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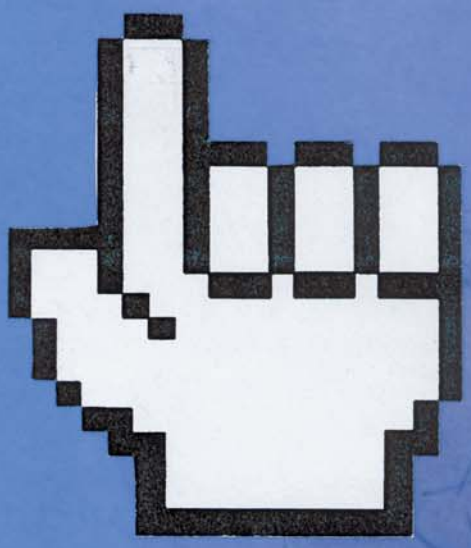

Free Software Licenses in Context

http://www.cepis.org

CEPIS, Council of European Professional Informatics Societies, is a non-profit organisation seeking to improve and promote high standards among informatics professionals in recognition of the impact that informatics has on employment, business and society.

CEPIS unites 36 professional informatics societies over 32 European countries, representing more than 400,000 ICT professionals.

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European Computer Driving Licence Foundation

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UPGRADE European NETwork
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UPGRADE is the anchor point for **UP**ENET (**UP**GRADE European NETwork), the network of CEPIS member societies' publications, that currently includes the following ones:
• **Informatik-Spektrum**, journal published by Springer Verlag on behalf of the CEPIS societies GI, Germany, and SI, Switzerland
• **ITNOW**, magazine published by Oxford University Press on behalf of the British CEPIS society BCS
• **Mondo Digitale**, digital journal from the Italian CEPIS society AICA
• **Novática**, journal from the Spanish CEPIS society ATI
• **OCG Journal**, journal from the Austrian CEPIS society OCG
• **Pliroforiki**, journal from the Cyprus CEPIS society CCS
• **Pro Dialog**, journal from the Polish CEPIS society PTI-PIPS

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"The 'Bologna Process' and The Informatics Profession"
(The full schedule of **UP**GRADE is available at our website)

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Editorial

Farewell to An UPGRADE Founder

CEPIS is a young organisation. Therefore, we have few occasions to celebrate anniversaries or pioneers. However, this edition of **UP**GRADE offers us for once the opportunity to do both.

Rafael Fernández Calvo has been editor of the magazine since its foundation in October 2000. He has presided over the production of 35 issues, with strong support from his home society - ATI, the Spanish Computer Society - and members of the editorial board from CEPIS Swiss societies (namely ***François Louis Nicolet***, co-founder of **UP**GRADE), and other societies as was possible.

UPGRADE has been an online publication. That means that it has been impossible to count the number of copies sold. However, we can and do count the number of accesses to our Web site and we can measure the position of our publication in the results offered by the major search engines. **UP**GRADE comes first consistently in searches for European professional Informatics publications. It does so because it contains interesting material from authoritative sources, and for that, we must be grateful to Rafa for his energy and obsession with quality.

Like a good project manager, Rafa has ensured that he has a successor and, with the endorsement of the ATI Board and the CEPIS Executive Committee, we welcome ***Llorenç Pagés-Casas***, also from ATI, as the next editor of our journal. We hope very much that he will demonstrate the commitment, enthusiasm and results of Rafa and look forward to working with him

We have limited opportunities to celebrate success and note our growing maturity. This transfer of responsibility is one, and I take pride in being able to do so. I am sure that all members will join me in wishing Rafa a long and enjoyable connection with us, and in thanking him for all the work he has put in on our behalf.

Geoff McMullen
President of CEPIS
<president AT cepis DOT org>

From The Editor's Desk

Thank You for The Privilege ...

For nearly 6 years I have had the privilege and the honour to be the chief editor of **UP**GRADE. CEPIS' online journal was launched in October 2000 through the determined efforts of ***Wolffried Stucky***, vice-president of CEPIS at that time, and ***François Louis Nicolet***, editor of the Swiss journal ***Informatik/Informatique***, alongside whom I was excited to work on a project aimed at providing members of CEPIS member societies and IT professionals all over the world with an open and independent, quality publication.

François and I were the first chief editors of **UP**GRADE. François stepped down in 2003 and now it is my turn to bow out (from the editorship of ***Novática*** as well, after 10 years at the helm) for strictly personal reasons as I announced a year ago to the Executive Committee of CEPIS and the Board of ATI (*Asociación de Técnicos de Informática*), the Spanish professional society that publishes our journal on behalf of CEPIS.

It is not for me to judge the quality of my work although, while I beg your indulgence for my many faults, I hope I have lived up to the expectations of those who entrusted me with this by no means easy task. However, I am confident that my successor, my good friend and colleague, ***Llorenç Pagés-Casas***, will surpass my efforts and bring the new ideas and perspectives that are essential for **UP**GRADE to establish itself as a flagship journal for European IT professionals.

Obviously a work such as this one is not possible without the cooperation of a great many people. First and foremost I would like to mention, in addition to the authors who so expertly fill our pages and feed the minds of our readers, the Associate Editors of **UP**GRADE (***François, Roberto Carniel***, ***Zakaria Maamar***, and ***Soraya Kouadri Mostéfaoui***), ***Antonio Crespo Foix*** (the artist responsible for our original and attractive cover artwork), and the person responsible for the composition of our journal, ***Jorge Llácer-Gil de Ramales*** (who was preceded in that vital job by ***Pascale Schürmann***), not to mention our volunteer English language editors and our professional translator, ***SteveTurpin***, who together ensure the linguistic correctness of everything we publish.

I cannot thank them enough for their valuable collaboration, but thanks are also due to the courage and foresight of CEPIS governing bodies for their commitment to an open and independent, quality publication, and to ATI for having determinedly undertaken the implementation of the project.

I would like to make it clear that my stepping down as editor of **UP**GRADE in no way means that I intend to cease collaborating in other fields with CEPIS, an organization to which I have a deep attachment: At least until the end of the year, I will be responsible for the coordination of **UP**ENET (**UP**GRADE European Network, which currently brings together journals from seven CEPIS members societies), the editorship of the **UP**ENET section of the journal, and the design of the cover page of **UP**GRADE and ***Novática***.

Thanks again to each and every one of you. I leave you all with a heartfelt "¡*Hasta siempre, amigos*!" (farewell, my friends!),

Rafael Fernández Calvo
(Outgoing) Chief Editor of **UP**GRADE and **Novática**
<rfcalvo AT ati DOT es>

British Magazine ITNOW Joins UPENET

ITNOW has joined **UP**ENET (**UP**GRADE European NETwork) effective June 30 2006, becoming the seventh partner of this initiative promoted by CEPIS (Council of European Professional Informatics Societies) since 2004.

In order to mark this event we republish an article from its May 2006 issue (see page 56).

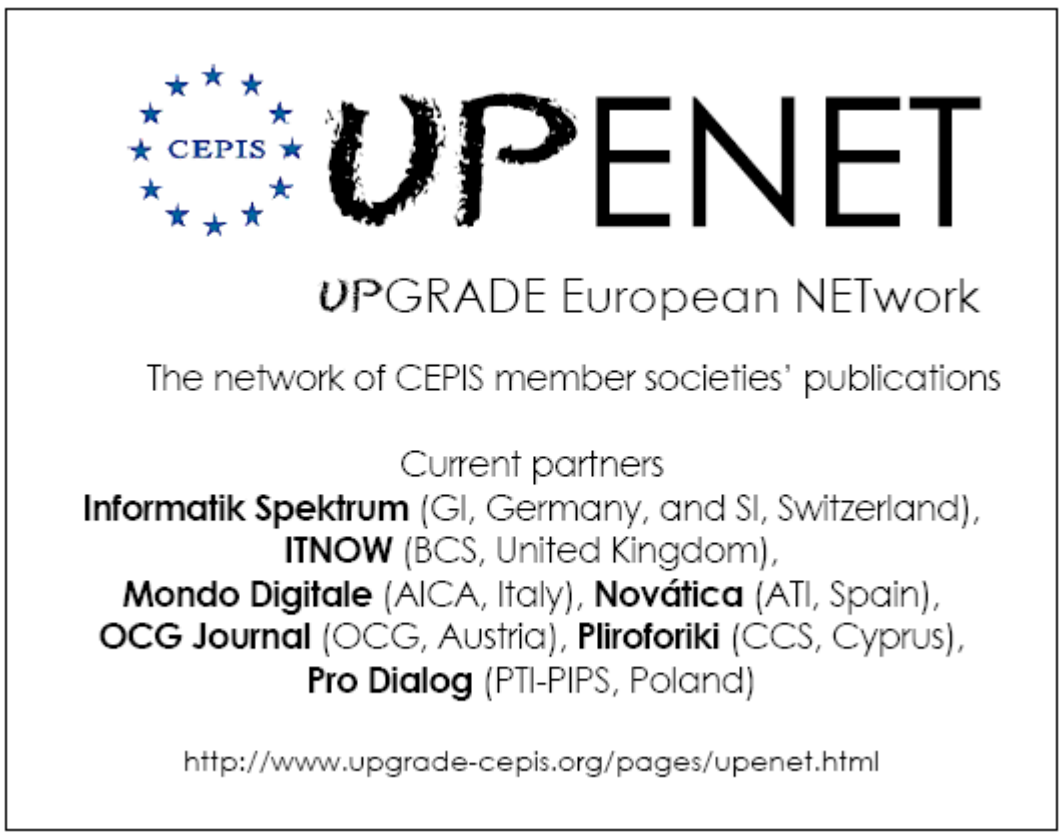
ITNOW, created in 1957 as "The Computer Bulletin", is the bimonthly magazine for members of the British CEPIS society BCS (British Computer Society), and is published, in English, by Oxford University Press on behalf of the BCS.

ITNOW's website is at <http://itnow.oxfordjournals.org/>.

ITNOW's Managing Editor, ***Brian Runciman***, becomes member of the **UP**ENET Advisory Board.

Welcome!

Ps. Detailed information about **UP**ENET is available at <http://www.upgrade-cepis.org/pages/upenet.html>.



Presentation

The Wide World of *Libre*/Free Software Licenses

Luis Fajardo-López

1 Introduction

Software licenses (legal documents regulating the use of intellectual property rights on software) can be considered from many angles, and this was our aim when I was entrusted, along with my French colleague ***Jean-Baptiste Soufron***, by the Chief Editor of the journals **UP**GRADE and ***Novática*** to put together this monograph. Having as main focus the world of *libre*/free software, we believed that it was important to include articles covering the legal side of software protection but that it was also necessary to tie software licenses in with the wider field of intellectual property (which also includes the controversial issue of software patents). We will also be looking at the doctrine and practice of open knowledge, which is also connected with the abovementioned fields and has been successfully developed over the past few years on the back of the *libre*/free software movement. And we will, of course, be including examples to illustrate specific experiences.

This, then, is the multidisciplinary approach that we have applied to the monograph, the content of which we will go on to describe.

2 The Intellectual Property

Software licenses fall mainly under intellectual property law, which is fairly standardized worldwide (especially in Europe) due to the existence of widely supported international agreements.

European standards on the subject are enshrined in the Berne Convention, the WTO (World Trade Organization, <http://www.wto.org/indexsp.htm>) and the TRIPS (Trade-Related Aspects of Intellectual Property Rights)[1] agreement. With regard to content, it is important to bear in mind that the TRIPS agreement includes the principle that Intellectual Property Law must contribute to technological innovation and transfer, as well as stating that software is to be protected in the same way as literary works. In terms of the European Union, relevant legislation includes Directive 91/250/EEC on the legal protection of software, and Directive 2001/29/EC (which has just been transposed into Spanish legislation in the recent reform of the Intellectual Property Law, IPL, and in the French one by the DADVSI law - Droit d'Auteur et Droits Voisins dans la Société de l'Information or Copyright and Neighbouring Rights in The Information Society Bill), a Directive quite similar to the American DMCA (Digital Millennium Copyright Act).

By studying all this legislation we can learn when intellectual property arises, to what extent it is protected, what its basic content is, and the difference between the originality required by copyright and the innovation required by a patent for a work to be protected. All this is explained in the

The Guest Editors

Luis Fajardo-López is a Doctor of Law specializing in Civil Law (to which intellectual property legislation belongs) from the *Universidad Autónoma de Madrid* (UAM), Spain. He has lectured at the UAM and the *Universitat de Girona*, Spain (he is accredited as an Assistant Professor). He has delivered a great many conferences on law relating to the new technologies at several universities and other forums, and he is a pioneer in the use of information technologies in university education. He was appointed by the Spanish Senate to advise on the Information Society and e-Commerce Services Law. He was responsible for networks at the Law Faculty of the UAM in the years when UAM's network infrastructure was being set up, and he is very familiar with the GNU/Linux operating system. For three legal years he was a substitute judge. He currently is a practising lawyer, mainly engaged in work related to Information and Communications Technologies. For further information see <http://fajardolopez.com/cv/LuisFajardo>. <luis@fajardolopez.com>

Jean-Baptiste Soufron obtained a master in International Business Law from the *Université de Paris I Panthéon Sorbonne* (France), a Postgraduate degree in Contract and Business Law from the *Université Lille II* (France), and another in Intellectual Property and Copyright from the *Université Strasbourg III* CEIPI (France). He is also teaching FLOSS (Free/*Libre* and Open Source Software) principles at the *Université de Paris VII*. He is currently head of the Legal Dept. of the Wikipedia Foundation and is pursuing his doctorate on a scholarship at the CNRS (*Centre National de la Recherche Scientifique*) and at the *Université de Paris VII*. He is working on a number of Wikipedia projects and several FLOSS projects. He has been practicing Intellectual Property Law for the last four years in Tokyo and in Paris. Additional information can be found at <http://soufron.free.fr>. <Jean-Baptiste.Soufron@cersa.org>

[1] To access the content of this and other legislation applicable to the field, see the "Useful References" section at the end of this presentation, on page 8.

article "*The Legal Protection of Computer Programs under Spanish and European Law*", by ***Javier Plaza-Penadés*** (professor of the *Universidad de Valencia*, Spain).

This latter aspect has become especially important in recent years. It is a well known fact that intellectual property does not protect ideas (as a patent does), but only protects the actual expression of a particular idea (which is why there are many different kinds of word processors; the idea of a word processor as such is not protected; only specific expressions of the idea receive protection). But there are times when the specific expression of an idea is the only way to realize that idea. In those cases the expression of an idea cannot be protected as it would be tantamount to granting a monopoly on an idea, which is contrary to the principle of social benefit that is enshrined in copyright law[2]. The same argument can be used to limit not only the scope of copyright, but also the abuse of patents in countries which allow the patentability of software, or in systems like the European one in which *de facto* software patents exist as a result of a highly dubious interpretation of the European Patent Convention.

3 Software Patents

The arguments put forward in the previous paragraph do not prevent certain, normally USA, companies from patenting software ideas (the mouse-click, the use of a "shopping cart" for online buying, a virtual keyboard superimposed on a touch screen, or the transparency effect in a window known as alpha blending). The aim is not to produce a program but simply to collect patent royalties from the original creators of the software implementing those general ideas. It is common for companies enjoying a certain degree of success to receive a letter demanding the payment of rights for the use of the 'invention' covered by 'weak' patents such as these, because the plaintiffs know that such companies cannot afford to defend the lawsuit. In other words, such patents are only used to threaten and demand in the almost certain knowledge that the programmer against whom the lawsuit is brought will prefer to pay a certain amount of money rather than to risk incurring the unknown expenses and consequences of being sued abroad.

Those who oppose software patents and therefore consider that the present legislation should be limited to basic aspects, say that patents stifle innovation as they cause companies who cannot compete in such a system to close down. Legislation today does not provide enough protection against such practices; what is required are legal provisions to protect companies against opportunistic claims of this type, at least in European jurisdictions. Clearly the mere existence of such a threat could raise the cost of software development in Europe unless a united front can be brought to bear against it. The European Parliament's rejection in 2005 of the Proposal for a Directive on the Patentability of Computer Implemented Inventions, while it was an important milestone politically, does not solve the problem, a problem which continues to exist in practice however clear the actual legislation may be.

