

An International Master Programme in Free Software in the European Higher Education Space

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Abstract – The Universitat Oberta de Catalunya (Open University of Catalonia, UOC) offers an International Master programme in Free Software. The first edition of this master programme began on November 2003 and there are about 240 students currently enrolled at the different specialities offered by the program. In this paper, the design, the methodology and the first few conclusions drawn from this higher education experience are discussed and summarized. After this master programme was changed to accomplish with European Higher Education Space (EHES).

I. INTRODUCTION

The Universitat Oberta de Catalunya (UOC) [1] is internationally recognized as the first institution to offer distance education of university degrees using exclusively the Internet as the basis of the academic activity. Since the early foundation of the UOC, in 1995, our educational system relies on a virtual campus platform which allows the students and the lecturers to interact under the condition that no coincidence in time or space is assumed. Nowadays, there are more than 30.000 students registered in the different bachelor, master, postgraduate and PhD programs at the UOC. As a result of our contributions to the distance education and e-learning initiatives, our institution has been awarded with the most relevant international prizes in this field.

In addition, it must be taken into account that the UOC student profile is quite different from that of the “traditional” universities. The standard UOC student is an adult person in his or her thirties or forties, with a family, employed, and with very little time to study. Many of these students have other university degrees and they register at the UOC because they are eager to acquire knowledge or skills in a new field. Thus, motivation is often one of their most remarkable qualities.

It is well known that the free software (FS) and the open source movements have gained widespread acceptance by both academia and industry in the last few years. As an academic institution, the UOC is deeply interested in this movement and FS products are commonly used in several of our departments. However, we reckon that the free and open source software technologies are still far from reaching a relevant position in the market compared to that of proprietary software. We think that one of the reasons why FS is not more widely used is the short number of academic courses in this technology. It is widely accepted that the people in the FS community usually acquire and exchange knowledge by visiting different web pages and discussing in forums. However, many end users, and specially the typical Information Technologies (IT) professionals, do not feel comfortable with this learning

model and are discouraged to try FS. There is a gap of guided and tutored education in this area which must be filled in.

For these reasons, we have decided to offer an **International Master programme in Free Software (MPFS)** [2, 3] since November 2003. This master degree, which is taught in Spanish, is devoted to provide with an integral education on the different aspects related to the FS technology. Among others, the courses which have been designed for the master degree are concerned with the philosophy and the history of the FS movement, GNU/Linux, computer networking, web management, database management, software development, laws and licenses, etc. The student can choose among these courses according to some suggested **itineraries** with four possible specializations: **Network and systems administrator, Software developer, Web and e-business administrator and Information Systems manager**, all of these, under the master degree in FS.

II. PRECEDENTS AND MOTIVATIONS OF THE MASTER PROGRAMME

The UOC and, in particular, the Computing and Multimedia Department, has a wide experience in using and promoting FS in an academic environment. For example, a GNU/Linux platform is used in the practical activities of the Operating Systems and Networking subjects since 1997. In these subjects, the students needed a UNIX-like platform to carry out their practical activities. However, the UOC is a distance learning university and it was required that the students could use the UNIX-like system at home. There were two possibilities to achieve this aim. The first one was to log in a remote UNIX server and work with a permanent (modem) connection. The alternative was to provide the students with a UNIX-like system to work with their personal computer. After evaluating the pros and cons, this second possibility was chosen and a Slackware [4] distribution of GNU/Linux was sent to the students. At the same time, a virtual tutored lab to support the students with installation problems, modem set up, etc. was created. Nowadays, Knoppix [5] has replaced the Slackware distribution.

Apart from this very early experience, FS products became a usual tool in several subjects of the official degrees in Computer Science Engineering, for example:

- Dev-C++ (programming)
- MySQL, TOAD (databases)
- GnuPG (security)

- Eclipse (software engineering)
- Apache, Tomcat (computer networks, e-commerce)
- OpenOffice (document exchange)

Nowadays, two FS CD are distributed to the students, one of them is a Live-CD of GNU/Linux (Knoppix) and the other one contains several programs which are used in different subjects of the Computer Science Engineering programs. This positive experience with FS (in particular with GNU/Linux) led to a postgraduate programme in GNU/Linux, which was issued in November 2001. Since November 2003, this postgraduate programme has been incorporated into the MPFS.

