Open source technologies in education

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Abstract: Every modern university of technology used widely in education computing today. A key decision is usually the choice of software used. This step is necessary to thoroughly analyse and think, because the decision may affect a whole generation of students. In most cases, universities still rely on proprietary software. Often choose by the habit of the Windows operating system. Such an approach is unnecessary increase in funding for IT and in addition prevents the freedom of choice as operating system, as well as software. We have decided to include as the main software package programs from the family of open source at Faculty of Electrical and Information Technology STU - Department of Information and communication systems. The advantage is to reduce the cost of license and possibility of choosing the operating system.

Key-Words: - Open source, education, university, productivity suites, development tools, image editors, webservers, costs, document formats

1 Introduction
Open source philosophy is based on idea that all software may be used freely and for free at least for personal use and at least for general usage programs like operating systems and productivity suites. To ensure freedom of such programs there is need to use open formats. Freedom in the meaning of the open sources is granted in four main freedoms:

- Freedom 0 - to use program for any purpose
- Freedom 1 - to study how program works and to modify program to better-fit user requirements
- Freedom 2 - to let friend to use program legally
- Freedom 3 - to distribute modified version when granting same rights as you have

These freedoms are based of academic freedoms. This is case that most of open source users are based inside of academic community. It is because most of the open source developers came for academic community. Another group of open source users is based in industry experts.

Basics of open source were established in hacker culture on Artificial Intelligence lab at Massachusetts Institute of technology at Cambridge, MA. Artificial Intelligence Lab is now part of Computer Science and Artificial intelligence lab [1]. Many of programs in the large open source projects like KDE have subprojects that are interested in education programs [2,3]. Opposite to history these programs are targeted to K12 education not for tertiary education. This is one of three main faults of open source management. Open source makes shift to more commercial then philosophical approach today. There are companies that sell software that grants open source rights but they add services to the classical open source. These companies are financing source for open source. Another source of financing of OSS is selling prepaid subscription to the Linux weekly news. This news page has more than 70,000 subscriptions at main cost of 7 USD/month. They pay 200 USD/paper to the novice authors and more for well-known and respected authors. Authors are mainly Linux hackers so this is way to finance open source development.

2 Open source at our department
Department of information and communication systems is using family of open source software products in no small range. We are able to cover most needs resulted from the activities of our department with open source programs. Programs could be divided into the following groups:

- Operating systems
- Productivity suites
- Development environments
Usage of open source programs at the department brings several advantages. GPL licensed programs are freely redistributable. There is no need of complicated license management and license server at all. Students have free access to all programs we used and they can legally install them on their computers with no additional cost. This allows them to continue work at home or in study hall or the hostel. The programs we use are mostly free so we save considerable resources to buy another software. Incompatibility of data files is not a problem when open formats are used. Convert from one format to another is much easier using open source programs. Conversion does not require protected licensed proprietary formats. A substantial advantage is platform independence. Open source programs are often available for all major operating systems (Windows, Linux, Mac OS X). Staff and students are not restricted to the choice of their computers mainly in software case. Our department focuses on platform-independence. Therefore courses provided by our staff are based on the use of open source programs. All documents are available in open formats and even lectures are prepared in open source programs.

3 Operating systems
Although vast majority of the computers in Slovak education system runs Microsoft Windows operating system some of the students like to learn other operating systems as well. Our department uses and teaches several operating systems like Apple Mac OS X based on open source kernel named Darwin or other Unix or Unix like operating systems (Ubuntu, Slackware, openSuse). These operating systems are not used only for computer programming courses but as well for another.

4 Productivity suites
Productivity suites are most used applications ever because they deal any office activities of any user. Teachers use this type of tools almost every day for documents, data processing or lecture presentations. Main advantages of open source productivity suites [4] do not force students to buy certain program from certain vendor. They provide document formats that are readable almost everywhere.