On the other hand, some analysts believe that recent legislation being adopted around the world implementing the so-called DMR (Digital Management Rights) is introducing a *de facto* new kind of intellectual property having effects that are potentially as dangerous as the ones caused by software patents, as explained in "*DRM as A Dangerous Alternative to Copyright Licenses*" by ***David Monniaux*** and ***Jean-Baptiste Soufron***.

These problems have caused various authors to rethink the socio-political foundations of intellectual property. An example of this can be found in the article *"Ideological Foundations and Real Effects of The Current Model of Intellectual Property*" by ***Eduardo Melero-Alonso*** (professor of the *Universidad Autónoma de Madrid*, Spain), which was chosen to form part of this monograph because it casts an interesting reflection on intellectual property as it is today. Whatever one's views on the subject, this article provides an x-ray of the social, economic, and political interests that underlie this regulation and need to be taken into account if we are to reach a reasonable, fair, and balanced solution to the current conflicts of interest.

Given the above scenario, we now need to look at how this legislation affects the world of *libre*/free software. And our first task is to define exactly what we mean by *libre*/free software, since to define "open source" and "*libre*/free" software is tricky to say the least. But if we look at their history we should be able to reach an appropriate definition of the two terms.

4 *Libre*/Free Software

As most readers will no doubt know, the FSF (*Free Software Foundation*, <http://www.fsf.org>) was set up in 1985 under the leadership of ***Richard Stallman*** to promote what was becoming standard practice in early software developments: the sharing of source code (the set of instructions making up a program). The FSF was the legal and philosophical instrument required by the GNU project, whose objective was to create a Unix-compatible operating system in which the code would always be freely modifiable and distributable[3]. The FSF promotes the use of the GPL license (General Public License) and, to a lesser extent, the LGPL (Lesser General Public License)[4]. The first version

[2] What is known in US law as 'merge doctrine' reaches the same conclusion and should be incorporated into Spanish legislation (cf Sau Sheong Chang, "Copyright and Open Source Software Licensing", Berkeley Electronic Press, 2005, paper 773, <http://law.bepress.com/expresso/eps/773>).

[3] This movement would gain much more momentum with the release in 1992 of a kernel for a Unix-type operating system called Linux, which gave rise to GNU/Linux.

[4] The LGPL license is intended to solve the technical problem of the need to link GPL libraries with non-GPL libraries. It allows such links even though the linked libraries are not GPL compatible or even open source.

of the GPL license was published in 1988, the second in 1991, and the third is scheduled to be published early in 2007[5]. It is currently the most commonly used license by *libre* software projects.

From a structural point of view, it opens with a preamble setting out the purpose of the license, which is:

1) That the software may be distributed and modified without prior permission from the licensor.

2) That the software is distributed without a warranty.

3) That the software released under GPL cannot be made subject to any restrictive patent (if it should be patented, the patent must allow free use of the software by anyone[6]).

The key concept of the GPL license is that of *copyleft*, which makes it obligatory for any software that is derived from other, GPL licensed software, to also be GPL licensed. In some quarters this has been viewed as a "viral effect" of GPL, since if a worker in a company inserts a section of GPL code into a proprietary program, all the resulting program will have to be considered as GPL. This notion of a viral effect is unfounded[7], since the legal sanctions arising from the violation of a GPL license are no different from those arising from the violation of any other type of license, and under European contractual law it is not possible to bind a third party to an agreement if they have not previously consented to its terms.

Under the US Common Law system a license is held to be a statute governing a specific property (intellectual property) in accordance with the wishes of the owner. However even under such a model the result would be a tremendously liberal interpretation, since property rights cannot be governed in different ways at the mere whim of the owner. In any event, the important thing is how the rights held by the "owner" (the holder of the intellectual property rights) are transferred to the licensee. Such a transfer of rights can only occur by means of an agreement. This does not give rise to problems regarding the use of licenses as is sometimes claimed. For a contract to exist there needs to be an agreement of wills; i.e. the making of an offer and its acceptance. An offer is precisely what a license contains, and the use of the software is generally understood to indicate acceptance of that offer. What GPL does have to comply with, as do other open source and so-called 'proprietary' licenses, are a number of legally imposed limitations as a minimum framework for such contractual relationships. These limitations are dealt with briefly in the opening article "*The legal framework of software licenses: Is the will of the licensor subject to constraints?*", authored by the author of this presentation, ***Luis Fajardo-López***, professor of the UNED (Spain's Public Distance University) Associate Centre at Tenerife, Spain, and guest editor of this monograph.

5 Open Source Software

In 1998 the OSI (Open Source Initiative, <http://www.opensource.org>) was set up with the purpose of certifying which programs could be considered as open source[8] and to promote their use while explaining their benefits. The model they put forward is explained by Eric Raymond (co-founder of the OSI)[9] in his famous article of 1997 "*The cathedral and the bazaar*". The OSI has certified 58 licenses as open source[10]. There are obviously differences between the OSI and the FSF. While the FSF only allows the combination of software licensed under GPL or another GPL-compatible license (if it is combined with other software, either the authorization contained in the GPL license is invalidated or the resulting software becomes GPL-licensed), the OSI does not only verify that a program is open source (that is, one that allows users to access, modify, and redistribute the source code), but also strives to ensures the reusability of GPL-derived software, which must be made available to the community once again. For this reason some major open source, OSI certified licenses, such as Apache or MPL (Mozilla Public License)[11] are considered to be GPL-incompatible.

The main features and differences of some other OSI-certified licenses are as follows:

- The MIT license (Massachusetts Institute of Technology) only requires the authorship of the original work to be respected and the inclusion of a liability exemption clause in derivative works.
- The BSD license (Berkeley Software Distribution) is practically identical to the MIT license and the latest versions of both are OSI-certified and GPL-compatible.
- The Apache license, version 1.1 of which is similar to BSD, includes the concept of contribution in its version 2.0, whereby contributed code becomes part of the original code if it is accepted, and is thus licensed under the same terms as the original code. It is not GPL-compatible though it is OSI-certified.
- The first versions of Perl AL license (Artistic License) were not considered to be *libre*/free software by the FSF and, althoughit was initially OSI-certified, this organiza-

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[5] At <http://gplv3.fsf.org/> you can follow the drafting process and suggest improvements.

[6] Clause 7th of the GPL license.

[7] Cf Sau Sheong Chang "Copyright and Open Source Software Licensing", The Berkeley Electronic Press, 2005, paper 773, p 26.

[8] The OSI publishes an "Open Source Definition" (OSD), by which the concept of open source is characterized by access to the source code, the possibility of altering the code, and free redistribution of the code. The difference between OSD and the concept of libre software as defined by the FSF is that the FSF does not require open source works to be produced under the same license.

[9] Jointly with Bruce Perens and Tim O'Reilly.

[10] A complete list and a copy of their content can be obtained at <http://www.opensource.org/licenses/>, although the most common are GPL, LGPL, BSD, MIT, and Mozilla Public License. The OSI recommends users to make sure they understand the entire content of the chosen license, select the one that is most appropriate for the company's business model, and consult a lawyer as the OSI does not give legal advice.

[11] To access the content of these and other licenses see the "Useful references" section at the end of this presentation.

tion has run into difficulties: when its distribution is authorized jointly with another program following the licensing system of the latter software, in practice a Perl AL license can be circumvented just by distributing it with that program. In spite of these drawbacks, the AL license is very popular, probably due to the popularity of the programming language Perl with which it is associated.

■ The MPL license, on which projects such as Sun's OpenSolaris is based, divides the program between what is *libre* code (protected code) and any other contribution that may be added by the community. If the protected code is modified, the new software must be distributed under MPL; if it is simply a case of adding archives without modifying the protected code part, both parts can be distributed jointly, regardless of the license under which the community contributed archives were. The MPL is technically a very good license; it is OSI-certified although the FSF does not consider it to be GPL-compatible.

Perhaps the most important development regarding these licenses is the forthcoming official publication of GPL version 3.

6 Legal Developments

The flurry of interest shown by Penal Codes in this matter can only be explained by the social alarm aroused in the digital world by the apparent lack of copyright protection, an alarm which feeds on fear and ignorance. Furthermore, faithfully reflecting the society to which we belong, most jurists are wary of and unknowledgeable about the new technologies. Or rather we are afraid of a technology about which we know very little, and therefore we try to make what we are ignorant about work in the same way as what we are familiar with.

From that viewpoint alone it is hard to appreciate the real importance that the dual issues of lack of interoperability and lack of standardization have as ways to control the market. And it is easy to lapse into clichés such as that the distribution of binary is a deference to the user, on the grounds that (and here is the fallacy) source code is not executable (forgetting all the runtime languages, non compilable languages)[12], to the point of believing that source code is only distributed in *libre* software, without stopping to think that the fact of having access to the source code does not give users the right to modify it. Obviously, on the basis of such technical misapprehensions, not even the best parliamentarian in the world can enact good legislation, nor the best jurist in the world give it its proper interpretation.

The major role played by public administrations in these issues prompted us to choose two articles. The first, "*Some Legal Reflections on The Use of* Libre *Software Licences in Public Administrations*", describes the most important legal issues affecting software in public administrations and is the work of ***Luis Fajardo-López*** and ***Luis Fajardo-Spínola***, professor of the *Universidad de La Laguna*, Spain, to whom the author of this presentation has ties of respect and admiration for his distinguished career as a jurist. This article looks at the ideas of interoperability and technological neutrality, and attempts to outline the principles that underlie governmental action in respect of software.

Another article on the same subject describes how and why the Regional Government of Extremadura, a region in Western Spain, is in the vanguard in the use of the new technologies and *libre* and open source software. The article is entitled "*Free Software in Extremadura, The History of Some Good Reasons*" and its author is the Minister for Infrastructure and Technological Development of the abovementioned government, ***Luis Millán-Vázquez de Miguel***, someone who is highly qualified to relate the challenges and motivations, the achievements and future prospects of this project, and a man to whom we are very grateful for his valuable work in this field over the years.

7 Open Knowledge

In the introduction we mentioned the field of open knowledge as a conceptual offshoot and extension of the *libre*/free software movement in the context of intellectual property and, to go deeper into the subject, the co-editor of this monograph, ***Jean-Baptiste Soufron***, has selected two interesting articles.

The first , "*Creative Commons: Open Content Licenses to Govern Creative Works*", is authored by ***Mélanie Dulong de Rosnay***, head of the Legal Dept. of Creative Commons, France. In this article she stresses the special importance of the moral rights of authors and takes a critical look at the nature of Creative Common licenses (designed for artistic and intellectual works unrelated to software) explaining their success and outlining their drawbacks. As readers will know, Creative Commons licenses are the most common of their type, probably because of the prestige of their principal driving force and creator, professor ***Lawrence Lessig***, but also because of the ease with which they can be adapted in a readily understandable way to the wishes and circumstances of the author.

In the second one, "*Scientific Publications: The Role of Public Administrations in The ICT*", ***Roberto Di Cosmo***, professor at the *Université Paris VII*, France, challenges governments to rise to the defence of culture as a collective asset, choosing as his battleground the field of scientific publications (a challenge which, unfortunately, has been not been taken up in the recent modification of the Spanish Intellectual Property Law).

[12] This fallacy is the reason why people tend to talk about source code transfer occurring in every case, when in fact sometimes the source code cannot be separated from the program as this is its only expression. Some authors consider binary as the true expression of the program, the most significant in economic/legal terms, when in fact this is a pernicious effect of the market, which violates a multitude of rights that legitimately belong to the consumers and the original creators. From a strictly legal viewpoint, the transfer of just the binary (without the making the source code available) should be considered as an anomaly or an exception, and not as a rule.

Acknowledgements

To close I would like to thank ***Rafael Fernández Calvo***, (outgoing) editor-in-chief of **UP**GRADE and ***Novática***, for his patience and support, and my colleague and co-editor of this monograph, ***Jean-Baptiste Soufron***, for his efforts in collecting several of the articles mentioned above; and, in particular, all the authors for their valuable collaboration which has helped bring to light the need for justice and common sense to prevail in the software industry and in the field of intellectual property if we wish to reap the benefits of a balanced model for the development of our information society.

Post Data

At the time of writing this presentation, in the summer of 2006, the Regional Government of Extremadura, in Spain, announced that the use of open document standards will be mandatory for all its documentary applications and, therefore, for all administrative activities, as will the use of *libre*/free tools by all its staff (other Public Administrations in Spain are apparently studying similar measures). Although a decision of this nature is just a drop in the ocean compared to what Public Administrations could be doing, it should be stressed that decisions such as this would not be possible if it were not for a prior, widespread technological dissemination of knowledge and information, and alongside this, a response from the world of *libre*/free software in the form of specific *libre*/free licenses for artistic and literary works, documents and studies, applicable to a field such as intellectual property which, while they may have some conceptual characteristics that are similar to those of software, differ from software insofar as their purpose is not to make a device such as a computer work, and that authors have a special interest in the integrity of their work being maintained when it is disseminated.

*Translation by **Steve Turpin***

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■ GPL GNU (General Public License, v. 2.0), <http://www.fsf.org/copyleft/gpl.html>.
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■ Sun Public License, <http://www.netbeans.org/about/legal/spl.html>.
■ Sun Industry Standards Source License (v. 1.1), <http://www.openoffice. org/licenses/sissl_license.html>
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The Legal Protection of Computer Programs under Spanish and European Law

Javier Plaza-Penadés

In this article an overview of the protection of computer programs in the Spanish legal system, based on the corresponding European Directive, is presented. According to both legal bodies, computer programs are under the umbrella of copyright.

Keywords: Computer Programs, Copyright, European Directive on Computer Programs Spain's Intellectual Property Law.

1 Introduction

Due to their special nature, it would appear that the legal protection of computer programs is best served by copyright law. Other instruments of industrial property law, such as patents, utility models, and industrial designs, are more restrictive due to the inflexibility of their legal requirements, such as the novelty requirement (although in the near future it may be possible to protect software through utility models).

Within the framework of international law, article 4 of the World Intellectual Property Organization (WIPO, <http://www.wipo.int/index.html.en>) Copyright Treaty of December 20, 1996 provides that "*Computer programs are protected as literary works within the meaning of Article 2 of the Berne Convention. Such protection applies to computer programs, whatever may be the mode or form of their expression*". This is the same line that was taken by Council Directive 1991/250/EEC on the legal protection of computer programs, <http://europa.eu/scadplus/leg/en/lvb/l26027.htm>, one which has formed the basis for the legislation of a number of European Union countries (including Spain).

But a computer program clearly has little or nothing to do with a literary work, except for the fact that its originality serves as the basis for protection, as provided for in article 1 of Directive 1991/250/ECE which states that a computer program will be protected if it is original in the sense that it is the author's own intellectual creation. No other criteria will be applied to qualify it for protection.

The protection of a computer program under copyright law is therefore based on appropriateness criteria. Any program created by a natural or legal person that is not a copy of another, although its outcome may be very similar in functionality and use to other existing programs that may already be on the market, is protected by the copyright law. In short, if a computer program, whether it be a spreadsheet, or word processing document, or a web page design…, has been created independently and originally without copying any other program it is afforded copyright protection, even if the program is not only not new, but is also identical to already existing programs. This means that all computer programs thus created can benefit from exclusive copyright protection that it possibly would not have enjoyed if it were protected by means of patents or industrial design legislation (which, at least at present, is impossible due to the fact that computer programs per se are expressly excluded from such protection).

The fact that software is protected by copyright means, first of all, that protection is granted to the creator of the program by the mere fact of its creation. This protection is also granted automatically and without the need to register it with any intellectual property office, although it is advisable to register computer programs since the fact of registration establishes a *iuris tantum* presumption of authorship. Software also enjoys the same exclusive rights of reproduction, distribution, public communication, and length of protection as a literary work.

