

Master's degree on libre software
Explanatory memory
Proposal of a European master's degree

Resumen

This explanatory memory, and the budget that accompanies it, are part of the presented documentation in the request of aid for the elaboration of an European master's degree (postgraduate degree) in libre software¹, in answer to the announcement of the Consejería de Educación de la Comunidad Autónoma de Madrid, according to order 6534/2002 of 26th November, published in the BOCM of 5th December 2002.

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1. Introduction

Libre software is a reality more and more ubiquitous in the world of computer science. In the last years, the world of libre software has increased exponentially (bending in size, according to almost any parameter that is considered, every 18 or 24 months), and the published studies indicate that this tendency is going to continue in the next years. libre software is more and more in the world

¹ In this document we use the term “libre software” to refer to both “open source software” (as coined by the Open Source Initiative) and “free software” (as used by the Free Software Foundation). Although both terms are not completely equivalent, and the communities behind them are certainly not the same, for the purposes of this document both terms are mostly interchangeable, and in any case we prefer to use “libre software” for them, since it lacks the ambiguity of “free software” while still stressing the freedoms that a user of libre software can enjoy.

of the companies, the public administrations, and has been considered like of strategic interest by institutions like the European Commission.

Nevertheless, in spite of all this activity, of the important thing that it is for the companies, of the impact that can have in the competitiveness of the engineers related to the technologies of the information when facing the work market, and of the necessary thing that it is for the society to have formed professionals affluent in this so new field, they are practically nonexistent still the university programs that consider libre software like integral part of the world of computer science.

This postgraduate program in libre software indeed tries to fill up this formative hollow, for which already a great demand is perceived. Its fundamental idea is to complement the knowledge and abilities of the engineers related to the technologies of the information (and fundamentally the computer science engineers and the engineers of telecommunication) with a near exhibition and in depth to the world of libre software, to its peculiarities, and to the new possibilities that offer.

In order to obtain these objectives, the program offers on the one hand a basic formation that allows to the students to obtain a general vision of the world of libre software from several optical (computer science, economic, legal, etc.). On the other hand, complements that allow to go deeply into the most outstanding aspects at every concrete technological moment, always from a oriented approach to take advantage of the special characteristics the world of libre software.

It is hoped that the students who follow the formation offered by this program can be professional with deep knowledge of this reality so important in the sector, but so unknown. In addition, its exhibition to the practical reality of the more important developments of libre software places them on specially good position to collaborate in a fast transference of the peculiarities of these technologies to the sector of the technologies of the information, and in special to the companies that are dedicated to make new developments inside it.

2. Participant institutions

The institutions that participate in this postgraduate program are the following ones:

- Rey Juan Carlos University (URJC), <http://www.urjc.es>
- Politécnica de Madrid University (UPM), <http://www.upm.es> and in individual two centers of it: the Computer Sciences Faculty (FI), <http://www.fi.upm.es/> and the Technical High School of Telecommunication Engineers (ETSIT), <http://etsit.upm.es/>
- Universidade do Porto (UP), <http://www.up.pt/> (Portugal)
- École Nationale Supérieure Électronique, Informatique et Radiocommunications de Bordeaux (ENSEIRB), <http://www.enseirb.fr> (France)

3. Memory

3.1. Areas or knowledge field

The most directly related knowledge field to the proposed postgraduate program is the one of the technologies of the information, in broad sense, since libre software has direct implications on practically all the aspects of these technologies. Importantly, but indirectly related, also the economy and the administration of companies, the law and the philosophy of the law and sociology can be mentioned to (both first in as much as far as new models of business and sustainability of the model of production of software, both following with respect to new approaches on the intellectual property, and last in which it has to do with motivations and group relations that are basic in the production of libre software).