Apart from these initiatives, the UOC has made a great effort to adapt the virtual campus platform, the web portal, the virtual library, and other web services to free browsers (e.g. Mozilla). In addition, the usage of multi-platform formats (such as PDF, HTML, RTF, plain text) for document exchange has been encouraged, and free alternatives to proprietary programs currently on use in the official degrees are being considered. Finally, we have started a project (within the Hispalinux Metadistros [6] project) to develop a Live-CD distribution of GNU/Linux specially designed for the UOC students.

There are several motivations behind this MPFS. The first one is the particular interest of a group of lecturers in helping to promote and disseminate the FS technology together with all its ethical and philosophical implications. A second reason is the fact that there is an increasing demand for IT professionals with a background in FS. A third reason, as pointed out in Section I, is the lack of traditional (guided and tutored) education in this field. The IT professionals do not usually have enough time for teaching themselves as often occurs in the FS community and, thus, the MPFS can help to fill this educational gap. Finally, we must not forget that the standard student at the UOC is an employed person. This makes it possible to have an influence in the private companies and public institutions which can benefit from the advantages of FS.

III. MASTER PROGRAMME DESIGN

The MPFS has been designed according to four different professional profiles related to Computer Science and Information Systems: networking and operating systems administrator, web development and e-commerce administrator, application developer and information systems management.

For each of these profiles, we have suggested a different **itinerary**, as shown in Figure 1. These itineraries are divided into different courses or modules the contents of which have been especially designed to focus on the particularities of FS in each of these fields. The academic objectives of these itineraries are the following:

- **Itinerary #1 — Networking and operating systems:** configure and administrate network services in GNU/Linux, know the basic aspects of networking security, identify the vulnerability problems of FS systems and learn to solve this kind of problems.

- **Itinerary #2 — Web development and e-commerce:** know the components of a web server and its possibilities, know some of the most widely used web servers, install a web server and a data base management system, be aware of the security aspects related to web servers, organize and manage information and data integrity and administrate data bases with web interfaces.
- **Itinerary #3 — Application development:** design and develop applications with FS tools, know the different possibilities for reusability of FS source code, know the different virtual cooperative environments for FS programming.
- **Itinerary #4 — Information systems management:** know the alternative to proprietary systems, know the legal and exploitation aspects related to FS and analyse practical implantation cases of FS platforms.

As the contents are concerned, these four itineraries have a common initial block of “core” or mandatory courses, consisting of an “Introduction to free software” [7] and “Basic Operating System GNU/Linux” [8]. These two core courses take 4.5 credits each, where 1 credit requires about 15 hours of student work. After these core modules, the MPFS offers different specialization courses depending on the itinerary chosen by the student:

- **Itinerary #1 — Networking and operating systems:** “Advanced administration of the operating system GNU/Linux” (4.5 credits), “Computer networks” (3 credits), “Advanced networking: security issues” (6 credits), and “Implantation” (6 credits)
- **Itinerary #2 — Web development and e-commerce:** “Advanced administration of the operating system GNU/Linux” (4.5 credits, elective), “Web development” (6 credits), “Database systems” (6 credits), and “Implantation” (6 credits)
- **Itinerary #3 — Application development:** “Advanced administration of the operating system GNU/Linux” (4.5 credits, elective), “Introduction to software development” (6 credits), “Advanced aspects of software development” (6 credits), “Free software engineering” (6 credits), and “Implantation” (6 credits)