That said, there is nothing to prevent the author of a program from waiving his or her economic rights to the program. An author can even make his or her creation available to others by publishing the source code so that they can know, improve, or add new functionalities to the program. In fact the power to decide how an intellectual creation is to be disclosed and exploited is one of the unalienable rights of the author.

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On the basis of the above premises I will now go on to take a brief look at the legal regime governing computer programs and their protection in Spain, as set out in articles 95 and following of the Redrafted Text of the Intellectual Property Law[1] (hereinafter RTIPL), which is in line with prevailing European and international law on the same matter.

2 Copyright Protection: when It Originates and what It Covers

In accordance with article 96-1 RTIPL and for the purposes of this law, a computer program is understood to be any sequence of instructions or indications intended to be used, directly or indirectly, in a computerized system in order to perform a function or a task or to obtain a specific outcome, whatever the form of expression and fixation may be.

The term 'computer program' also includes its preparatory documentation, so a program's technical documentation and user manuals enjoy the same protection as computer programs.

In order to see to what extent protection is extended to the preparatory phases we need to examine the various technical phases that go into the design of a computer program and how they meet the set of legal criteria that dictate exactly when copyright protection originates.

Applicable legal criteria are based on the distinction between ideas per se and the expression of those ideas, and therefore while a computer program in its creation phase is merely an idea, it is not protectable by copyright. But from the moment it is the *expression* of an idea that meets the originality requirement for copyright protection then it is protected, given that under intellectual property law computer programs are deemed to be "original in the sense of being the author's own intellectual creation".

On the same subject, article 96-4 RTIPL states that the ideas and principles which underlie any element of a computer program, including those which underlie its interfaces, are not protected by copyright under this law.

Let us now take a brief look at the different technical phases that (at least theoretically) go into the creation of software.

The first phase is what we might call the functional analysis phase. In this phase we define the functions that we want our future computer program to perform.

The second phase is what we might call the organic analysis phase. In this phase we establish exactly how and in what form we wish the computer program to execute the functions that we want it to perform. This is where we define methods, operating systems, algorithms… with a view to determining how the program will appear on the screen.

Up until this point we are in the realms of plans or ideas, but the computer program as such is yet to be materialized.

With the third phase we move into the creative phases; this is when we write our source code, the real 'soul' of a computer program. In this phase we take all the aforementioned functions and put them into a programming language which is understandable by a technician or expert but not by a machine.

In the proprietary software model, the source code of a computer program tends to be one of the programmer's most closely guarded secrets, not only due to the complexity and the laborious nature of the task, but also because of its functionality, since by modifying the source code you modify the actual functions of the program. In fact, when source code is transferred to allow some of its functions to be modified, a third party is usually involved that acts as custodian or trustee and that only allows access to certain specific parties (escrow contract).

Finally, when the programming language or the distribution method so requires, the source code is translated into object code or machine code; i.e. into a binary language that uses just zeros and ones (current and no current) and is only understandable by the machine.

The upshot of this is that copyright protection of the program starts when the source code and, by extension, the object code is written. This is also provided for in article 96.

According to article 96-3 RTIPL, the protection of computer programs applies to any form of expression of a computer program. This protection also extends to any successive versions of the program as well as to derivative programs, except for versions created for the purpose of causing harm to a computer system.

3 Ownership and Duration of The Rights on A Computer Program

According to article 97 RTIPL, the author of a computer program is considered to be the natural person or group of natural persons who created it, or the legal person who is considered to be the rightsholder in those cases expressly provided for by this law.

In the case of a collective work, in the absence of any agreement to the contrary, normally the natural or legal person who publishes or discloses the work under their name is considered to be the rightsholder. In effect this covers the authorship of legal persons, an authorship which extends to all rights, both moral and economic. In this case, the production of the program must be the result of the initiative of a coordinating legal person whose employees are responsible for the various phases of its creation .

It is different when a legal or natural person contracts a third party to create the program under the third party's initiative. In this case the author is the employee and in this respect, article 97-4 provides that when an employee in the execution of his duties or following the instructions given by his employer (instructions given in the functional or organic phases), the employer is exclusively entitled to the economic rights corresponding to the computer program so created (both the source program and the object program), unless otherwise provided by contract.

Finally, when a computer program is the unitary result

[1] Available, in Spanish, at <http://civil.udg.es/normacivil/estatal/reals/Lpi.html>. This law has been recently modified in order to adapt it to the European Directive 2001/29/CE; the updated text is available, in Spanish, at <http://www.boe.es/boe/dias/2006/07/08/pdfs/A25561-25572.pdf>.

of a collaboration between a number of authors, the copyright is jointly owned by all of them in whatever proportion they may decide and is governed by the provisions of article 7 RTIPL.

Whether the author of the computer program is a natural or legal person affects the length of copyright protection, which in any event is excessive given the current rate of change in the computer industry. According to article 98 RTIPL, when the author is a natural person the economic rights of a computer program last for the standard 70 years after the author's death (articles 26 to 30 RTIPL) depending on a number of special circumstances that may arise.

However, if the author is a legal person, copyright protection lasts 70 years starting from the first day of the year following the legitimate disclosure of the program or its creation in the case of an unpublished work.

4 Economic Rights and Their Limitations

According to article 99 RTIPL, the rights granted by the authorship of a computer program are:

Firstly, the total or partial reproduction of a computer program by any means and in any form, whether permanent or temporary, even for personal use[2].

When the loading, displaying, execution, transmission, or storage of a program requires a program to be reproduced, permission from the rightsholder must be obtained.

Secondly, the translation, adaptation, arrangement or any other alteration of a computer program and the reproduction of the results thereof, without prejudice to the rights of the person who alters the computer program.

Finally, the law recognizes the right to public distribution of the program, including the rental of the original computer program or copies of that program. The first sale in the Community of a copy of a program by the rightsholder or with his consent exhausts the distribution right within the Community of that copy, with the exception of the right to control further rental of the program or a copy of that program.

These rights over computer programs are alienable rights and can therefore be transferred, either exclusively or non-exclusively. Furthermore, the author, in the absence of any prior agreement, cannot object to the economic rightsholder making or authorizing any successive versions of the program or of derivative programs thereof.

This means that, unless there is proof to the contrary, the transfer of the economic rights of a computer program is of an non-exclusive or non-transferable nature, and assumes that such a transfer is made only to meet the user's needs.

But the economic rights over a computer program are subject to a number of specific limitations or exceptions that are set out in article 100 RTIPL. According to this article, unless otherwise provided by contract, authorization from the rightsholder is not required for the reproduction or alteration of a computer program, including the correction of errors when such corrections are necessary for the legitimate user to utilize the software for its intended purpose.

The legitimate user of a copy of a program is also permitted to observe, study or test the functioning of the program, without any prior permission from the rightsholder, in order to determine the ideas and principles which underlie any element of the program, if this is done while performing any of the acts of loading, displaying, running, transmitting or storing the program which the user is entitled to perform.

With regard to personal copies, only one back-up copy per authorized user is permitted, although the making of a back-up by a person having a right to use the computer program may not be prevented by contract in so far as it is necessary for that use.

Finally, it allows a legitimate user of the program to perform any acts of reproduction and alteration that may be indispensable to achieve program interoperability. By interoperability we usually mean the ability of various processes, such as electronic communications protocols or data storage formats, to work together. However, inoperability can also refer to the situation when we buy a program from company "X" that turns out to be incompatible with the hardware of its computer which is from company "Y". Interoperability in terms of copyright protection refers to the reproduction and transformation required to allow a program from company "X" to be readable and executable on a computer with technology from company "Y".

Article 100 concludes by stating that these limitations cannot be interpreted in such a way as to unfairly prejudice the legitimate interests of the rightsholder; i.e. in a way that conflicts with the normal exploitation of the computer program.

By way of conclusion, we should be aware of the fact that the protection that intellectual property rights grant to computer programs is not only limited to the recognition of those rights, but also includes protection against certain unlawful acts and technological infringements of 102 RTIPL (that could even infringe article 270-3 of the Spanish Penal Code), such as bringing one or more copies of a computer program into circulation when it is known or can be presumed that they are unlawful in character; stocking one or more copies of a computer program for commercial purposes when it is known or can be presumed that they are unlawful in character; bringing into circulation or stock for commercial purposes any material the sole purpose of which is to facilitate the unauthorized removal or neutralization of any technical device used to protect a computer program.

These measures of technological protection against piracy extend to all other new technology related intellectual property rights with the incorporation of the WIPO Treaties and Directive 2001/29/EC on the harmonization of certain aspects of copyright and related rights in the information society into Spanish legislation.

*Translation by **Steve Turpin***

[2] Barring the exceptions of back-up copies and interoperability actions.

DRM as A Dangerous Alternative to Copyright Licences

David Monniaux and Jean-Baptiste Soufron

Copyright Licences are the traditional way for authors to control software but Digital Rights Management (DRM) techniques are becoming increasingly used, especially since new laws to that effect are being adopted around the world. This is altering the delicate balance between the need for authors to obtain revenue from their software, and the need for the public to access and use this software. Ultimately, these two models seem to be in opposition. Instead of being seen as the continuation of copyright rules, DRM could be more appropriately described as a whole new kind of intellectual property.

Keywords: Copyright, DADVSI, DRM, EUCD, Intellectual Property.

1 Introduction

Most people see licences as the normal way to implement software copyright. But Digital Rights Management (DRM) techniques - a new-fangled term for copy protection systems - are now legally protected against 'circumvention' in many jurisdictions. We explain here how this protection can, depending on how it is legally worded, introduce a de facto new kind of intellectual property. We will then try to understand how this new kind of intellectual property can be a replacement for Software Licences, and an obstacle to their development.

The 1996 World Intellectual Property Organization Copyright Treaty (WCT)[1], the 1998 Digital Millennium Copyright Act (DMCA)[2], the 2001 European Union Copyright Directive (EUCD)[3], and the 2006 French bill known as DADVSI (*Droit d'Auteur et Droits Voisins dans la Société de l'Information* - Copyright and Neighbouring Rights in The Information Society Bill)[4] all grant specific protection to so-called digital rights management techniques. We contend that this protection introduces a *de facto* new kind of intellectual property.

2 The Legal Protection of Software by Copyright

Authors (or publishers) of computer software are granted a copyright on their work - unauthorized copying of software is illegal in most jurisdictions. This protection is very similar to that granted to books, photographs, songs etc. (though under *droit d'auteur* legislations, software authors do not typically enjoy as many "moral rights" as authors of other kinds of work). Accordingly, this copyright only covers specific programs, as opposed to the abstract ideas and techniques used in software production.

This is an important distinction to make. Computer software is generally written as source code (a human-read-

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[1] Available at <http://www.wipo.int/treaties/en/ip/wct/trtdocs_wo033.html>.

[2] Available at <http://thomas.loc.gov/cgi-bin/query/z?c105:H.R.2281.ENR: >.

[3] Available at <http://europa.eu.int/eur-lex/lex/LexUri Serv/LexUriServ.do?uri=CELEX:32001L0029:EN:HTML>.

[4] Available at <http://www.legifrance.gouv.fr/WAspad/UnTexteDeJorf?numjo=MCCX0300082L>.

able, machine-processable text), which is then translated (or, in technical terms, compiled) into directly executable code. In most cases, the source code does not express novel techniques; yet, it is an original work, covered by a copyright, in the same way that bad novels without any novel ideas are also covered by a copyright. If the software presents interesting techniques, other software producers may decide to implement the same techniques in their own products, provided that they do not copy the software itself but only the ideas that it implements.

In the industrial world, techniques do not give rise to copyright protection, but people can use patents to control their use. Patents grant the inventor of a novel technical technique an exclusive right over the exploitation of that idea, in exchange for the publication of the idea in the patent document. Whereas previously inventors had to keep their inventions as trade secrets if they did not wish competitors to copy them, patents allow inventors to publish their inventions and to grant licences to other suppliers, thus encouraging the spreading of new ideas and new techniques. Also, the duration of patents is limited, typically to 20 years, which is thought to be a good compromise between the general interest of making inventions free for everyone and providing the inventor with a return on investment, all of which is supposed to encourage innovation.

3 Patents on Software

The application of patents to computer software techniques is highly controversial. Some forms of "software patents" are allowed by the US Patent and Trademark Office. Software patenting is forbidden as such by European texts, but the European Patent and Trademark Office (EUPTO) is often described as extending the very narrow exceptions to these rules in order to circumvent that European legislation. Nevertheless, in 1995 the European Parliament refused to generalize the EUPTO practices and to adopt similar provisions to the US ones.

There are manifold reasons for opposing software patents:

■ Software ‘techniques’ often consist of algorithms; that is, mathematical descriptions of computing processes. Traditionally, algorithms have been considered in the same way as mathematical formulas - they are not patentable in themselves, though there are ways to work around this restriction.

■ The experience with the administration of "software patents" by the US Patent and Trademark office has been highly controversial. In many cases, patents were granted to techniques already known in the state-of-the-art or immediately derivable by a technical person - both of which are normally precluded by patent rules.

■ The pace of the computing industry is very fast compared to other industries. Take, for example, medical suppliers: medicines may be used for decades after they are invented, but patents only grant a monopoly over the first couple decades. Furthermore, the lengthy approval procedures subtract from the "exploitable" patent period. However, in the case of a software invention, 20 years may often extend beyond its period of usefulness.

■ Finally, the economics of software are governed by powerful "network effects". This is important with respects to DRMs, and we shall therefore explain these effects in more detail.

In many industries, the intrinsic qualities of a product are overshadowed by its compatibility with what other users have adopted. For instance, the Betamax format for videotapes ultimately lost out to the VHS format. Many have argued it was technically superior, but VHS was more widespread and the differences were not compelling enough to justify an alternate technology. In computing, there is the constant issue of "compatibility" and "interoperability" - meaning the ability of several software or hardware components to work together.

Historically, it has been often the case that hardware manufacturers introduced gratuitous incompatibilities between their hardware and that of other manufacturers (or even between different hardware lines in their own company) in order to lock customers in : for instance, they produced computers that would only work with their own terminals and printers. Patents over connectors, interfaces, and communication protocols may prevent competitors from manufacturing compatible systems.

The same applies to software, especially in today’s wired world. We do not generally buy our software in isolation - because of the Web and e-mailing, for example, we want our word processor, our spreadsheet, etc. to be compatible with those used by our colleagues and friends. In the past, there were a number of competing office suites with significant market shares - but today there is only Microsoft Office and, far less commonly used, its libre competitor OpenOffice.org. With regard to operating systems - the essential software infrastructure on computers -, there are only two widespread desktop systems: Microsoft Windows and Apple’s MacOS, though the libre competitor Linux is making some inroads. One reason for this is that for many applications one is more or less forced to use Windows or MacOS. For instance, there are proprietary multimedia (audio and video) formats for which documentation is not freely available and whose designers only supply players for Windows and MacOS. If you wish to play such content, the easy solution is to have Windows or MacOS. The same applies to, let’s say, documents supplied in the Microsoft Word format - if you require good compatibility, you have to have a copy of Word, which is available only for Windows and MacOS but not for Linux. Thus there are strong network effects that reinforce quasi-monopolies.

4 DMR and Software Patents

Despite these difficulties, some software makers manage to produce ‘compatible’ software - software capable of reading proprietary formats. They often do so by "reverse engineering" software and file formats for compatibility purposes, which is allowed by current European law. Now,

here's the catch with DRMs. DRMs "technical methods" are simply a new word for "copy protection" systems - systems that prevent unauthorized software from playing or copying content. If you wish to produce software compatible with a DRM 'secure' format, you will essentially have to understand how to work around the DRM system. For instance, if the DRM-encumbered file is encrypted for copy protection purposes, the 'authorized" software will have to decipher it, and so will the 'compatible' software.