Based on this description of the implied knowledge fields, and until a more detailed study is done (that will do as a part of the process of designing the postgraduate program), we could have an approximated distribution as it follows:

- 50 %-60 % of knowledge directly related to the technologies of the information, in some of its fields. An example of this type of knowledge would be the one of the techniques of engineering of software used in projects of libre software, or the one of tools used in projects of free software.
- 20 %-30 % of knowledge related to the technologies of the information, but strongly oriented from other knowledge fields. For example, this would include tools and mechanisms of coordination and decision making in projects of libre software, or impact of the model of libre software in the innovation in technologies of the information.
- 10 %-20 % of knowledge of fields not directly related to the technologies of the information. For example, models of business in the world of libre software, or implications of the legislation of intellectual property in libre software.

It is considered that the two last categories introduce a suitable degree of multidisciplinary, essential in these studies (that already cover all the technologies with the information, but as we have seen it is divided in other directions).

As far as knowledge areas, the most implied (as far as teaching staff) they are the own ones of studies of computer science engineering and, partially, engineering of telecommunication: Architecture and Computer Science Technology of Computers, Languages and Systems, Telematics Engineering, Sciences of the Computation and Artificial Intelligence. The postgraduate program that sets out is conceived so that it can fundamentally give to students of Computer Science Engineering and Engineering of Telecommunication: both degrees provide the precise basic knowledge, and in both cases it is considered that this postgraduate program can contribute to knowledge and very valuable complements for the student.

3.2. Duration of the program

The program will consist of 60 credits ECTS, given during two semesters. The structure of the program will be sufficiently flexible like so that the student it can follow it of modular form, being each one of the modules reasonably selfcontained, and with few previous prerequisite (in addition to the generals to attend the complete program).

3.3. Number of students and periods of mobility

In its first edition, it is hoped to count on a group of between 25 and 50 students between all the participant Universities, of which half would be at least in the Universities in the Madrid area. This number will assure on the one hand that can be provided to the pupils the suitable quality of theoretical and practical education, and on the other hand that the cost by student is not excessively high.

Most of the modules (around 60 %-70 % of credits) will take place in the Madrilenian Universities, and could be followed by the students of the foreign universities by means of videoconference, or in presence if they move to Madrid. It is hoped that all the students of the foreign universities visit Madrid to follow at least a third of the credits given in the Madrilenian universities.

The rest of the modules will be given in the foreign universities, and could be followed by the students of the Madrilenian universities by means of videoconference. It is hoped that all the students of the Madrilenian universities visit at least in one occasion the foreign universities, to follow the modules that are given in them.

In addition, the possibility (voluntary) of longer stays (of at least half semester) for the students in universities different from those will be anticipated from its country of origin. During these periods,

the students (who will continue attending the classes) will be able to initiate their postgraduate projects (in case that they are made during the first semester), that will be able to complete later in their university of origin.

It will be possible, if the number of registered students justifies it, that a same module is given in more than one of the participant universities (and even in all of them) simultaneously.

3.4. Number of teachers and periods of mobility

The total number of teachers implied in the teaching of the master's degree is hoped that it is, like minimum, between 15 and 25, given (of approximate form) of the following form:

- Teaching staff of the URJC: between 6 and 9 teachers
- Teaching staff of the UPM: between 3 and 4 teachers
- Teaching staff of the foreign universities that collaborate in the program: between 3 and 5 teachers
- Non member experts with any of these universities: between 3 and 6 teachers (although its number could appreciably greater if a module of experiences is included on libre software, with format of specific mini-seminaries, given by those who they have promoted those experiences).

It is hoped that a minimum of a 20 % of the teachers participates every year in modules given outside their habitual location. Normally, the teachers of the foreign universities will move to Madrid to participate in modules given in the URJC or the UPM, and those of these last ones will move to participate in the given ones by some of the foreign universities.

In order to participate in these modules, it is hoped that the implied teachers move during periods of around two or three weeks to the university where the module is given in which they participate. Also sessions of videoconference as much for participation in modules given in other universities like for coordination workings will be used. In any case, face-to-face meetings of coordination and pursuit of periodic form will also be anticipated.