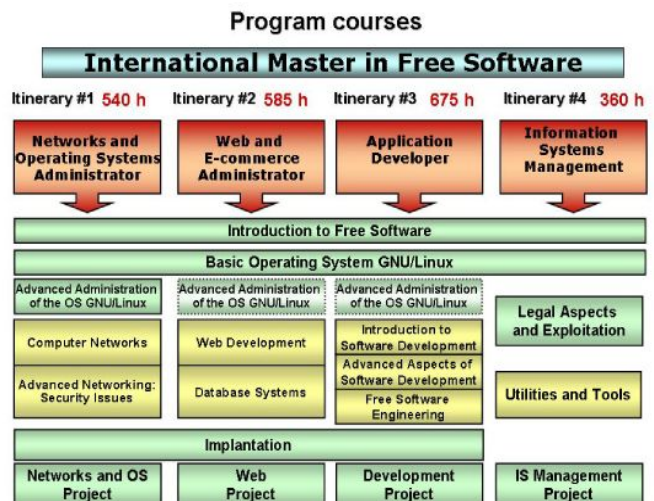


Figure 1 Master programme design

- **Itinerary #4 — Information systems management:** “Legal aspects and exploitation” (6 credits), and “Utilities and tools” (4.5 credits)

The advanced course in GNU/Linux and a course on practical issues about FS implantation are common to the more technical itineraries (#1, #2 and #3). In addition, all the itineraries finish with a practicum or final project (with 7.5 credits for the itineraries #1, #2 and #3, and 4.5 credits for the itinerary #4). Note, also, that the fourth itinerary (IS manager) is shorter than the other three ones, since it only leads to a postgraduate diploma and not to a master degree. The master degree itineraries (#1, #2 and #3) take four semesters and can be completed in about 18 months. The shorter itinerary takes just two semesters or about 10 months.

As far as we know, there is not any other similar offer of a master programme in FS. We have found some other postgraduate courses in this issue, but their scope, contents and length are quite different from ours. Thus, we prefer not to establish any kind of comparison with them.

IV. ADAPTATION TO EUROPEAN HIGHER EDUCATION SPACE (EHES)

Before the MPFS began in 2003, the UOC contacted several Spanish, European and Latin American institutions to share this experience with them. From these meetings, the *Masterlibre* or MoLOS group was created with different lecturers of European universities from Spain, France, UK, German, Italy and Norway, to begin a discussion about a common master programme in Free Software adapted to the Bologna process (EHES).

In order to satisfy the conditions of the EHES, a master programme must keep some requirements:

- Accounting the educational load with the European Credit Transfer System (ECTS) system. Each ECTS credit stands for between 24 and 30 hours of student work. This accounting system must include all the student work inside and outside of university centre. A full-time student can take 30 ECTS credits per semester or 60 ECTS in a full academic year.
- The Master degrees should take from 60 to 120 ECTS.

From the UOC contributions to the Masterlibre group, the academic structure of the MPFS was adapted to the requirements of the EHES. The new MPFS is a programme with 90 ECTS with the same objectives described in Section III.

The contents of MPFS are distributed as follows: 30 ECTS credits in core (compulsory) courses, 30 ECTS credits in elective courses and, finally, 30 ECTS credits in a practicum or master's thesis.

Core courses:

- **Introduction to free software.** 1 course, 6 ECTS credits.

- **Operating System GNU/Linux:** 2 courses, 12 ECTS credits. This module consists of the following courses: “Basic GNU/Linux Operating System”, and “Advanced Administration of the GNU/Linux Operating System”.
- **Exploitation of Free Software:** 2 courses, 12 ECTS credits. This module consists of the following courses: “Legal aspects and exploitation of free software” and “Free software systems implantation”.

As the 30 ECTS elective credits are taken into account, the students can choose among 48 ECTS credits offered in MPFS:

- **Administration of computer networks:** 2 courses, 12 ECTS credits. This module consists of the following courses: “Computer networks” and “Advanced networking: security issues”.
- **E-commerce:** 2 courses, 12 ECTS credits. This module consists of the following courses: “Web development” and “Database systems”.
- **Free Software Development:** 3 courses, 18 ECTS credits. This module consists of the following courses: “Introduction to software development”, “Advanced aspects of software development” and “Free software development”.
- **Utilities and tools:** 1 course, 6 ECTS credits.