The original wording of the DADVSI bill criminalized working around DRM protections, without exceptions. Many people became worried that this law would indirectly allow designers of DRM formats to claim exclusive rights to produce software or hardware capable of reading such formats, since any maker of compatible software or hardware could be accused of circumvention of the DRM, which is a felony. Designers of DRM systems would thus enjoy rights equivalent to those of a patent (exclusivity of production of compatible systems) without the limitations (limited duration and obligation of publication), even though software patents had been refused by elected representatives. Because DRM formats are now used in video, audio, and even text, and because of the "network effect", this might have had severe consequences for competition. For instance, neither Apple nor Microsoft produce players for their popular DRM-encumbered formats for the competitor operating system Linux, and the law could have been used to outlaw any 'compatible' player; thus, Linux would have been unable to play the majority of videos downloadable from the Internet, making it unsuitable for many desktop deployments.

Because of this risk, the French Parliament ended up including provisions that made circumvention of DRMs legal for compatibility and security reasons. We have already explained the compatibility issue; the security issue is justified by the actions of some manufacturers whose "copy protection" software was insecure and even tried to spy on the users (see for instance the Sony *rootkit* scandal). Should the original law have been passed, producers of such systems could have prevented the revelation of their flaws by security researchers by threatening prosecution for circumvention.

But that is not to say that there are no flaws in it. The French Constitutional Court has just released its ruling on the DADVSI bill, and there are two ways it can impede the normal development of licences.

Firstly, the Court eliminated the exception that protected software developers who were specifically working on collaborative software, research or file sharing. Given the decision, any French developers working on such software could be sued by DRM producers or copyright holders, even when its software is intended for non-copyrighted contents. So, regardless of whether people use P2P (Peer-to-Peer) software for a distributed business model or just to share Creative Commons-music, it is already illegal. In this sense, DRM is actually a new form of intellectual property. Hierarchically, DRMs are meant to precede software copyright.

The same mechanism is at work again on another issue. The Court accepted a compulsory licence system whereby DRM developers must grant licences of their DRM Software to other DRM producers. The law creates a DRM Regulation Authority that will centralize problems and propose solutions. But as of today, any Software editor, any DRM producer, or any webservice can ask to access the "essential information" needed for interoperability: if Microsoft wants to interoperate with Apple, they can go to the DRM Authority. And the latest thing is that, if the DRM producer refuses to let the plaintiff access its DRM essential information, the Authority has the power to mandate him to communicate them. In other words, if Apple refuses to let Microsoft interoperate, the Authority can mandate Apple to provide them with the information. So much for their copyright. So much for their patents or their DRM. So much for their ability to refuse and negotiate agreements.

This mainly concerns companies like Apple who could be forced to disclose the functioning details of their software, but it is indicative of the current hierarchical move from copyright to DRMs.

One way or another, software is increasingly perceived as an essential facility. The copyright licensing scheme that has prevailed for 30 years is now being challenged by Software Patents and DRMs. And this new hierarchy is challenged in turn by the need for competition.

The current mechanism has been successful in many ways. It has allowed the parallel development of commercial business models under the exclusive licensing of the right to use a program and access its source code, and the development of more complex and modern *Libre*/Free Software and licensing schemes. The development of software patents has been seen as a threat to these two models from the start. But the development of DRM and the relative discrediting of copyright is just beginning to be perceived as a threat too.

5 The Need for A Serious Debate

There is certainly a serious debate to be had on the opportunity of allowing "software patents", and, if they are allowed, under what conditions. There is also a debate to be had on the business model of the entertainment industry in the Internet age. But, copyright for music and films should not be used as an excuse to introduce harmful *de facto* patents in other industries, especially when this "new kind of intellectual property" would clearly hamper competition and innovation.

Ideological Foundations and Real Effects of The Current Model of Intellectual Property

Eduardo Melero-Alonso

Legislation on intellectual property grants authors private property rights that can be broadly broken down into moral rights and proprietary rights. This model is based on a number of specific ideological presuppositions and on the effect that it has on society. This article puts forward a critical reading of the legislation governing intellectual property, the ideological presuppositions behind that legislation, and its real effects. Because knowledge and culture are produced socially and intellectual property legislation gives rise to the creation of monopolies that exert immense power over culture.

Keywords: Ideological Presuppositions of Intellectual Property, Intellectual Property Legislation, Legal Framework, Monopolies and Oligopolies of Intellectual Property, Moral Rights, Proprietary Rights, Social Function of Intellectual Property, Social Production Of Knowledge And Culture.

1 Introduction

The current model of intellectual property is based on a number of specific ideological presuppositions and on the effect that it has on society. This article, which takes current international and Spanish legal regulations as its starting point, puts forward a critical view of these two issues, in order to provide an in-depth critique of the current model of intellectual property.

2 Intellectual Property as Private Property: Constitutional Framework

Intellectual property legislation assigns the author private property rights over his or her literary, artistic, or scientific creations (art. 1 of the Spanish Intellectual Property Law[1], hereinafter IPL). Intellectual property is a type of private property. Any study of the concept needs to start with article 33 of the Spanish Constitution (SC) which recognizes the right to private property (art. 33.1) and states that the social function of that right will determine the limits of its content (art. 33.2 SC). The Constitution also guarantees the essential content of the right to property (art. 53.1 SC).

The right to property has a dual nature: there is subjective component which comprises the rights of use (enjoyment, exploitation, or private use) and disposition (disposal and transfer) [1, p48] and a social function which imposes "*a set of duties and obligations (…) having regard to the values and interests of society*"[2]. The social function forms part of the essential content of the right to property, as has been expressly recognized by the Spain's Constitutional Court[3]. The legal regulation of intellectual property should guarantee both the subjective component and the social function of this right.

3 Intellectual Property Legislation: General Principles

I would now like to move on to look at intellectual property law, not only Spanish legislation but also regulations adopted by the European Union and a number of international treaties (see Table 1). The scope of application of this kind of legislation is now global. This means that, barring

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[1] Spain's Royal Legislative Decree 1/1996, of April 12, approving the Redrafted Text of the Intellectual Property Law, regulating, clarifying, and harmonizing prevailing legal provisions regarding the matter: <http://civil.udg.es/normacivil/estatal/reals/Lpi.html>.
[2] Spain's Constitutional Court Ruling 37/1987, of March 26, FJ 2.
[3] Spain's Constitutional Court Ruling 37/1987, of March 26, FJ 2.

the legislative peculiarities of each individual state, the general principles of intellectual property protection are basically the same nearly the world over.

International Legislation

■ Berne Convention for the protection of literary and artistic works, revised at Paris on July 24, 1971.

■ Universal Copyright Convention, revised at Paris on July 24, 1971.

■ Convention Establishing the World Intellectual Property Organization (WIPO) signed on July 14, 1967.

■ World Trade Organization Agreement and annexed agreements (Annex 1C: Agreement on trade related intellectual property rights), signed in Marrakech on April 15, 1994.

■ WIPO Copyright Treaty, WIPO Diplomatic Conference on Certain Copyright and Neighbouring Rights Questions, Geneva, from December 2 to 20, 1996.

European Union Legislation (A Selection)

■ Council Directive 93/98/EEC, of October 29, 1993, harmonizing the term of protection of copyright and certain related rights.

■ Directive 2001/29/EC European Parliament and of the Council of May 22, 2001, on the harmonisation of certain aspects of copyright and related rights in the information society.

■ Directive 2004/48/EC of the European Parliament and of the Council, of April 29, 2004, on the enforcement of intellectual property rights.

Spanish Legislation

■ Intellectual Property Law (Royal Legislative Decree 1/1996, of April 12, approving the Redrafted Text of the Intellectual Property Law, regulating, clarifying, and harmonizing prevailing legal provisions regarding the matter.

■ Penal Code (Organic Law 15/2003, of November 25, modifying Organic Law 10/1995 of November 23 of the Penal Code).

Intellectual property grants the author two types of subjective rights: moral rights and proprietary rights (art. 2 IPL; art. 6.bis.1 Berne Convention[4]). Moral rights basically refer to the right to claim authorship of the work and to object to any modification that would be prejudicial to the author's honour or reputation (art. 6.bis.1 Berne Convention[5]). The Spanish IPL deems moral rights to be inalienable and indefeasible; that is, the author can never waive those rights nor can (s)he transfer them to other people (art. 14 IPL). An author's moral rights of attribution and integrity are protected in perpetuity, even after the death of the author.

Proprietary rights are primarily concerned with matters of an economic nature. Proprietary rights grant authors exclusive economic rights. They allow them to seek financial gain from their works, normally by transferring economic rights[6] to an intermediary. Proprietary rights are protected

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Spanish Legislation

- Intellectual Property Law (Royal Legislative Decree 1/1996, of April 12, approving the Redrafted Text of the Intellectual Property Law, regulating, clarifying, and harmonizing prevailing legal provisions regarding the matter.
- Penal Code (Organic Law 15/2003, of November 25, modifying Organic Law 10/1995 of November 23 of the Penal Code).

Table 1: Key Intellectual Property Legislation.
Note from The Editor: The text of most of these legislative pieces can be found at the URLs mentioned in the footnotes of this article and in "Useful References" on page 8.

legally for a certain period of time, after which the creation is released into the public domain and anyone can use it freely provided that they respect the authorship and integrity of the work (art. 41 IPL). At present, within the European Union, such proprietary rights are protected during the life of the author and 70 years after his or her death (Directive 93/98/EEC[7]; art. 26 IPL).

Finally, salaried workers also have copyright related subjective rights. A worker engaged in a literary, artistic, or scientific work is considered as an author for the purposes of Intellectual Property Law. Therefore, in principle, the worker is entitled to the moral and proprietary rights arising from the authorship of that work [8 p. 842]. However, this is in principle, because in fact the situation is normally different, due to the rules governing the transfer of economic rights to the employer set out in art. 51 of the IPL. First of all, whatever has been agreed in the worker's employment contract takes priority over the aforementioned principle (art. 51.1 IPL), and if nothing has been expressly agreed "*economic rights shall be assumed to have been transferred exclusively*" to the employer (art. 51.2). This means that, in practice, the employer keeps possession of the economic rights.

The social function of private property imposes a number of limitations on property rights. With regard to copyright law, these limitations solely affect proprietary rights. Among these limitations are: the right to make a personal copy for non-commercial purposes (art. 31.2 IPL; although art. 25 IPL provides for the right to remuneration for such copies), the right to quote from a work (art. 32 IPL, art. 10 of the Berne Convention), free reproduction and lending in specific establishments (art. 37 IPL) and the right to parody (art. 39 IPL). Other exceptions to intellectual property in the Spanish Intellectual Property Law are copies for visually impaired people for non-commercial purposes (art. 31 IPL); information and works relating to news and current affairs (arts. 33 and 35 IPL); works located on public thoroughfares (art. 35.2); and official acts and religious ceremonies (art. 38 IPL). A further limitation is the period after which works are automatically released into the public domain, which under the Spanish IPL is 70 years after the author's death (art. 41 IPL).

A study of the legal regulation of intellectual property leaves no doubt as to the fact that the subjective component clearly takes precedence over the social function.

4 Ideological Presuppositions of Intellectual Property Legislation

This model of copyright is based on certain ideological presuppositions that legitimize intellectual property legislation so as to make it appear fair to citizens.

First of all, intellectual property law protects the author who is understood to be a separate individual. The model assumes an author to be a natural person, a *person of flesh and blood*, and not a legal person: enterprise, company, association... (art. 5 IPL; arts. 3.1 and 7.1 of the Berne Convention; art. IV.2.a of the Universal Copyright Convention[8]). Thus the perspective adopted is an individualist one. Knowledge and culture are understood to be the product of individual wok. The author should receive sufficient economic remuneration to encourage people to devote themselves to scientific research or artistic creation.

Secondly, the market is held to be the best instrument for optimally transmitting and distributing that knowledge. An author's right to the dissemination of his or her work is not guaranteed by law. The dissemination of cultural works is only governed by the rules of the capitalist market.

The third presupposition is that intellectual property should not be an obstacle to the development of knowledge and culture. It states that ideas are free; ideas cannot be the subject of copyright protection. The only thing that is protected is the vehicle by which the idea is materialized[9]. From this perspective, intellectual property law should not prevent the free circulation of ideas.

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[4] Berne Convention for the protection of literary and artistic works, of September 9, 1886, and all updates: <http://www.wipo.int/clea/docs_new/en/wo/wo001en.html>.

[5] Under Spanish copyright law, moral rights are regulated by art. 14 IPL. Among the most important rights granted are: (1) the right to decide whether the work should be disseminated and in what form, art. 14.1; (2) the right to demand that the authorship of the work be acknowledged, or authorship rights, art. 14.3 and 14.2; (3) the right to demand that the integrity of the work be respected, art. 14.4; (5) the right to alter the work, while respecting any rights acquired by third parties and protecting properties of cultural interest, art. 14.5; and (6) the right to withdraw the work from circulation as a result of a change in the author's intellectual or moral convictions, with the obligation to compensate the holders of the economic rights for any damages incurred, art. 14.6.

[6] The typical situations involving economic rights provided for under the IPL are: (1) reproduction, art. 18; (2) distribution, art. 19; (3) public dissemination, art. 20; and (4) transformation, art. 21. The author can transfer his or her proprietary rights, either exclusively or non-exclusively, by means of a contract. The most common form of contract is the publishing contract (arts. 58-73 of the IPL).

[7] Council Directive 93/98/EEC of October 29, 1993 harmonizing the term of protection of copyright and certain related rights. Available at <http://www.paemen.com/websitecontent/copyright/1993termdirconsol.pdf >.

[8] Available at <http://www.unesco.org/culture/laws/copyright/html_eng/page1.shtml> .

[9] Article 9.2 of the World Trade Organization's Annex 1C entitled "Agreement on Trade-Related Aspects of Intellectual Property Rights" states that "*Copyright protection shall extend to expressions and not to ideas, procedures, methods of operation or mathematical concepts as such*". Article 2 of the World Intellectual Property Organization Treaty uses an identical text.

The principal mechanism ensuring the protection of individual creators is the attribution of private property rights over cultural creations. Private property rights are thus the universal mechanism whereby authors' rights are protected.

5 Material Needs That Are Supposedly Promoted by Intellectual Property Legislation

Intellectual property is seen as an essential instrument to ensure intellectual creation. It encourages investment knowledge and cultural innovation as it ensures a return on the investment. It also safeguards the independence and dignity of authors by protecting their interests. In short, it helps to disseminate knowledge and culture, thereby benefiting both authors and society as a whole.

6 Criticisms of The Existing Model of Intellectual Property Legislation from A Social Perspective

6.1 Criticisms of The Ideological Presuppositions

Ideologically speaking, intellectual property legislation conceals the fact that knowledge and culture are produced socially[10]. In scientific and cultural creation, two dimensions need to be taken into account: on the one hand the role of the individual authors and, on the other, the consideration of knowledge and culture as socially created products.

We can say that knowledge and culture are social products in a dual sense. Firstly, the production of knowledge and culture presupposes the production of the means to satisfy the essential necessities of life, such as eating, drinking, clothing, and shelter[11]. The production of these resources is undertaken socially, by means of the combined work of countless people. To put it another way, in order that certain people can devote themselves to writing books, composing music, or making films, it is necessary for other people to grow food, make clothes, transport these products, build houses, …

The second sense in which knowledge and culture are social products stems from the fact that their production is based on knowledge and culture past and present. Knowledge and culture are the product of all the work done by mankind through the ages. Language, numbers, musical notes, mathematical formulae, scientific concepts, artistic ideals, etc. are achievements of mankind as a whole, they are the result of socially accumulated human work. Individual authors do not emerge from thin air, they do not create in a vacuum. Instead they use a number of artistic techniques and forms, they use various kinds of instruments or scientific apparatus, they form part of certain cultural and scientific traditions. All these elements are the result of the accumulated work of mankind; they are socially produced assets. Without this base of accumulated work the task of individual authors would be impossible. And their work is also impossible without the cultural assets that are being produced by various people today.

