Prague, study branch Geodesy, Cartography and Geoinformatics. In the fifth semester the students work on semester project, the goal is to develop a web-based CGI application written in C++ using QT framework and light-weight database SQLite.

Similarly also GIS-related courses are focused on usage of Free Software and Open Source tools. Beside commonly widespread proprietary GIS platform provided by Esri company (Esri ArcGIS) the students learn about Free Software and Open Source for Geoinformatics (FOSS4G) in general - from community-driven development to the most important FOSS4G desktop and web-based projects. As we noted above PostgreSQL database system is used as a platform for teaching the Geoinformatics students at the CTU basics of SQL. PostGIS as a program that supports for geographic objects to the PostgreSQL object-relational database, was a natural choice when choosing platform for teaching the students how to store, manipulate and analyze geospatial data in object-relational database management systems. In other words, the assignments for Introduction into Spatial Data Processing course were mainly developed with PostGIS, some lessons are also dedicated to the SpatiaLite database as light-weight solution based on SQLite database.

The heart of FOSS4G in education at the CTU in Prague, study branch Geodesy, Cartography and Geoinformatics is Free Software in Geographic Information Systems (GIS) course [4]. Within this course, the students learn about the FOSS4G environment in general, including a community-driven development, or OSGeo role. In practical lessons the students learn how to use FOSS4G tools when manipulating, storing or analyzing geospatial data.

The assignments were developed with mostly used open-source GIS desktop applications like GRASS GIS, QGIS or gvSig. The students learn basics about development of web-based mapping applications using MapServer, and javascript library OpenLayers. The students also enhance their knowledge in programming or scripting, the assignments contain programming for GDAL/OGR library in C++ or Python, specific Python GIS-oriented libraries, introduction into writing C++ or Python plugins for QGIS or scripting in Python for GRASS GIS. One practical lesson is also dedicated to OpenStreetMap project including active mapping near the university campus. The students have also opportunity to borrow handy GPS at the university to do mapping for OpenStreetMap in their free time. The Free Software GIS course is also available in English to make it accessible for international Erasmus students.

Since 2005 the assignments for Remote Sensing course in the Geoinformatics program have been developed with GRASS GIS. The assignments are in Czech only, and available online [5]. GRASS GIS project is one of the most popular GIS and Remote Sensing tools world-wide. Beside GRASS GIS also Orfeo Toolbox or OSSIM are used for several tasks. The students have opportunity to report bugs in GRASS software or wishes directly to the teacher who is actively contributing to the GRASS GIS project since 2005. Smaller bugs are fixed or wishes implemented for the next lessons which makes the students happy and as a result interested in open-source software development.

Thanks to the fact that several courses at the CTU in Prague, study branch Geodesy, Cartography and Geoinformatics are based on usage of Free Software and Open Source, some of the Geoinformatics students from CTU became interested in contributing to the open-source projects, not only as developers (e.g. currently there are three our students which are actively contributing as developers to GRASS GIS project), but also as testers, bug-hunters, translators or power users. Since 2008 several Geoinformatics students from CTU participated in Google Summer of Code (GSoC) program and developed a new GUI in GRASS GIS for visualization of geospatial data in 3D (wxNviz, participation in 2008, 2010, and 2012) [6] or GUI front-end for GRASS vector network analysis tools (wxVNet, participation in 2012, [7]). Other GRASS-related projects which were developed by the Geoinformatics

students from CTU is wxGUI Cartographic Composer [8], wxGUI tool for supervised classification [9] or the new version of r.in.wms module in Python for downloading WMS (Web Map Service) data in GRASS GIS [10]. Some of the Geoinformatics students from CTU were also involved in QGIS development, recently has been developed by the students QGIS plugin for Czech cadastral data [11] or Workflow builder for QGIS Sextante project. The important point is that the students learn about different environments. The open society, open access to the knowledge and information, namely Free Software Foundation, projects which are based on open sharing of information like Wikipedia or OpenStreetMap play very important role nowadays. The students should simply learn about such aspects at the university.

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