These courses take 2 academic years. A first semester with 24 ECTS credits (18 of which are required and 6 are elective), a second semester with 18 ECTS credits (6 of which are required and the remaining 12 are elective), a third semester with 24 ECTS credits (6 of which required, 12 of which are elective and the remaining 6 are part of the practicum or master's thesis) and, finally, a semester with 24 ECTS credits the practicum or master's thesis. It is worth pointing out that the MPFS programme could also be taken in only 3 semesters since it takes 90 ECTS credits.

V. PEDAGOGICAL MODEL OF THE MASTER PROGRAMME

The UOC is based on a virtual campus platform which provides with the means for inter-communication. This platform is physically supported by a complex computer network and is completely web-based. The virtual campus offers several forums for the exchange of information between members of the UOC community. Some of the facilities offered by the virtual campus are:

- interactive communications between the students and course tutors (or consultant lecturers) both asynchronously and, exceptionally, synchronously,
- interactive communications between the students,
- access to the UOC information resources (libraries, bulletin boards, databases, etc.) and
- access to administrative services.

Using the electronic mail and the Internet at any Internet-connected computer, the students are able to exchange messages, ask questions and make enquiries to the course tutors without time constraints. Course tutors, themselves, also contact students to monitor their progress

or give assistance over any difficulty that may arise. In this way, the students always feel assisted.

The UOC faces an important challenge as it develops a new concept of pedagogical model: from teaching to learning. The course tutors are no longer mere transmitters of knowledge but rather a guide in the learning process, for which the student is the ultimate responsible. It is a student-centred educational model, since the student is the central element and the rest of the elements are made available to support the learning process. The following elements are directly involved in the learning process:

- The **learning materials** gather and transfer the basic contents of the course. They contain the objectives, self-evaluation activities, summaries, etc., and they are designed to make the learning process simple and stimulating. The materials for this master programme are available both in paper-based and web-based formats.
- The students are assigned a **course tutor or consultant lecturer** for every course. This lecturer provides general advice throughout their studies and becomes their personal advisor and their main interlocutor during the semester.
- The **continuous evaluation** is a series of activities that are carried out during the semester in order to ensure the optimal achievement of the course objectives.
- The **virtual library** supports student training and allows students to gain access from their homes to the services developed by the UOC library.

All these different elements of the pedagogical model of the UOC are integrated into the virtual campus. This platform allows the students to send public (using the forums) and private (using personal e-mail accounts, integrated into the campus) messages to their classmates and lecturers, making it possible to share experiences, ask for assistance or make suggestions and participate in the university's different social, cultural and academic activities. In addition, this platform also makes it possible to access all the university administrative services.

VI. FINAL REMARKS

The first edition of the MPFS presented in this paper started in November 2003 with about 90 students, mainly from Spain but also from Latin American countries. The second, third and fourth editions of the MPFS are also running with a total number of 250 enrolled students. In addition, some grants are given each year by the Fundación Carolina [9] to cover part of the registration fees for Latin American students.

It must be pointed out that this MPFS gives back some return to the FS community. In particular, the didactic materials are being licensed using the GNU Public Documentation License (GFDL) [10] and can be downloaded (in Spanish) from the master's site: <http://www.uoc.edu/masters/softwarelibre/esp/materials/>.

Furthermore, an international scientific council of experts has been constituted in order to:

- watch over the quality of the Master's contents and design,
- take into account sound opinions of different members of the FS community,
- contribute to the promotion, diffusion and development of FS projects,
- take into account viewpoints coming from different cultures and environments and
- make the master programme internationally known to gather students from various origins.

The members of this council are: Manuel Castells (UOC), Vinton Cerf (MCI), Marcelo D'Elia Branco (software libre project), Juan Tomás García (Hispalinux), Jesús M. González Barahona (Universidad Rey Juan Carlos), Pekka Himanen (University of California at Berkeley) Miguel de Icaza (Ximian/Novell) Òscar del Pozo (Softcatalà) Pam Samuelson (University of California at Berkeley), Rafael Macau (UOC), David Megías (UOC), Jordi Mas (UOC, Ximian/Novell, Softcatalà).

In conclusion, the first few editions of this experience have been very positive and we are in contact with other European and Latin American universities which are interested in offering a master programs in FS.

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