Knowledge and culture are produced socially and yet we represent them to ourselves as the product of individuals. One of the reasons this occurs is because intellectual property legislation places the emphasis on the individual dimension of the creation. The model of the individual author is used to justify the attribution of private property rights and to adopt specific measures, such as extension of the length of copyright[12]. It thus fulfils an ideological function, by creating a hegemony, since the current model of intellectual property is assumed by citizens to be fair.

6.2 Criticisms of The Effects of Intellectual Property Legislation on The Material Base of Society

Moving on to the effects that IPL has on the social base, first of all we need to bear in mind that intellectual property legislation is applied within a capitalist economic system. A system that turns knowledge and culture into marketable goods. Intellectual property legislation only ensures the free circulation of knowledge in exchange for an economic consideration.

Turning knowledge into a marketable asset means that only those who can pay the price can have access to it. The capitalist market is not an efficient institution, neither does it distribute assets fairly; it tends to benefit those with the greatest economic resources, those who can pay most for those assets[13]. Thus barriers are set up that impede access to cultural assets or at least to certain cultural assets.

We need also to take into account the fact that most cultural assets lose their commercial value quickly; in other words, a few years after they have been put on the market, it ceases to be economically profitable to market them. This is the case of books, songs, and films that are not re-published or re-released. Nevertheless, intellectual property legislation protects all these assets up until 70 years after the death of their author. This in effect prevents the free circulation of cultural assets that have ceased to be economically viable[14].

In addition to this marketization effect, another factor to consider is the minor role played by the social function of intellectual property, evidenced by the lengthy period of time that has to elapse before individual creations pass into the public domain: 70 years after the death of the author. The average term of protection of intellectual property is over 100 years, and there are few exceptions allowing the free use of a creation. IPL also requires that private copies

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[10] On the social production of knowledge see [2, pp. 88-89, and 102 and following]. On the social nature of production, see [4, pp. 5-8].

[11] Karl Marx and Friedrich Engels [6, p. 28] stated that the first historical act is the production of the means to satisfy the essential necessities of life.

[12] In regard to this, see the previously mentioned Directive 93/98/CEE of the Council, of October 29, 1993, on harmonising the term of protection of copyright and certain related rights.

[13] On the dysfunctions of the real capitalist market, see [9, pp. 16 and following].

[14] This issue was raised by Lawrence Lessig [3, pp. 226-232].

be paid for, by levying special taxes on equipment for copying books, records, or videos, and on the media used for that copying (art. 25.5 IPL). What is more, these taxes are levied regardless of the fact that the copying equipment or media may actually be used to copy works that are not protected by intellectual property law. And then there is the debate currently underway about whether public library lending should be subject to a copyright fees. All these measures serve to reduce the social function of intellectual property legislation and evidences the fact that the content of this social function is under threat.

The most serious criticism that can be levelled at intellectual property legislation is that its main effect is to create monopolies by assigning exclusive economic rights. Exclusive economic rights that, generally speaking, are held by *intermediaries*, not the individual creators themselves, as they have to transfer them both to earn a crust and to ensure that their work is disseminated.

When these intermediary companies acquire exclusive economic rights, they also gain a hugely important advantage over their competitors. Exclusive economic rights effectively create a monopoly on the scientific or cultural product involved, the origin of which is solely legal. This reinforces capitalism's tendency towards the formation of oligopoly markets.

Two types of capital concentrations are being created. On the one hand there is a horizontal concentration, as most of the business is in the hands of very few intermediary companies, multinational companies that are the same the world over. For example, the five major record labels in the USA - Universal, BMG, Sony, Warner, and EMI – are also the five biggest in Europe. Meanwhile, there is a vertical concentration that affects the entire economic process; i.e. the production, circulation, and consumption of cultural assets. A single group controls all these stages of the economic process involving its products. To a large extent, the entire chain of vertical oligopolies revolves around the monopoly over content; i.e. the exclusive economic rights guaranteed by intellectual property.

The existence of these legally protected monopolies (oligopolies in practice) flies in the face of free competition and free circulation, causing a breakdown in the free transmission of knowledge and culture.

Intellectual property legislation uses the model of the individual author as its alibi. However, this legislation mostly benefits the major media and communication groups. These large companies receive a legal boost their already privileged position in the market, thereby favouring the concentration of capital.

This concentration means that the major media groups exert a private power with a very important public effect: they have the power to exercise an enormous influence over what we read, what we listen to, what films we see. To a large extent they are able to control ideas. This is clearly political power: it plays a huge role in determining which issues are discussed by public opinion. It therefore affects the exercise of people's fundamental rights, and ideological freedom and freedom of expression (articles 16 and 20 of the Spanish Constitution).

7 Conclusions and Proposals

Intellectual property legislation has to be placed in the context of the capitalist economic system. A system in which production is based on the principle of collective work, while the appropriation of the social product is a private affair. Intellectual property legislation is totally coherent with this context, as it ensures the private appropriation of socially produced knowledge and culture. It also plays a fundamental role in the development of capitalism, thanks to the growing importance of intellectual property within a capitalist system[15].

From a social perspective, the attribution of private property rights to authors should be questioned. Within a capitalist system this is unquestionable. In practice, the effective exercise of intellectual property rights is in the hands of intermediaries, while the authors only receive a financial consideration. One idea could therefore be to ensure that they receive monetary compensation by other means, perhaps through the payment of a basic guaranteed income [7, pp. 127-128].

A second criticism is the long term of protection of economic rights, more than a century counting from the moment when the work was created. A hundred years in such a changing society as ours is excessive. I believe that this term should be drastically reduced.

This term is an eternity if the protected works have ceased to be economically viable. Take, for example, the case of books, records, or films that are nor re-published or re-released. For these cases there should be a much shorter term before the works pass into the public domain. The social function of intellectual property would justify the reduction of the term of protection of proprietary rights. The Intellectual Property Law could provide that every work that remains unpublished for 10 or even 5 years passes automatically into the public domain. As the digitalization of information tends to reduce the cost of reproduction and distribution of cultural assets to zero, a measure of this nature would enable these works to be readily disseminated over the Internet.

*Translation by **Steve Turpin***

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The Legal Framework of Software Licences: Is The Will of The Licensor Subject To Constraints?

Luis Fajardo-López

Intellectual property rights and the powers arising therefrom are regulated and defined by the law, and as such are inalienable. It is possible, however, for the rightsholder to transfer his powers by contract under whatever conditions he sees fit. However, with regard to software licences, the licensor (i.e. the person who grants a license for a computer program) is actually not free to set the conditions, as he is obliged to respect a number of licensee rights and to take certain precautions in the licensee's interest. The aim of this article is to review the nature of these constraints on the licensor's freedom of action, while analysing the validity of liability exemption clauses or the prohibition of decompilation, and also the way in licences should be implemented. We reach the conclusion that the libre licences meet current legislation better than proprietary ones.

Keywords: Anti-Piracy Techniques, Constraints on The Terms of Licences, Consumers, Liability Defective Products, Exemption, Interoperability, Software Licences..

1 Introduction

If licences for the use of computer software are not laws (since laws can only be enacted by democratically elected legislative bodies) why are they binding? Logically, these licences are binding because they are agreements. However, under British-based common law (and more so under USA common law), a licence is normally seen as something different from an agreement. Eben Moglen[1], member of the board of FSF (Free Software Foundation, <http://www.fsf.org>), states this clearly when he says that licences are not agreements because the user is bound by the terms of the licence, not as a result of any prior agreement (contract), but because the software user has no right to act outside the framework of what is permitted by the licence[2]. This interpretation is questioned even in the context of US law, but it is totally unsustainable within a continental European-type legal system, and in particular within the Spanish legal system in which a licence can only be a contract.

It is quite another thing to claim that a licence establishes the way legally conferred intellectual property rights are exploited when they affect third parties. However, intellectual property rights can only be transferred by means of an agreement. Or in other words, while the economic rights of an author may be the subject of an agreement, that agreement does not define or establish the rights in the way that Moglen would have it, but instead is dependent on the interpretation of the law. That is to say, the rights of the user are not unilaterally decided by the creator of the work. Rather the rights are imposed, not only by the social function that Spain's Intellectual Property Law (IPL)[3] recognizes in art. 33.2 of the Spanish Constitution (CE), but also because the powers implicit in these rights must be transferred in accordance with some contractual models that need to be included in the agreements if they are to be binding (art. 1258 of the Spanish Code Civil)[4]. In short, the author is not free to dispose of his work as he wishes, just as neither is the

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[2] Eben Moglen, "Free Software Matters: Enforcing the GPL, I", August 12, 2001, <http://emoglen.law.columbia.edu/publications/lu-12.html>.

[3] Spain's Royal Legislative Decree 1/1996, of April 12, approving the Redrafted Text of the Intellectual Property Law, regulating, clarifying, and harmonizing prevailing legal provisions regarding the matter: <http://civil.udg.es/normacivil/estatal/reals/Lpi.html>.

[4] Full text available at <http://civil.udg.es/NORMACIVIL/estatal/CC/INDEXCC.htm> .

owner of a piece of land free to dispose of it as he wishes.

The problem then is not whether licences are binding but whether they respect the limits within which they are permitted to act. A licence or end user licence agreement (EULA) should at least conform to the LGCC[5], to the laws regulating liability for defective products[6], and any other laws that may be applicable (including, of course, the IPL). The aim of this article is to identify the minimum content of licences, the 'imperative' content that the author cannot alter, and see whether this requirement is respected by the main types of licences currently in use.

In practice there are two types or groups of licences, each with different variants within the group:

1. *Libre* licences, hereinafter LIBLs[7], in which the end user is allowed to benefit from almost any form of economic exploitation and, in particular, make any kind of alteration, for which purpose the use is provided with access to the sources of the program[8]. The user is allowed to redistribute the program and is only limited (occasionally) with regard to receiving financial gain from the economic rights that such an alteration may give rise to[9].

2. Proprietary licences, hereinafter PROPLs, under which the end user is not allowed either to alter or redistribute the program, and is not allowed to make any copies (even for personal use) except for a back-up copy, as set forth in IPL art. 100.2. The licence thus only grants the right to use the program without altering it, and therefore software licensed in this way tends to be distributed in object code[10], and may only be used on the number of computers that the licence specifies (usually on the basis of one computer per licence).

Both types of licences state that the program is delivered "as is" and do not hold the licensor (i.e. the person who grants a license for a computer program) responsible for any damage that the use of the software may cause, even as a result of using it in accordance with the instructions provided.

In the next section we will outline the legal restrictions that these licences have from the point of view of product liability and consumer protection.

2 Limitations

2.1 General Limitations

GPLs (General Public Licenses), which are the paradigm of LIBLs, and any other licences that we may wish to use or invent, can only be effective within the legally established limits of the party autonomy (the parties' ability to negotiate), as set forth in article 1255 of the Spanish Civil Code: the law, the morals, and public order. Therefore licences should at least respect the law, morals, and public order.

Of the three, the reference to the law is the one that most interests us, in the understanding that it logically refers to imperative law as a limitation on party autonomy.

Therefore the new question we need to answer with regard to limitations on licences should be: which imperative laws should licences in Spain comply with? The question of whether licences violate morals and public order issues is not unimportant, but does not fall within the scope of this article.

As licences are unilaterally drafted, they should be considered as pre-formulated clauses and, in most cases, general contractual conditions, so it could even be questioned whether they are able to modify dispositive law without sufficient reason[11]. If only one of the parties has pre-formulated the content of the contract, the question arises: is such a pre-formulated agreement sufficient to avoid the application of dispositive law? Our reply would be if and only if there are good reasons for it, and in such a way that, if the

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[5] Law 7/1998, of April 13, on General Contracting Conditions (BOE no. 89, 14-04-1998), available at <http://civil.udg.es/NORMACIVIL/estatal/contract/lcgc.htm>.

[6] In particular, the Law 22/1994, of 6 of July, on civil liability for damage caused by defective products, (BOE 161, 07-07-1994), available at <http://civil.udg.es/NORMACIVIL/estatal/resp/Lrp.html>. And with regard to general civil liability, articles 1902 ff of the Civil Code for extracontractual liability, and 1101 ff of the same code for contractual liability.

[7] Occasionally I will refer not only to *libre* licences (free software licenses as defined by the General Public License - GPL) but also to all open code licences, making a distinction between the two types of licences when necessary.

[8] By source program is meant the texts and commands that are passed to the computer so that it can execute the orders that the programmer has planned in response to different events, in such a way as to be human readable and therefore alterable.

[9] To be strictly accurate we should make a distinction between *open source* software, in which the sources of the software are made available to users (all programs written in non-compilable languages and interpreted in runtime will therefore be open "by necessity"), and *libre* or *free use* software, in which the emphasis is on the 'liberty' or 'freedom' to reuse the code in order to meet new requirements (in the 'purest' form of *libre* licences any such alterations must be re-licensed under the same licensing system) rather than on their cost-free nature.

[10] Object code, or machine code, is the name given to the result of an operation that converts source code into a series of ones and zeros, which are the real instructions that the computer executes and are not human readable. The reason for converting source code into machine code is so that the computer does no have to 'translate' every time it has to execute a command, which makes the program run faster. Also, machine code provides practical protection against any supposedly illicit alteration of the program (such an enhancement of it).

[11] That is, regulations established by the legislator for when the parties do not reach any prior agreement. However, by reaching a prior agreement the parties can circumvent dispositive law, unlike the case of imperative law under which non-compliant agreements reached by the parties are null and void.

law was applied, it would prevent the two parties from entering into a mutually beneficial business.

2.2 General Contractual Conditions

General contractual conditions should be subject to the content, inclusion, and interpretation controls set forth in the aforementioned Law 7/1998 on general contractual conditions and related provisions.

It is impossible to establish general criteria, because what is acceptable in one context may not be acceptable in another. Thus, for example, distributing a standard code and including a liability exemption clause if that code is used in equipment that is critical to human life is not the same as charging for making bespoke use of that code for a medical system (for example) and including the same liability clause. General conditions must be considered in each case. What we are trying to do is protect the free expression of acceptance and limit the scope of clauses that go beyond what is permitted unilaterally. These are issues that fall well outside the scope of this brief article. However it should be mentioned that it is not only a case of controlling the content of the conditions, but there should be a prior control (prior to assessing the legality of its content) known as inclusion control. This control obliges clauses to not only be drafted clearly, but to be made available and known to users at all times. In my opinion, this makes it necessary to include them in an electronic format that should be digitally signed by the licensor[12]. In the case of *libre* licences, in practice a reference to the wording of a well-known licence, and the digital signature of that reference, is sufficient.

If the agreement is not digitally signed, it could be considered that the conditions do not meet the necessary requirements to be deemed to have been included in the contract[13], in which case the agreement will have to be integrated not on the basis of these unilaterally pre-formulated rules, but on the basis of the general contract law applicable in each case (sale, leasing, simple loan,...). In other words, if we do not want certain general conditions to be considered as not included in the contract, it is highly advisable for them to be a) distributed together with the software b) easily accessible (preferably from an option-type menu, like the "About" option that is usually included in the "Help" menu of a great many programs) and c) electronically signed. In practice, programs distributed under *libre* licences tend to be digitally signed and include an archive with the licence which forms part of the signed package. However, this does not always meet the abovementioned requirement. For this practice to be considered as legally valid, the distribution that was downloaded (or acquired by any other method) should be available to the user licensee permanently on the Internet.

2.3 Limitations Arising from Civil Liability Law

2.3.1. General Regime of Contractual Civil Liability

In our legal system, civil liability, whether contractual (arts. 1101 ff CC.) or extracontractual (arts. 1902 CC. ff CC.)[14], is regulated by a set of clearly imperative laws (and so there is little room for manoeuvre in terms of party autonomy and negotiation).

If we apply this fact to the issue in hand, we can see that in the case of LIBLs "fault or negligence" would be very rare indeed, since the *libre* software community makes every effort to improve their products. The very philosophy of *libre* software means that it would be unusual to find cases of fault or negligence.

