

FREE/LIBRE software usage in the Belarusian system of higher educational institutions

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The particular features of free/libre software usage in the academic activity of Belarusian higher institutions are reviewed. The analysis of supporting software for the educational process is undertaken as far as of one studied in practical courses. Changes in free/libre software share in the academic activity are discussed in light of the graduates' up-to-date employment situation.

The scope of free/libre/open source software (FLOSS) in higher educational institutions includes three categories:

- 1. Software supporting the academic process (mainly system software on servers and workstations),*
- 2. Additional application software, particularly one used by students at preparing and formatting their term papers,*
- 3. Software studied in academic and laboratory courses.*

Labour market demands studying a lot of proprietary software products ranging from Windows platform to specialized CAD/CAM systems. This tendency is accompanied with weak motivation of FLOSS usage, caused by the fact that license violation risk is still in the area of assumptions, with no real actions of the inspection bodies in Belarus. Legally purchased software share was increasing in last years due to special discounts from vendors and also because of high economic indices before the year 2011. Nevertheless, economic factor is mainly not the determining one for making choice between a free/libre software and a proprietary one. As a result, FLOSS usage in the universities is usually reasoned by its technical advantages over proprietary analogues, or by the labor market demands. Server software choice may be the sole exception, as it is substantially influenced by the administrators' personal tastes.

FLOSS of the second and third categories can obviously be seen more often in the engineering higher institutions, especially ones training the IT-specialists. Server software is less influenced by the university specialization [1].

1. Software supporting the academic process

In most cases free/libre system software on workstations is presented by a GNU/Linux in the multiboot mode, which plays the role of an alternative OS in computer classrooms of departments, teaching programming to students with engineering specialization. In pedagogical universities Linux desktops are rarely seen due to their low demand in Belarussian schools [2], but successful usage of Linux-based thin clients with a terminal Windows server was also

noticed in several universities, e.g. in Yanka Kupala State University of Grodno (GRSU).

In a period of 2007–2011 Ubuntu distribution had leadership in the segment of Linux desktops in the universities, because of its broad availability and good quality. But starting from the year 2011 and the withdrawal of the desktop metaphor in Ubuntu, system administrators are searching alternative distribution for the regular systematic upgrade of computer classrooms. Nevertheless there is no general approach among administrators, and choice is a matter of personal taste to some extent. Beside Ubuntu, ALT Linux, Fedora and Mandriva are also predictably popular on workstations, while latest Ubuntu versions are seen mostly on the students' notebooks, as far as Linux Mint was until the most recent times.

Broader variety of distributions is typical to the server segment. Leadership obviously belongs to Debian, and from the aforementioned desktop list only the choice of Mandriva is not typical on servers. But as server distribution choice has not much influence on the end users, so administrators have more freedom to follow their personal likes. Therefore Gentoo or some binary distribution with manually recompiled packages can be often seen on university servers. Modified versions of standard software packages are also not a rare case, with more functions and/or non-typical configurations added.

GNU/Linux platform is traditionally used on servers to provide firewalls, mail and web-hosting, personalized Internet access, networked users authentication and file-servers. BSD systems are used rarely. The Internet access for students and teachers is often organized with Squid, but billing systems based on RADIUS-servers (particularly FreeRADIUS) also can be found. Most typical free authentication server is a Samba-based domain controller, while more complex solutions involve OpenLDAP with Kerberos or without it, and/or the VPN-segment. ClamAV is used for antivirus protection of Linux-based mail and file servers with different levels of its integration. FLOSS server databases are mainly represented by MySQL and PostgreSQL (used in web-sites, logs storage, and in other system components more often than in education process). Distributed solutions based on DRBD are also used.

The distribution choice and the complexity of a sever configuration is not strongly correlated to the university profile. For example, Maxim Tank Belarusian State Pedagogical University (BSPU) has complex sever Linux segment, which is totally built on the source-based approach.

Belarussian higher educational institutions usually have heterogeneous server segment. Windows systems are needed to run server versions of studied software (Microsoft SQL Server, 1C:Enterprise system of programs, etc.) and to use hardware keys of licensed applications. Old Novell NetWare servers still work in some places also. Beside that, computer department often has its own independent segment in the local network, with different set of software and services [1].