4.1 Writer
OpenOffice.org contains modern word processor called Writer, which looks like Microsoft Office Word 2003. With Writer you can write documents, include pictures, tables and other objects. The style of output documents can be for example letter, newspaper, invitations or notes. OpenOffice.org uses ODT format (part of ISO 26300) natively but it can work with Microsoft Office Word format as well. Standard functions of Writer are AutoCorrect, AutoComplete, Styles, Formatting and other useful features. Students can use Writer in individual projects or thesis (bachelor, master, PhD). Export to PDF format contains only two clicks from user.

4.2 Calc
For making spreadsheets OpenOffice.org offers Calc. Calc offers working with data in tables, analyze and prepare them for presentation. Calc can also work with Microsoft Office Excel files. It also has build in wizards for fast formulas editing and data manipulation. You can also arrange and filter data. Sheets can contain charts that are adapting to data changes in tables. Calc uses ODS format (also part of ISO 26300). Export of the data can be made in different formats.

4.3 Impress
OpenOffice.org has tool for making multimedia presentations. You can include text, pictures, charts, sounds or video into presentation. For more professional feeling you can use animations and special effects. Impress can read Microsoft Office PowerPoint presentations. For easier usage Impress contains many templates. Impress uses ODP format (also part of ISO 26300). Presentation can be saved also in PDF, flash or html format.
4.4 Draw
Tool for making pictures or diagrams in OpenOffice.org is called Draw. Pictures are created with lines and curves. This means that all images are vectors. We can work in 2D or 3D plane and setup the position of lights. Intelligent connectors, grids or edge lines make connections between objects. Draw contains image gallery with many pictures, animations, sounds that can be used in your paintings. Draw uses ODG format (also part of ISO 26300). Support for standard formats like bmp, jpg, gif or png is certainty.

4.5 Base
OpenOffice.org has tool for manipulating database data. Base support file databases (dBASE) or external relational databases like MySQL or Oracle. We can create and modify database tables, forms, queries and outputs with built-in HSQL database engine. Base has also many wizards for easy usage for beginners and also advanced users.

4.6 Math
Math is special tool for making formulas and symbols. It contains many operators, functions and formatting assistants. All this is in window on which can easy click by mouse. Equation can be written by internal command also but you must know them. They are very similar to TeX commands. Equations can be saved in standard format and also in special XML format for formulas MathML. Formulas can be included in any other documents made by OpenOffice.org.

5 Development environments
During Computer programming lectures at Universities of Technology are often used tools that are not only compilers or interpreters but also more sophisticated Integrated Development Environments (IDEs) and their plugins. They communicate directly to the server applications that manage source code and team members.

5.1 NetBeans
NetBeans [5] started as a student project (originally called Xelfi) in the Czech Republic in 1996. The goal was to write a Delphi-like Java IDE in Java. In the summer of 1999 then Sun Microsystems wanted better Java development tools, and had become interested in NetBeans. While Sun had contributed considerable amounts of code to open source projects over the years, this was Sun's first sponsored open source project. Current version NetBeans IDE 7.0 is modern integrated development environment for several programming languages like Java JDK7, C/C++, PHP and many others. NetBeans has a large ecosystem of the community developers. They help another people dealing with this IDE. It is very suitable for novice programmers for its simplicity of usage.

5.2 Eclipse
Eclipse [6] is Integrated Development Environment a tool that integrates all of last three tools and much more it eases development of the application. We do not use this IDE because we use much less complicated and not so much powerful IDE NetBeans. It is more suitable than Eclipse during education process but not so used in the commercial practice. Our students use Eclipse in the individual projects as well as team projects.

5.3 PsPad
Parallel to complex performing development environments such as Eclipse or NetBeans there are successfully used simple text editors like PSPad. It is one of a number of open source editors, which are suitable for creating simple programs using different programming languages or creating web pages using HTML. Editor has syntax highlighting keywords for many languages. Of course there are C, C++, Java, HTML, PHP, Java, Javascript and many others syntax highlighters. The disadvantage is that there is only version for the Windows platform. For the Linux platform, however, we can choose Kate or Gedit. For Mac OS X we can use Smultron up to version 6.3. Smultrons newer versions are already available only as a closed source commercial product. And for this reason we decided to join just started KOD project [7]. It is an open source project that aims to develop a text editor for Mac OS X. Our students join a group of developers from the USA and Sweden.