The case of proprietary computer programs (PROPL) is very different: companies feel under pressure to release versions even when they know that the product is still not debugged. This is further encouraged by the system of product development known as module based programming (in which the need to maintain secrecy means that one set of programmers are unaware of what the others are doing), which causes problems that may still be there when the product is released. This is an imprudence that, when it causes damage to the user, is penalized under Spanish law by the obligation to make good the damage caused.

In the case of *libre* products, things tend to work differently. A *libre* product is either acquired for personal use, with nothing more than a sort of bailment (a technical term for a simple type of loan), with the peculiarity that the goods do not need to be returned because only "a copy" has been delivered, in which case the bailor will be responsible under the terms set forth in 1752 CC[15]. Or the *libre* product

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[12] At least insofar as the Spanish Information Society and e-Commerce Services Law (and in particular articles 27.4, 23.3, and 24.1) is applicable, <http://www.lssi.es/s>, which I believe should be applicable extensively to agreements concerning software copyright. The law should be applied in combination with RD 1906/1999, of December 17 (BOE 31-12-1999), <http://www.juridicas.com/base_datos/Admin/rd1906-1999.html>, regulating agreements made by telephonic or electronic means containing general contractual conditions.

[13] Or cause other effects detrimental to the effectiveness of the agreement. The exact consequences are the subject of some debate in legal doctrine.

[14] Especially in this latter case since by definition it refers to liability arising when there is no contract, and so clearly there can be no contractual moderation.

[15] Another solution, albeit not so acceptable, is to consider that there is no contractual relationship at all between the author of the program (and the successive people who may redistribute it and transfer on the redistribution rights) and the end user. In this case we would be in the realms of extracontractual liability as set out in art. 1902 CC., the provisions of which are basically the same as art. 1752 CC. which identifies only one behaviour that can be considered to be negligent according to art. 1902 CC, and only if the possible damage was known, and it cannot oblige the author to such a "guaranteeist" behaviour as if the relationship were contractual.

may be acquired under a type of leasing agreement, whereby the lessor asks the lessee for the solution to certain computing requirements for which the lessor uses *libre* licensed software.

In this latter case, the result of the application should not leave the lessor's possession or, if it is does, it should do so under the terms of the licence (LIBL) imposed by the licensor. In the latter supposition, the issue of liability would not be covered by the licence but by the service lease contract instead, especially when the lessee can choose the technical solutions that he deems to be most appropriate (i.e., choose to use one program or another). The issue of liability between the lessee and the programmer licensing the software used to fulfil the terms of the lease is covered by the aforementioned bailment model.

In both types of licence the developers are, in one way or another, exempted from any liability. That would conflict with our legal system because if they cause damage through their own fault or negligence they should be obliged to repair it. The fact is that, in the case of LIBLs, the duty of care is limited to reporting the known errors that the program has (a duty of subjective good faith: errors that may reasonably be known). However, for proprietary licences a somewhat greater duty of care is required: not only the errors that may be known, but also those that should be known, as the licensor is obliged to perform tests and ensure that program appears to have no faults. In the case LIBLs, the software does not need to be checked as the developers voluntarily share their knowledge and software developments with others[16].

2.3.2 Limitations Arising from The Law on Defective Products

Finally I would like to look at the law governing defective products, in particular Spanish Law 22/1994, on civil liability for damage caused by defective products[17]. The definition of art. 2 of the Law leaves much to be desired: "*For the purposes of this Law, a product is understood to be any movable good, even when affixed or incorporated to another moveable or immovable good. Gas and electricity are also considered to be products*". The wording certainly demonstrates the problem of incorporating software into existing legislation, while giving an example of the inflexibility of such specific legislative texts which, for all their inflexibility, are no more precise, and that instead of using general terms such as "supplies"[18] prefer to list what each term includes (such as "electricity" or "gas").

Paragraph 3 of art. 3 states that "*a product cannot be considered to be defective solely due to the fact that an upgraded version is released later*". This does not exempt PROPL licensors from liability in cases in which the product was not sufficiently tested before its release, or if there are faults of which *objectively* they could not have been aware. The real purpose of this paragraph is to prevent something which was good by the technical standards of the day and served the purpose for which it was intended from being subsequently claimed to be bad.

2.3.3. Limitations Arising from Intellectual Property Law

In recent years there has been a lively debate in the European Community as to whether software should be protected by patent law[19] (a debate which continues unabated in spite of the fact that in July 2005 the European Parliament rejected in an almost unanimous way the Proposal for a Directive on the Patentability of Computer Implemented Inventions presented by the European Commission). Currently software is still expressly excluded from patent protection, although there are nevertheless a great many patents protecting computer programs in some way or other filed with the European Patent Office. Whatever the case, the appropriateness of the degree and type of protection afforded by the IPL is being questioned. Some see it as excessive, especially with regard to the term of protection (seventy years from the distribution of the first copy, art. 98.2 IPL[20]), which is out of step with the pace of information technology development (a computer program loses its market value in just a few years), and because moral rights do not tend to make much sense with regard to this type of work. However the most vociferous criticism is from those who maintain that the IPL does not afford enough protection, because it protects against small-time piracy but not against unfair competition[21].

Actually, the best protection against unfair competition

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[16] In practice, programs with LLIBs tend to undergo many more tests than LPROPs, among other reasons because the former benefit from a community of users willing to "perform tests" while users of the latter group prefer to "pay for something finished".

[17] Obviously this is not a complete list of all regulations governing licences, although it does include the most important.

[18] Either "private supplies" or supplies provided by companies that are independent from the public; in short, if what was intended was to exclude the supply of water, it would be necessary to say so explicitly (although we would be in the same situation of lack of foresight). The law is available at <http://civil.udg.es/NORMACIVIL/estatal/resp/Lrp.html>.

[19] Which prompted the Commission to present a Proposal for a Directive of the European Parliament and of the Council COM (2002) 92 final, of February 20, 2002, on the Patentability of Computer Implemented Inventions, <http://europa.eu.int/eur-lex/lex/LexUriServ/site/en/com/2005/com2005_0083en01.pdf>, adopting the resolutions of the European Patent Office concerning the patentability of computer programs, which is the practice commonly adopted by governments in Europe.

[20] Or after the death of the author if the author is a natural person (arts. 26 to 30 IPL).

[21] Legislation governing unfair competition, which does not fall within the scope of this article, plays an important role in the proper functioning of the IT market, and particularly with regard to the validity of some clauses to be found in licences.

would be the disclosure of the source code of applications, combined with an effective way of detecting the originality of a given piece of code[22]. But first let us look at the terms in which current legislation is drafted before moving on to address these and other criticisms.

Economic rights are regulated in article 99 of the IPL and broken down into three sections, each referring to a different method of economic exploitation: reproduction (99.a), transformation (99.b) and distribution (99.c)[23]:

But art. 99 of the IPL already states that the rights set forth therein are "*without prejudice to the provisions of article 100*" regulating limitations on economic rights.

The most important, and the most controversial, limitations from a practical point of view are those contained in points 1 and 5 of the aforementioned art. 100; the former allows the adaptation of the program to the purposes of the user, while the latter permits the "*reproduction and translation of its form*" for the purposes of achieving interoperability with another program created independently[24]. Let us take a closer look at the two paragraphs.

a) Software Adaptation and The Interoperability Requirement

Paragraph 1 of art. 100 of the IPL states that: "*unless otherwise provided by contract, authorization from the rightsholder is not required for the reproduction or alteration of a computer program, including the correction of errors when such corrections are necessary for the legitimate user to utilize the software for its intended purpose*".

First of all we see that this is a limitation that can be altered by agreement. However we need to study whether this authority to limit the adaptation of a program to the needs of the user can be stipulated in general contractual conditions, or whether it is only valid in the case of a negotiated condition. As the law is drafted now, general conditions cannot preempt dispositive law unless there is a powerful large-scale trade related reason. In the case we are considering here, the reason for preempting the law would be solely for marketing purposes or to avoid competition, but would not be for any reasons that would justify the use of general conditions[25]. From this point of view, any such preemption would need to be included in a separately negotiated clause.

This would seem to indicate that the prohibition which proprietary licences tend to include with regard to altering the program[26] may violate the provisions of paragraph 1, article 100 of the IPL, in the sense that by law an authorized end user is permitted to adapt the software to meet his needs. The reality is that the end user does not usually have the technical knowledge required to perform any such alterations, but there is nothing to stop a user from running a second program on their computer that has been designed by a third party and which modifies the original program, thereby adapting it to the needs of the end user.

A program that alters an original program (commonly known as a patch or a service pack) could therefore be developed by a third party under the terms of either the first paragraph of art. 100 of the IPL or the fifth, which invalidates paragraphs a) and b) of article 99 of the IPL (reproduction and transformation) in order to allow programs to be produced that can interoperate with those protected by the above mentioned paragraphs. In most cases the new programs can be considered as a module that interoperates with the protected program, but even if this were not the case and we are talking about a mere patch, correction, or

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[22] US case law has developed a number of interesting ways of deciding whether a design is original or a copy of a program, which could be extrapolated to our European legislation. Perhaps the most interesting of these is to focus not only on the literal content of its source code but also on the various structures of logical functioning, data flow and storage, etc,... but ignoring known structures which are devoid of any originality in either of the two programs under comparison.

[23] "*a)The total or partial reproduction of a computer program by any means and in any form, whether permanent or temporary, even for personal use. When the loading, displaying, execution, transmission, or storage of a program requires it to be reproduced, permission from the rightsholder must be obtained; b) the translation, adaptation, arrangement or any other alteration of a computer program and the reproduction of the results thereof, without prejudice to the rights of the person who alters the computer program; c) Any form of public distribution including the rental of the original computer program or copies of that program."*

[24] These articles are not expected to be affected by the reform of the IPL which is currently being drafted in Parliament.

[25] In other words: if we forget for one moment the general conditions of the agreement, the corresponding transaction costs are not altered, because the only purpose of that clause is to fend off the competition, capture market share, or obtain a monetary gain from a right that legally does not exist, which, quite aside from any infringement of the Spanish Competition Law (LDC), is not very desirable from the viewpoint of any purely economic analysis of the law.

[26] As an example, the licence for a well-known suite of office software says "*Limitations on Reverse-Engineering, Decompilation, and Disassembly. You may not reverse-engineer, decompile, or disassemble the software product, except and only to the extent that such activity is expressly permitted by applicable law notwithstanding this limitation*". We will leave aside the ambiguous drafting which prohibits whatever is not allowed, thereby requiring the user to find out whether there is a law that allows him to do what he wants to, or rather, whether there is a law that prohibits the prohibitive agreement that this condition establishes, a condition that arises from the interpretation of articles 99.b and related articles 100.3 and 100.5 LPI.

[27] Note that, although Spanish law does not expressly provide for it, art. 5.1 of Directive 91/250/EEC, which forms the basis for the first exception of the Spanish IPL's art. 100, which states that *"Unless otherwise specified by contract, reproduction or alteration of a computer program, including the correction of errors, shall not require authorization by the owner of rights where those acts are necessary for the use of the computer program by the lawful user in accordance with its intended purpose"*

change[27] to the way the original program operates, it should be considered as a correction that can not only be made by any legitimate user, but may also be transferred by that user as a separate program from the original one with which it interoperates under the terms of paragraph 5 of art. 100 of the IPL.

In support of this theory is the fact that copyright law does not protect the ideas and principles underlying a computer program, only the expression of those ideas in code, and that a patch, fix, or functional add-on (insofar as they do not include the protected code but merely bring about a modification of that code on the user's computer) do not violate the economic rights of the holder under IPL.

b) Technical Anti-piracy Measures

In the light of this, we might well ask whether the technical anti-piracy measures incorporated in some software might not be illegal or at least represent an unlawful restriction on the rights of the user from which some kind of contractual liability might arise insofar as they seriously impinge upon the rights that article 100 grants to the end user. The reform of the Intellectual Property Law is being drafted as I write[28] and incorporates the international treaties ratified by Spain (and in particular Directive 2001/29/CE). However this does not mean that such measures will not be a way to bypass the limitations on software copyright.

The wording of point c) of art. 102 IPL is therefore surprising, as it considers to be in breach of the rights recognized in art. 99c "*any person who puts into circulation or possesses for commercial purposes any means the sole purpose of which is to facilitate the unauthorized removal or circumvention of any technical device used to protect a computer program*".

The sense of surprise persists even after we see that at the top of the article it says that the provision shall be applied "*without prejudice to the provisions of article 100*". The same apparent contradiction, which allows a program to be 'de-protected' while considering that anyone who has the technology and means to remove or circumvent the protection is infringing copyright, can be seen in the text of the Directive that these articles enact. But even more remarkable is art. 270, paragraph 3 of the Penal Code (PC) which states that "*The manufacture, distribution, and possession of any means the specific purpose of which is to facilitate the unauthorized removal or circumvention of any technical device that may have been used to protect computer programs shall also receive the same penalty* [a prison sentence of six months to two years or a fine of six to twenty-four months]"[29].

It should be noted that, as a rule, the technical means used to protect software are the same as those needed to remove the protection. Not only that, but even if that was not the case, the possession of these means is necessary to be able to exercise the rights granted by art. 100 of the IPL. Without the PC provision, it would be possible to try to defend an interpretation which turned the burden of proof and, once possession of the technical means were proven, presuming that the infringement had taken place.

However, criminal legal practice seems to be tidier and more respectful of other principles such as the presumption of innocence than the unfortunate drafting of the above mentioned law[30], and requires that the technical means can be used *solely and exclusively* for the purposes intended[31].

This contradiction needs to be resolved by means of legal interpretation, an interpretation that should not be too different from that afforded by the Penal Code.

One possible interpretation is to understand that the (civil) infringement, in breach of paragraph c) of art. 102 of the IPL, occurs when a person possesses or puts into circulation a tool that is specifically designed for the unauthorized removal or circumvention of technical devices protecting software. However, in practice that would be tantamount to preventing the application of the article and would reduce the scope of its application to hypothetical cases only, since the existence of such a tool specifically designed *only* for unauthorized circumventions is practically inconceivable[32].

I am therefore of the opinion that the above interpretation faithfully reflects the content of the legal presumption that the law in question contains, once the commercial intent of possession is proven. Therefore, mere possession does not imply infringement. For there to be an infringement there must be evidence of the commercial or for-profit purpose of possession, in which case the alleged infringer will have to prove that possession or distribution of the tool was for a legitimate purpose. Therefore "sole use" should refer to the only use that the alleged infringer makes of the tool, not that it is the only possible use of the tool from an objective viewpoint.

3 Minimum Content of Licences

From the standpoint that licences are part of an agreement and not a mere instance of copyright, we should not forget the obligations that contracts carry, as set out in art.

[28] Its latest publication reflects the amendments approved by the Senate: BOCG (Official Gazette of the General Courts) *Congreso de los Diputados* (House of Representatives) number A-44-17 of June 9, 2006, <http://www.congreso.es/public_oficiales/L8/CONG/BOCG/A/A_044-17.PDF>.

[29] The Spanish Penal Code is available, in Spanish, at <http://www.juridicas.com/base_datos/Penal/lo10-1995.html>.

[30] See the ruling of the Barcelona Criminal Court no. 8, of 19-2-2002, <http://www.bufetalmeida.com/sentencias/sentencias.html>. The Attorney General's Office confirmed this ruling in its Circular 1/2006.

[31] See Circular 1/2006 of the Spanish General Attorney's Office, available at <http://www.fiscalia.org>.

[32] J. Delgado Echevarría. "Article 102", *Comentarios a la Ley de Propiedad Intelectual*, 2nd edition, Tecnos, Madrid, 1997, pp 1512-1518, v. pp 1514 ff.

1258 of the Civil Code. This article requires consumers to be advised of their rights and, in particular, provides that the duty of information should extend to the limitations to economic rights specified in art. 100 of the IPL.

From the perspective of the IPL, the minimum content of a EULA (End User Licence Agreement) would seem to be the use of the program, which should include authorization to store it temporarily (in RAM memory or disk cache) when the loading, displaying, execution, transmission, or storage of a program requires such reproduction (art. 99 a), which is the normal way a computer program works[33]. The licence should specify the period of time for which use is authorized and, in the absence of any such indication, use is assumed to be authorized for ever (sale), and to determine which of the types of economic rights set out in article 99 of the IPL are transferred. Finally, the licence should state whether it is free or requires the payment of a price or fee.