In case that some of the modules is given in several universities, the number of implied teachers will be greater.

Given the experience of the coordinators of this postgraduate program in the world of free software, and their many personal communications (that they already have used in the past making seminars and talks with very excellent guests), it is hoped that the quality and relevance of the participant external experts in the program are especially suitable to the objectives of the program.

3.5. Structure of the program to give and educational methodology

Although some of the concrete aspects related to the structure and the methodology will be defined with detail in the phases of design and elaboration of the postgraduate program, in this section offers a scheme of how it considers currently.

Structure of the program will be based on 12 educational modules, of 4 credits ECTS each one, and a postgraduate project, of 12 credits ECTS.

3.5.1. Educational modules

In order to complete the 12 educational modules, the students will have to register themselves of 6 modules compulsory and to choose the rest (6 modules more) between a stock market of optional modules that will offer every year by the participant universities. It is hoped that the supply of this stock market is extended according to the program is maturing, although the first year of teaching could include the minimum number of modules necessary to be able to complete the total of modules

of the program. In general, the compulsory modules will offer during the first semester, providing basic general knowledge, and the optional during the second semester (being chosen by the students at the end of the first semester, when they already have a reasonably detailed idea of the field), although some of these could be supplied during first (if it is considered that it does not have prerequisite forts).

As much the compulsory modules as the optional will be defined with detail in the design and implantation study. Even so, it is possible to be advanced that is hoped that between the compulsory modules are the following ones:

- General foundations of the libre software (introductory module to all the specific aspects of libre software, that would serve like point as starting the other obligatory modules, and that it would include computer science, economic, legal and ethical approaches)
- Economy of libre software (including both macroeconomic and microeconomic studies of the implications and impact of libre software)
- Management models and development of libre software projects (how the libre software projects are being managed, and what technical of software engineering its are being used successfully)
- Environments and development technologies used in libre software (what tools the developers of libre software are using, and what technologies and components are to their disposition habitually)
- Study of libre software projects (review of the classic libre software projects more interesting, as far as results obtained, model of management, historical evolution, impact on other projects, etc.)
- Tendencias in the world of libre software (study of the new projects more innovators in the world of libre software, its possible contributions, and the impact that is expected of them)

In stock-market of optional modules would be more specific modules, that approached very concrete aspects of the panorama of software at every moment. For example, currently its are being considered like candidates to be including in this stock market, among others, the following courses: systems of *grid-computing* with libre software, libre software in Internet, impact of libre software on the innovation in technologies of the information, systems management with libre software, extension of the model of libre software to other production systems of information, libre software in the public administrations, libre software for SMEs, free development of applications for web based on libre software, free systems *peer-to-peer*, services of lodging for free projects, and licenses and rights of author in the scope of libre software.

All the educational modules will have a theoretical part, exposed normally by means of lecture classes (that in any case they will be oriented to foment the participation of the student), and a practical part, that it will consist of guided practical works, to make by the students with a very near pursuit on the part of the teacher. Especially in the practical part emphasis in the work in equipment will be made, including the distribution of tasks and the internal organization of the equipment like part of the work to make. In general, this practical part will be given in laboratories qualified to the effect, whenever it consists fundamentally of work made in computer (construction or use of software, study of programs, etc.).

3.5.2. Postgraduate project

The postgraduate project, on the other hand, it will have to be made of personal form by each student (although it will be able to consist of a part of work in group whenever the responsibilities of each student clearly are differentiated). This project will be able to consist of the participation in real

developments of libre software (perhaps in collaboration with real projects), studies of implantation of libre software in organizations or companies, studies on real projects of libre software, etc. The postgraduate project will begin at the end of the first semester, and it will be completed during the second semester.