Fig.2 KOD editor project
5.4 Developments tools integrated into IDEs
As of this type of software that is mostly open source are systems to maintain source codes. [8, 9] Software to do so is Concurrent version system and subversion. They are planned to use as monitoring tools for student tasks progress.
Bugzilla is another tool for development of the software. It is used to organize team and feedback from users. We have planned to use it as organizing tool to study teamwork that is not used for our students, yet.

6 Image editors (vector and bitmap)
There is an essential part dealing with picture in the process of education. The computers are facing two different representations of graphical files.

- Vector graphics
- Bitmap graphics

Between people are very popular proprietary programs aside from Adobe. They are professional programs and their abilities significantly exceed the requirements of our department. Restrictions and high cost are considerable disadvantages. Another disadvantage is that Adobe Photoshop and Adobe Illustrator are built only for Microsoft Windows and Apple Mac OS X. Linux users are so excluded.
Because of these reasons we decided to use open source products in the field of graphics processing. We proved GIMP [10] to be suitable alternative to Adobe Photoshop (bitmap) and Inkscape [11] as a replacement for Adobe Illustrator.

Both products are available in addition to Windows and Mac OS X, as well as for Linux. The advantage of graphics editors GIMP and Inkscape is also a great cooperation with the OpenOffice.org suite. These programs are so good for the whole publishing achievements.

7 Web servers
Nowadays, modern sites rely on some languages that allow some interactivity. This is often tied to the database to serve as a repository of necessary information. A popular combination is to use the PHP scripting language and MySQL database server. Both technologies are generally available from the hosting provider. But here we face the problem of developing our own web pages. Designing a program that you planed upload to the web and then start testing it is very complicated and inefficient. Therefore there is a need to install your own server with support of mentioned technologies (PHP and MySQL) on your personal computer. Debugging and web development therefore is shifted to the local machine and only finished product is uploaded to the server from provider. Work is then more efficient and allows developing work even without Internet connection. This case is preferred during courses focused on Web technologies.
In our department we use only open source technologies in conjunction with the web. Webservers that we use is Apache connected with MySQL database system via programming language PHP. All these technologies are open source. In the past, Apache, MySQL and PHP installed separately. The administrator has to deal the task of interconnection of them, then. Since then a trio of open source programs there is a possibility to pack them into a single coherent installation, thus eliminating user configuration problem. The merging of Apache, MySQL and PHP interpreter resulted in at least three packages for different operating systems.

- LAMP for Linux
- MAMP for Mac OS X
- WAMP for Windows

It is obvious that the first letter in the abbreviation represents the operating system. Other characters stand for Apache, MySQL and PHP (on Linux can also P stands for Perl or Python).
8 Costs savings

Expenses to the open source desktop are at range of 1/3 desktop as shown on well-known German ministry of foreign affairs [12]. Cause of their revert to proprietary system is caused by interoperability issues to the systems that uses not open standards and formats. Same case is in our country. Company EEA found in their OSIN project massive savings when open source software will be used in public administrations and education institutions. Some documents shows that open source productivity suites can reduce expenses. License for open source program and operating system is usually free. On the other side costs for training and file migrating is greater for new-implemented software. Study [13] compares Microsoft Office 2007, StarOffice 9 (Enterprise Edition) and OpenOffice.org and show that in company with 1000 computers we can save 48% of the costs.

9 Conclusion

We use open source, but we still resisting force to use proprietary software form another departments and another institutes at our faculty and university. This is main case not to use open standards. When external entities use proprietary standards you are forced to use them as well. But proprietary software is only 100% good implemented in certain software from certain vendor. This is case when minority of state officers is able to enforce whole country to use certain proprietary software. Our department still resists, as we know that educational institutions mission is to block such practices.

Acknowledgement

This work was supported by VEGA agency under contract number 1/0592/10, and KEGA agency under contract number 032STU-4/2011.

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