*Translation by **Steve Turpin***

[33] Once the reform of the IPL which is currently being drafted in Spainsh Parliament is in force, such authorization will be assumed to be granted automatically, unless otherwise agreed, under the new wording of article 31.1.

Some Legal Reflections on The Use of *Libre* Software Licences in Public Administration

Luis Fajardo-Spínola and Luis Fajardo-López

The internal workings of public administrations (PAs) and the development of what we know as e-government require the use of new technologies, and in particular information technology (IT), to an ever greater extent. The technical solutions used to meet these needs are not only of a scientific nature, but may go as far as to impinge upon the principles underlying the way public administrations function. Thus not all technological solutions are equally acceptable from a legal point of view. This article describes the principles that, in the authors' opinion, the Government should apply with regard to the public acquisition of IT goods and services, the electronic relationship it has with its citizens, and access to civil services. It concludes by proposing that the source code of programs acquired by PAs should be made available to them, and recommends the use of open source code and the adoption of open standards in communications with citizens, operating under principles of technological neutrality and interoperability. Compliance with these principles is subject to the control of the courts.

Keywords: Access to Civil Service, Availability of Source Code, Guiding Principles of Public Administration, Interoperability, Open Standards, Procurement of IT Goods and Services, Technological Neutrality,.

1 Introduction

These brief legal reflections on software licences and public administration, and more specifically on so-called *libre* licences, aim first of all to identify the areas of public administrations (PAs) in which computer programs are the object of legal relationships. This issue may be approached in many ways as government and computing interconnect on a large number of fronts. PAs are offering an ever increasing range of computer based services to their citizens: documents[1] and programs[2] are made available electronically, and computing resources are placed at the service of administrative procedures[3], which is another way to build a bridge between citizens and government. If all citizens are to have access to e-government, a number of different technological options need to be considered so as not to benefit one set of citizens over another with regard to either access to information (standardization of formats) or participation in administrative procedures and services (multiplatform software). In this article, however, we are

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only going to look at the matter of government procurement of the goods required to implement e-government (i.e. software and hardware) and the impact that information technologies (IT) has on the selection of civil servants. We will close by looking at the regulatory role played by government in the new technologies market, with a view to seeing whether it is advisable, or indeed possible, for government to play a more active role in these policies.

However, before addressing these issues we need to take at least a brief look at these basic principles that government should abide by in all its workings, but particularly when using information technology. Even when empowered to act discretionally, in fact especially in these cases, PAs should respect the principles underlying governmental activity and justify their resolutions on the basis of those principles. In other words, the actions of PAs must never be based on the whim of the decision maker, nor on criteria other than those legally established.

2 Basic Legal Principles

But what are these legally established principles in the Western world? What regulations are they enshrined in? For instance, the Spanish Constitution guarantees the Rule of Law (art. 1), which for our purposes means that the Government is subject "*to the Constitution and all other legal provisions*" (art. 9.1), guaranteeing, among other principles "*the principle of legality, the hierarchy of legal provisions*" and "*and the prohibition of arbitrary action of public authorities*" (art. 9.3). More specifically, public authorities are to take a proactive stance to "*promote conditions ensuring that the freedom and equality of individuals and of the groups to which they belong are real and effective; to remove the obstacles preventing or hindering their full enjoyment, and to facilitate the participation of all citizens in political, economic, cultural and social life*" (art. 9.2); in short, PAs *shall serve the general interests in a spirit of objectivity* (art. 103.1). The Spanish Constitution contains a number of articles that establish the duties and obligations of public authorities, among which are that they: "*shall promote and watch over access to culture…[and] promote science and technical research for the benefit of the general interest*" (art. 44); "*shall guarantee the preservation and promote the enrichment of the historical, cultural and artistic heritage of the peoples of Spain and of the property of which it consists*" (art. 46); "*shall promote conditions for the free and effective participation of young people in political, social, economic and cultural development*" (art. 48); "*shall carry out a policy of preventive care, treatment, rehabilitation, quality of life and integration of the physically, sensorially and mentally handicapped*" (art. 49); "*shall guarantee the protection of consumers and users, and, by means of effective measures, safeguard their safety, health and legitimate economic interests* ", "*promote [their] information and [...] education*", for which "*the law shall regulate domestic trade and the system of licensing commercial products*" (art. 51). Public authorities are also bound to act in accordance with the principle of equality and non-discrimination (art. 14), and respect the fundamental right to personal privacy and the secrecy of communications, for which "*the law shall restrict the use of data processing in order to guarantee the honour and personal and family privacy of citizens and the full exercise of their rights" (art. 18).* Another fundamental right is the right to *"obtain effective protection from the judges and the courts in the exercise of their rights and legitimate interests"(art. 24)*

All these principles need to be taken into account by PAs with regard to information technology which, while it is undoubtedly beneficial to citizens, it is also potentially detrimental to their fundamental rights. For the purposes of this paper, these principles are embodied in Law 30/1992 on the Legal Regime of Public Administrations and Common Administrative Procedure (published in BOE, Spain's Official State Gazette, of November 27), available at <http://www.juridicas.com/base_datos/Admin/l30-1992.html>, and in the Consolidated Text of the Law on Public Contracts (approved by Royal Legislative Decree 2/2000 of June 16, published in the BOE of June 21), available at <http://www.juridicas.com/base_datos/Admin/rdleg2-2000.html>. The same principles are also referred to, with regard to civil servants, in Law 30/1984, of August 2, on Civil Service Reform Measures, available at <http://juridicas.com/base_datos/Admin/l30-1984.html>, which, together with the various civil service laws at Autonomous Community level and the old Civil Servants Law (*Ley de Funcionarios Civiles del Estado*), make up the basic legislation regulating access to the civil service. Now let us take a look at the basic content of the above legislation insofar as it affects the procurement of goods and services, and access to the civil service.

2.1 Application of The Abovementioned Basic Principles to Public Procurement, And Peculiarities of The Procurement System

It is not normal for the PAs themselves to produce the software and hardware they need to perform services within their area of competence. Instead they tend to acquire them on the open market, through the public procurement of goods and services. Basic legislation governing public procurement provides for the use of one of two public procurement

[1] For example: official gazettes such as <http://boe.es>, <http://www.gobcan.es/boc>, municipal information such as <http://www.munimadrid.es> and <http://www.cabtfe.es/>, or educational institutions (<http://www.eull.es>, <http://www.uam.es) and independent authorities (<http://www.aena.es). It is unusual nowadays for an entity not to provide information electronically.

[2] The PADRE program of the AEAT (Spanish Tax Agency) which helps citizens file their income tax returns is a good example.

[3] For example: the online filing of applications for grants and subsidies, the online filing of tax returns, online access to property and mercantile registers, or the cadastral register. In short, what is known as e-government, a prime example of which is the recently launched Portal 060, <http://www.060.es/>.

models depending on the nature of the transaction envisaged for the procurement of IT goods. Thus, for the acquisition of equipment or software that is already manufactured/produced and available on the market, or data processing systems, and for the maintenance of such equipment (and of data processing systems and all their devices *and programs* when such maintenance is contracted as part and parcel of the original acquisition or leasing), a supply contract is required (art. 172 TRLCAP[4]). However, to contract the production of bespoke software a service contract is used (196.3.d. TRLCAP).

The way IT related transactions are treated under two different contractual regimes does, however, need some serious consideration if we are to prevent decision makers from choosing one regime over another simply by including certain equipment or systems. As we understand it, the inclusion of the maintenance of programs in point 3 of article 172 refers to any maintenance required for the equipment to perform in accordance with the use specified in the contract (for example, drivers, at the very least) but may also include management programs if the device should need one for it to serve the purpose for which it was acquired (for example, the management program of a telephone exchange, when the software and hardware are sold together).

With regard to the acquisition of bespoke software, once the work or service has been performed, the resulting programs can still be used by the public authority: "*they shall be free to be used by the [public administration]*" (196.3.d. TRLCAP). Elementary logic dictates that PAs cannot finance the development of a product and then pay to use it. It would be another matter if Pay Per Use were to be negotiated directly, but then we would not be talking about a bespoke software acquisition contract. Given that the bespoke software is acquired by the PA, would it not also acquire the economic rights over that software? Would acquisition extend to the application's source code? Although these two issues could be the subject of an agreement between the two parties, if no such agreement exists the PAs will acquire the right to use the program, with the possibility of altering it in the future. A correct reading of the article in question would involve the bespoke program's source code being handed over to the public authority. In some cases the public administration could even be considered to be the author of the program: for example, if (as set forth in Royal Legislative Decree 1/1996, of April 12, approving the Consolidated Text of the Intellectual Property Law, LPI, <http://inicia.es/of/tip/LPI.doc>) the program is produced by (salaried) staff in its employ (article 97.4 LPI), or if it publishes and distributes software that was produced by a third party (art. 97.2 LPI)[5]. In any other situations, the public authority will not be considered to be the author, nor will it hold economic rights over the work. What it will hold, whatever the situation, are the rights (present and future) to use the software internally[6]. If this were not the case, we would have the paradoxical situation in which the public administration would pay for the development of a program, but could not put it to any use other than the one originally agreed on, in spite of having tacitly financed other companies producing similar products, since the product could compete freely on the market. However, the most dangerous aspect of this extended interpretation is the fact that the source code is not made available to the administration, in spite of it having paid to have the software produced, which means having to start from scratch every time an adaptation or improvement is required, or to continue working with the same company or supplier, with the subsequent restriction to free competition and the use of public bids. In this respect, article 196.3.d) TRLCAP is insufficient as it only provides that bespoke software "*shall be free to be used by the [public administration]"* but it fails to regulate the scope of that availability, and does not deal with the issue of having access to the source code. For this reason we believe that if the law is to be interpreted in such a way as to be coherent with the principles governing public procurement, any bespoke software commissioned by the public administration should automatically include access to the source code, unless otherwise agreed.

Availability of the source code is especially necessary for PAs using IT resources, since they are responsible for safeguarding, with even greater diligence than private individuals, rights such as the secrecy of communications or personal privacy, particularly regarding information requiring special protection under the Personal Data Protection Act (Spanish acronym: LOPD <http://www.proteccion-datos.com.es/law.htm>). Data handled by PAs is, to a greater or lesser extent, of the type considered by the LOPD as meriting a high level of protection. It is difficult to audit and ensure the integrity, security, and maintenance of that data within the environment in which it has to be used to serve its purpose, if the software processing it is not transparent (in other words, if the source code is not available) And the more sensitive the data to be processed is, the more

4 TRLCAP, Spanish acronym for Consolidated Text of the Law on Public Contracts, Legislative Decree 2/2000 of June 16, <http://www.juridicas.com/base_datos/Admin/rdleg2-2000.html>.

5 If the work is produced collectively (which is almost always the case), this article attributes authorship to the person (natural or legal) who publishes and distributes it under their name. Also note that a commission to produce software is not a publishing contract (art. 59.2), although its exact nature is not clearly explained in the Law.

6 There is, perhaps, one exception when, in the absence of any agreement to the contrary, the PA is not considered as the author of a program under article 97 LPI, but can still be considered as having the exclusive right to use that program. This is when a program is commissioned by the PA to meet a certain need that would not be satisfied if the program were to be distributed outside the public authority that commissioned it, and when this circumstance were known by the contractor when the procurement contract was drawn up (e.g. programs that compromise national security).

important it is to have access to the source code. If, besides privacy, we also consider the need for secrecy in specific situations due to the nature of the process (police, justice, foreign policy, defence,... and many more), the principle of effectiveness underlines the need for functional transparency. Therefore, we can conclude by saying that knowing how the software works and being able to check it and audit it, although it may not always be possible within the current legal framework governing public contracts, is at the very least highly recommendable[7].

The above recommendation could be implemented by the source code being deposited by companies who would keep the code secret as far as the market were concerned but would allow government technicians access to it, or provide access to third party auditors chosen by the government, who could check whether it serves the purpose for which it is intended. However, a much better solution would be the ongoing audit that society as a whole (in fact, a global community) subjects to open code, or open source, software. The code of these programs is public knowledge, which makes them especially transparent. As all *libre* software, or *free software*[8], is open code, it is also transparent in nature. The use of open code, at least open for the government (either by means of escrow contracts, or encryption, or direct access to the code) is therefore advisable for all programs used by public administrations. "*Libre* software" certainly fits the bill, but it is not the only type of software to do so. Proprietary programs could also meet the security conditions required by PAs, either by providing the corresponding legal guarantees or by disclosing ('opening') the code.

2.2 Its Application in The Access to Civil Service and Peculiarities of The Staffing System

Apart from software and hardware, public authorities also require staff, tenured or otherwise, to be able to carry out their competences. Nearly all of them will, to a greater or lesser extent, require computer skills to be able to do their jobs, and some will need specific training and experience in the use of computer systems. The relationship between the method of recruiting this kind of staff and the link to a particular technology or commercial brand of IT products merits a brief comment in this paper.

It is an undeniable fact that when defining requirements for candidates' level of training or skill in IT, most civil service entrance tests refer to specific brands of hardware and software. This practice almost always flies in the face of the principles of free and equal access that underly community and state legislation on public procurement. The consequence is extremely serious, as it leads to a situation whereby these brands enjoy an authentic monopoly in the civil service in Spain. The official exam syllabus should also apply the principle of technological neutrality, and it would also be a good idea to take this into account in the syllabuses to be followed by our IT technicians and engineers.

3 The Role of Public Administrationss with Regard to The Technological Market

Finally, we should also take the technological neutrality of PAs into account with regard to their interaction with the information technology market. For the last four years, community legislation (Directive 2002/21 CE[9]) has required public authorities to be technologically neutral, while recommending them to adopt and promote standards ensuring interoperability[10]. However, any close look at the current state of affairs will reveal that this requirement is not being met by Spanish PAs. The commercial monopoly of IT products used by public authorities is not only ill-advised from the point of view of the transparency of the enormous databases being created, but also contravenes state and community legislation on the subject.

*Translation by **Steve Turpin***

[7] This opinion is echoed in a report from the Spain's *Consejo Superior de Administración Electrónica* (Higher Council on e-Government) entitled "Proposal for recommendations to the General State Administration on the use of free and open source software", available in Spanish at <http://www.csi.map.es/csi/pg5s44.htm>.

[8] Obviously not used here in the sense of "at no cost", but in the sense of freedom to reuse; i.e. in the sense of the concept often referred to as *copyleft*.

[9] Directive of the European Parliament and of the Council of March 7, 2002, on a common regulatory framework for electronic communications networks and services (OJEU no. 108 of April, 24 2002, pp 33 to 50, <http://europa.eu.int/eur-lex/pri/en/oj/dat/2002/l_108/l_10820020424en00330050.pdf>.

[10] To mention only the most recent examples, Decision 2004/387/EC of the European Parliament and of the Council of April 21, 2004, on the interoperable delivery of pan-European e-Government services to public administrations, businesses and citizens (IDABC), <http://ec.europa.eu/idabc/servlets/Doc?id=1891>; and, more recently, Commission Communication of February 13, (COM (2006) 45 final), <http://ec.europa.eu/idabc/servlets/Doc?id=24117>.

Free Software in Extremadura, The History of Some Good Reasons

Luis Millán-Vázquez de Miguel

The Spanish region of Extremadura launched in the early 90' a pioneering initiative for modernization with the purpose of facilitating the transit towards the "Information Society" that was emerging at that time. Having as its main objectives universalization, connectivity, technological literacy and free knowledge, the Regional Government of Extremadura (Junta de Extremadura, *in Spanish*) *has achieved through this initiative a high level of technological development, recognised worldwide, becoming the first region in Spain that has developed its own free software distribution, known as gnuLinEX, that is being widely used by all the socio-economic players; Extremadura is also the only Spanish region that has full broadband coverage all over its territory.*

Keywords: Connectivity, Extremadura, Free Knowledge, Free Software, Gnulinex, Imagination Society, Information Society, Knowledge Society, Technological Literacy.