Once finished its accomplishment (that will include the writing of a memory), the postgraduate projects will be presented personally by each student, in session which they will attend (of actual or remote form) several teachers. This session in addition will be recorded, and it will be stored next to the recordings of all the classes of the program.

3.5.3. Language

In order to facilitate the mobility and the attendance of students of any European country, teaching of each module will take place in English as soon as there is at least a student or teacher who cannot express themselves in the native language of the university that gives it. It is hoped that this facilitates the attendance (actual or remote) of students from any university to any module given by any other university. The postgraduate project will have to be made in English, to facilitate the diffusion of its results (especially to the rest of students of the course).

On the other hand, to facilitate the control on the part of any teacher, the exhibitions of the students and the works that they write up they will be in English, although exceptionally other languages will be able to be used.

3.5.4. Temporary organization

The temporary organization of the educational modules will be made of the following form, to favor the mobility of the students:

- Each educational module will be celebrated of intensive form during a period of three weeks (exceptionally, of two or four weeks).
- In general, it will be avoided that a student must register itself of modules that are given simultaneously (safe, perhaps, in the case of some of stock-market of optional modules).
- In each semester, they will be to organize the courses so that the given ones in a same location (Madrid or the two foreign locations) are followed temporarily. As in the Madrilenian universities there is more teaching, this organization will cause that in each semester there are three weeks of teaching in each one of the foreign universities, and 12 weeks of teaching in those in the Madrid area.

This organization will allow the students of the Madrilenian universities to move during relatively short periods of time to follow the classes in the foreign universities, if therefore they wish it. The students of the foreign universities will be able to also move to Madrid for relatively short stays, to attend concrete courses (it must remember that all will be available by means of videoconference). This will allow to reduce the displacement costs, without losing great part of the benefits that mobility provides the students. And on the other hand, it allows that the students who wish it can move per longer periods (either because they move to a University and they follow the local courses there, and by means of videoconference the others, or because they are moved to follow all the courses in presence).

In addition to its benefits with a view to the mobility of students, it is hoped that this temporary organization, who is inspired, to a large extent, in the experience of the Ars Digita University (currently continued in <http://www.aduni.org/>), also contributes educational benefits, when allowing that the students concentrate during a certain period of time in the subject that is object of the study.

3.6. Remote classes and recordings

In order to make possible the remote attendance to any educational module, all of them will be given in classrooms with videoconference possibilities, and all the universities will make available of the students of master's degree classrooms equipped with sufficient capacities so that the students can follow in remote these classes. Part of this equipment already is available in the implied universities, that they also have experience in the teaching of courses in these conditions.

All the modules given in anyone of the universities will have left filed and recorded available at all the students of the program.

3.6.1. Tutors

As a support to the student registered in the program, each one of them will have a tutor who will make a customized pursuit, and he will advise to him in:

- Mobility options
- Special and customized support during the stays of the student
- Master's thesis

Also, each given educational module will have a local tutor of reference in each one of the remote locations, so that the students who cannot follow it of actual form can, besides to participate by means of videoconference, to make consultations and to have local references whenever it is necessary.

3.6.2. Evaluation

Modules evaluation will become in general of continuous form, being based on the intervention of the student in the classes, the works (of theoretical and practical content) in charge to the students, of their exhibitions, etc. The evaluation of the work made in the practical part will suppose an important part of the final qualification.

3.6.3. Coordination and educational organization

As far as concerns educational organization of each module, the general design will become of common agreement between teachers of at least two universities. In case that the same module in more is given than a university, one will become on a program detailed common, consensed by all the implied teachers.

Teachers will make an educational material for each module that will make available of the students before its beginning. This material will be organized and put in a Web site, following the idea promoted by the OpenCourseWare program, of the MIT (<http://ocw.mit.edu>). Besides to serve as publicity mechanism of the postgraduate program, and to help his knowledge, it is hoped that this decision serves to help in the control of quality of the developed educational material for the program (when facilitating the feed-back of external experts, and even of accidental visitors).