A tendency can be seen in some universities to place Windows and legacy Novell servers into the virtualized environments, working atop of GNU/Linux — as to provide the hardware abstraction, so to improve the system safety and to simplify its failure recovery [1, 3]. VirtualBox and KVM are the most used FLOSS virtualization systems. Desktop virtualization in computer classrooms is also used in some computer departments: successful VirtualBox usage in Computers dept. of Belarusian State University of Informatics and Radioelectronics (BSUIR) and highly-integrated approach to VirtualBox-based isolation of Windows desktops in Computers & Systems dept. of Brest State Technical University (BrSTU) should be mentioned here. These approaches improve speed and stability of virtualized Windows in comparison with its functioning on bare hardware; students are allowed to work with administrator privileges if they need so, and computer classroom administrators have an instrument of quick rollback of the guest system to its previous state snapshots (or stateless configuration can be used with automatic rollback after each reboot) [3, 4].

2. Additional application software

Complimentary software proposed to students includes the standard set of the OpenOffice.org office suite & the Firefox web browser. Firefox is widely spread, while OpenOffice/LibreOffice is more often installed on teachers' workstations than on students ones in non-IT departments — supposedly due to its more conservative interface approach and the ease of PDF export. IT departments often have both proprietary and free office suites installed in classrooms. Some technical universities also use LaTeX document preparation system (mainly those having developed scientific school). Moodle and iTest projects are used for examination.

In non-IT engineering specializations other FLOSS is mostly used for mathematical calculations. Perhaps SciLab is most popular because of its ease of installation, small size, good set of features and Matlab compatibility [5]. Among non-engineering universities computer departments of medical institutions have most noticeable interest to mathematical FLOSS [6] due to essential possibility of the analysis of used algorithms and their correctness, which improves the reliability of medical researches.

Free CAD/CAM systems (mainly QCAD/LibreCAD, and Blender, which also can be related to this area) are used occasionally and mainly for non-core specialization students, while core engineering subjects are more strictly bounded to professional proprietary products. As an exception, some universities of the radioelectronics direction use GNU Electric as an integrated circuit CAD system.

There is a special case of building and studying platform for the GRID systems and clusters, where GNU/Linux has no alternatives. FLOSS is used as key components in the national GRID system of Belarus, which incorporated resources of the leading universities (Belarussian State University, GRSU, BSUIR, Belarusian National Technical University among them), scientific institutions and enterprises of the country under the joint Russian & Belarusian

SKIF-GRID program [7, 8]: OpenMPI, Torque, Unicore, GLite, etc. are expanded on the classical cluster stack based on GNU/Linux systems.

3. Studied software

Theory and practice of the GNU/Linux command line basics are widely studied in IT-oriented specializations. Until the recent time, system programming for this platform was taught in several departments only — e.g. set of subjects related to low-level programming and computer architecture in BrSTU, or network programming in BSUIR; in both cases Linux was used as the basis due to such its advantages as no unnatural limitations from the owner, simplicity of development, simple documentation, compliance with standards and wide spread of the platform.

In last years there is a growth of corporate employers' interest to the Linux development, mainly for embedded and server systems. In a related move the computer departments are considering courses of system programming and Linux architecture, and large players of the market are actively announcing their own trainings and seminars dedicated to the same subject.

Among hardware-independent FLOSS platforms Java and PHP have leading positions in the academic load. The last one can be met not only in engineering universities, but also is included into web programming courses in pedagogical ones. From the other side, many perspective programming languages, such as Python and Ruby, are not studied for limited number of class hours and base curriculum bounded to classic C/C++ language. As additional measures to amend this issue, individual study of such FLOSS platforms is stimulated for the term and diploma projects, and in the student research contests.

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We consider the use of open source software Moodle for distant learning at the Technical University. The experience of teachers of public higher education institution "Priazovsky State Technical University" online-training courses in the system to Moodle.

На даний час все більшою популярністю користується навчання за допомогою Internet технологій. Такі технології існують в OpenSource системах LMS \ LCMS, таких як ATutor, Claroline, Dokeos, LAMS, Moodle, OLAT, OpenACS, Sakai. До одних з основних достоїнств OpenSource систем відносять можливість доопрацювання та адаптації конкретної системи до своїх потреб і поточної освітньої ситуації; відсутність прив'язки до конкретної операційної системи, конкретному Web-браузеру; реалізація набору функціональних можливостей з істотно меншими економічними витратами в порівнянні з комерційними.