1 Introduction

We are often asked why the Regional Government (*Junta de Extremadura*, in Spanish) of the Spanish territory of Extremadura chose free software as a technological tool for the projects we are promoting. This short article intends to explain most of the good reasons on which the decision was based, and which are enabling us to be in the forefront of a revolution which many thought was beyond the reach of a region like ours.

From the beginning of civilization, the philosophy of free knowledge has been proven to be the most effective way to develop culture. History has proven that on many occasions that when for whatever reason there are limitations to free knowledge, these restrictions have always meant a step backwards in the harmonic development of human beings. While times of freedom, crossbreeding and free knowledge have always led to advances and development.

The Free Software Foundation, <http://www.fsf.org>, states that a computer program is free when it can be executed, copied, distributed, studied, modified and improved without restrictions of any sort. This is the type of software defended by the *Junta de Extremadura*; this is gnuLinEx, presented under the slogan: "*Be legal, copy gnuLinEx*". The underlying concept being a defence of free knowledge.

Software is what it is; knowledge, a product of human intelligence. We believe that an algorithm, a few lines of programming, are never the product of a single individual and therefore, nobody can claim it as exclusive property, because even if this could benefit the individual, it will not benefit the human race that has not asked for anything in compensation for the numbers and knowledge that lie behind the software they believe to be their own and without which it could not have been designed.

2 The Information Society

This philosophy of free knowledge is based on a series of objectives that have motivated the policies of the *Junta de Extremadura* since the early 1990s. Our Information Society policies have been considered part of development policies in general and technological development in particular. In fact they are an integral part of the research and technological development strategy for the region.

Our information society policy is seen as a process and not an end in itself. A process that intends to reach other objectives, beyond the democratic access to information.

In the early 1990s, Extremadura began an ambitious regional development project, based on adapting the academic and research facilities of the *Universidad of Extremadura* to a new century characterised by the technological revolution. To consolidate this process, a series of technological centres were opened in the mid-90s to attend the field of

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greatest interest for the economy of Extremadura. FUNDECYT (Foundation for the development of Science and Technology in Extremadura, <http://www.fundecyt.es>) was created as a structure to generate synergies as an 'interface' between the science and technology system and socio-economic development. We intended to facilitate the transfer of knowledge from the University and technological centres to citizens, companies and the Administration.

As a part of this process for the creation of a science and technology system adapted to our needs, the regional government decided to prioritize action in the field of the Information Society, within the framework of European initiatives for regional development, aware of the urgent need for action, to avoid future exclusion of citizens or social sectors. And this is when we began the more specific work on the information society, addressing the problems of the time, but without losing sight of the key objectives established for this regional development model.

One must remember that in 1995, the greatest problem of Extremadura in this field was the evident risk that most small villages in rural areas could be excluded from the so-called "information highways."

Accordingly, connectivity (the right of all citizens to access networks) and technological literacy (the right of all citizens to enjoy the possibilities offered by new technologies) were the two basic objectives we wished to guarantee.

Having reached this conclusion, it is necessary to highlight that a fundamental factor for the success of our strategy was, and still is, the political promotion of the project by the President of the *Junta de Extremadura*, making a top-priority strategic issue something that in most organisations is still considered as an instrumental element.

In 1999 we started work on the main problem, which was connectivity. This revolution would be interesting for Extremadura if nobody was left out and everyone had the possibility to take advantage of it. The regional Intranet proved that it was no pipe-dream to be able to get broadband to the every village in the region, where in addition to schools, it could be subscribed to by any private individual.

Today, anyone in Extremadura, wherever they may live, can subscribe to broadband access as a private individual or a company, thanks to the efforts of the Regional Government of Extremadura, specifying universal rural broadband access, which guarantees all citizens in Extremadura, regardless of where they live or work, access to the web, both in the public and private spheres, by subscribing to the services offered by the operators in the market.

It could be said that connectivity has achieved the first phase; that of the Information Society, the desktop full of documents, reference material and books, with a high entropy. Anyone can access information, but this is one phase in a process, which by itself will not achieve deep social transformation. It doubtlessly opens up possibilities that were inconceivable before, but this was not the only goal.

2 The Knowledge Society

We needed a second phase, which is the Knowledge Ssociety, the transformation of information into knowledge and its use when shared with others. A process of socialisation of knowledge. This second phase is exemplified by our own free software distribution, gnuLinEx.

What is the use of having access to all the information if we continue doing the same things? We will only be able to progress if we turn information into knowledge.

And this is what we did. We saw that people with a good knowledge of on-line software resources obtained very high quality programs from the Internet in a completely legal manner and without being subject to licences, limitations and restrictions imposed by software manufacturers.

Therefore, the free software alternative existed and was very solid, but its social acceptance (its socialisation) was very limited because few people had the necessary computer knowledge to make use of this option.

The question was clear, why not collect all this knowledge (free software) and turn it into a tool that can be used by anyone?

This was the beginning of a new stage. The table was still full of documents, reference material and books, but they begin to be grouped and sorted and we are able to obtain greater knowledge from them, enabling some things, properly organised, to do one job and others to do other jobs. The knowledge obtained from the information was enabling us to do what we needed to do in an efficient manner and with the best results.

And here came the question we have been asked so often: why did you choose free software? The answer is simple and clear: for civility and to comply with the law.

In Spain the law demands Public Administrations to be efficient, i.e., to provide services and invest in the best products, at the best price. If an administration can obtain a product absolutely free and can adapt and distribute it to citizens without any limitations, it is inconceivable for that administration "*to pay for a licence to use a similar product*", without knowing when they will have to pay for a

[1] Spain's Ministry for Public Administrations, Higher Council for e-Government. *Propuesta de recomendaciones a la Administración General del Estado sobre Utillización del software libre y de fuentes abiertas* (Proposal for recommending the General State Administration on the use of free software and open source programs) Ministry for Public Administrations, Madrid, 2005. NIPO: 326-05-044-3. Available, in Spanish, at <http://www.csi.map.es/csi/pdf/Recomendaciones_ swl_200505_final.pdf>.

[2] Report by the Court of Auditors on the analysis of the effectiveness of the RHODAS project. Publication of the resolution in the *Boletín Oficial del Estado* (Spain's Official State Gazette), <http://www.boe.es/boe/dias/2005-11-29/pdfs/A39174-39174.pdf>; full text, in Spanish, available at <http://www.hispalinux.es/informes/tribunal_cuentas_rhodas.pdf>.

new licence, and forcing its citizens to use this same company if they wish to access public services.

Any doubts that may exist about the legal basis of free software, are be answered in the survey undertaken by computer professionals from the Central Administration on free software, contained in a report written by the Spanish *Consejo Superior de Administración Electrónica* (Higher Council for e-Government)[1]. In response to the demands of general interest, effectiveness and efficiency, transparency, security, preservation, accessibility, standardisation and interoperability, language modes, intellectual property and patents and subscriptions, the questions to be asked are how is it possible for administrations to continue being subject to excesses of licensing contracts for proprietary software? What sort of self-respecting public service can place the mechanisms used in its services in the exclusive hands of one company?

In any case, the Junta de Extremadura has not been excessively concerned with passing regulations and limitations since we understand that the application of the State Contract Law (*Ley de Contratos del Estado*) requires the software used by Public Administrations to be free, in the FSF sense, and this has been reported by the *Tribunal de Cuentas* (Court of Auditors)[2] on the understanding that it is more important for Public Administrations to legislate on the establishment of standards and regulations for inter-operability to guarantee citizen's equal access to information.

For civility, the proprietary software model left us with the role (in Extremadura and elsewhere) of mere intermediaries for technology created by others which we could only consume without complaining. Free software is enabling us to create a small and modest technology sector which will probably not concern any software giant but will at least enable some of our people to earn their living from this sector creating in addition a model for sustainable and joint development which we are proud of.

Having reached this point, I am constantly amazed that, on issues referring to the Information Society, many politicians defend and explain their decisions with technical reasoning while many technicians also pontificate on political questions.

The case is that many people accept that one businessman can tell everyone on the planet how they must communicate and access information, event if their proposal is preposterously totalitarian and nobody has the ability to demand that all programs for public services should be absolutely transparent and all information flows should respond to the will of the people in charge of the institution and not the secret whims of developers.

If we have learnt one thing with gnuLinEx experience, this has been not to be afraid. We know it is not indispensable for others to decide for us and we are willing to exercise our responsibility, only requesting respect from the rest of the people.

There are many well-intentioned individuals, probably victims of their own ignorance, who offer us explanations and justifications for our decisions in respect of free software when it seems more logical that those who are paying for licences should be the ones justifying what that are doing, why they are submitting to clearly abusive requirements and why are they abandoning their responsibilities with reference to efficiency in public spending.

I think it is necessary to abandon the hypocrisy that forms part of the debates. We do not know whose interests are being protected by those who defend proprietary software and nobody asks them, but those who defend free software and know what we are doing, are asked and required to give justifications.

The option created by free software, which enables the participation of our small companies and their workers, independently from other reasons of continental politics, is very important for us. We would also like to ask those who fervently defend proprietary software, giving reasons such as the wealth it generates in Spain, to explain how and who is affected by this. I am sure we would be very surprised**.**

Therefore, I insist that it is necessary to abandon hypocrisy. The proprietary software model works because there is a large amount of pirated software installed on computers. Only the unavoidable purchases of the Administration and pre-installed software agreements when buying a new computer sustain a market where almost nothing is what it seems, and where many look for confusion and permit some things and not others. This is creating general uncertainty where nobody dares to demand security, transparency and guarantees, because almost everyone has the sensation of being a delinquent taking advantage of the situation.

It is very difficult to sustain a strategic sector based on these moral foundations.

3 Free Software in Practice: gnuLinEX.

When we made the decision to incorporate free software into the educational system in Extremadura, apart from the advantages which have been explained so many times, we were also aware of the fact that it would be impossible for the education Administration to control and guarantee the legality of all the software that any user decided to install on any of the thousands of computers we were going to install in school classrooms. To have the sensation of being accomplices in piracy and to assume that our users would also be was something which we were not willing to tolerate.

Extremadura was the first region in Spain to develop a distribution of free software – gnuLinEx. This software enabled the daily operations of more than 70,000 computers in the educational system and those being installed in health centres and hospitals under the *Proyecto Jara* with the aim of transforming the information systems of public health in Extremadura.

The best acknowledgment we receive is to realise every day that this is not a dream, that we can be the owners of our development and advancement tools. Every day our teachers, doctors and business people can face this globalized and demanding information society without any complications, with our own resources and the talent of our

people. This is without doubt the best acknowledgment.

However, in addition to this daily acknowledgment, we have received about thirty formal acknowledgments in the Information Society field, of which I would like to highlight the European Award for Regional Innovation, granted to Extremadura by the European Commission within the framework of the European Regional Programme for Innovative Actions, for the gnuLinEx Project. And the Ramón Llull Spanish Computer Prize awarding the Junta de Extremadura for its experience in the use and promotion of free software.

Despite the fact that many do not have confidence in the possibilities of free software, the support received encourages us to continue on this route. Free software enables us to place solid, safe and totally legal technological tools in the hands of citizens. Thus people can buy cheaper computers if they have free software pre-installed instead of proprietary software, with the additional knowledge that thousands of applications can be downloaded from the Web without any legal limitations. They can avoid the devastating effects of viruses and they can access the source code of the programs and adapt them to their needs. All of this without being accused of piracy or harming anyone.

From my point of view, the greatest advantage is to be able to influence the development of technology.

Let me explain myself, there is a very popular "preposterous idea", which neither philosophers, scientists or politicians seem to question, by which the perfect model to access universal information is one which is the same for all, i.e., the human race connected through a single system and with a single point of view... ... It's crazy! Isn't it?

Well, almost everyone accepts this uncritically and there is at least little public criticism. In contrast to this model, free software not only enables everyone to adapt their model for accessing universal information, but they can also help - as a user, transmitting their problems or needs to programmers - in the development and improvement of software. Many of our teachers do this every day, contacting our developers and others all over the world. The teachers transmit their needs and the developers improve and adapt the software, to the point that today we have versions of gnuLinEx adapted to every educational level: pre-school, the two stages in primary school and secondary school. Some may not see the value of this possibility, but for us who have always suffered the decisions of others, to be able to make our own decisions is worth a great deal.

For all these reasons, although there may well be technical reasons in favour of choosing proprietary software, there are ethical and political reasons that lead us to defend the opposite. It is not only a question of cost, but also a question of security and transparency.

It is indispensable for Public Administrations to collaborate and make the most of our investments, which are very similar in different institutions, instead of competing among ourselves.

There is a real demand in society for policies promoting these kinds of applications and there is ever more awareness of the need to promote actions to disseminate the advantages of open standards. Apart from the initiative in Extremadura, there are 132 free software user groups in Spain, 142 town councils and public organisations acknowledging their use, 622 educational centres all over the country have incorporated it into their systems with pedagogical or administrative aims, and 458 companies provide technical support for users. A year ago, the companies offering this kind of service hardly amounted to 60 in the whole country. These figures speak for themselves. The free software alternative is very quickly gaining a foothold in Spanish society.

When anybody doubts the reliability of free software, one should ask: what is the reliability of a computer system that can easily be attacked by viruses, that does not offer security, that does not adapt to the user's needs, but rather to the interests of the developer? Despite these facts, those in charge of public and private organisations are willing to pay, while other control the keys of the programs where they handle their most sensitive information, without complaining. We, at least can guarantee that the educational system in Extremadura has more than 70,000 computers networked with broadband Internet access working under gnuLinEx without having to stop for even a moment for any of the above-mentioned technical reasons.

Information and communication technologies are evolving at a rate never seen by any human invention up to now. What have we achieved by riding this wave? To do our daily work without depending on others and the knowledge that we can continue developing things, without having to pay for it and without having to ask anyone's permission. What more reliability could we wish for?

As a general conclusion, we understand that the problems we faced in the mid-1990s, referring to infrastructures, have begun to be eliminated, but once this hurdle is overcome, the next great problem or challenge appears: Where are we at this moment?

4 The Imagination Society

And this is the third phase, following the stages described above. After the Knowledge Society and based upon the foundations of the Information Society, the future will be defined by the Imagination Society. The confluence of knowledge and technology requires the concourse of creativity to give new fruits, responding to new social and economic realities we are immersed in.

We have observed that innovation policies still respond to an idea of modernisation that corresponds to the old industrial production lines, and what is offered is above all financial resources for infrastructures, when innovation can be the result of a visit to a place where things are done differently, the incorporation of an atypical professional profile within a business structure, the development of a project without signs of immediate profitability or an imaginative solution to the situations created by new ways of living derived from the technological revolution.

We understand that it is necessary to turn the informa-

tion society into a knowledge society as soon as possible so that we can place ourselves on the starting line of the coming imaginative society as soon as possible if we wish to find the answers to problems of the future which are likely to be very different to those in our past.

An undertaking which we will have to obtain from the administrations is to bestow social prestige upon creative people and to facilitate the citizens' development of their own creative qualities, not only by financing and supporting projects (which is indispensable) but, above all, promoting social acceptance of the fruits of the imagination.

To carry on doing the same things we did before makes all the effort invested in accessing and learning to use technology of little use. It is therefore as important to change society as it is to use technology itself.

However, to achieve this transformation it is necessary to involve creativity and entrepreneurs in transforming society. It is necessary to increase our efforts in avoiding innovation policies becoming the back door to indirectly financing declining sectors and by supporting initiatives which enable real progress and transformation. We understand that this comes by way of promoting creativity and fully developing the Society of Information, Knowledge and Imagination.

Note from The Editor of UPGRADE

At the time of going to press we have just received news that the Extremadura Regional Government has decided to use open formats for the documentation it generates and to equip its civil servants and staff with free software office automation tools. Further information, in Spanish, is available at <http://www.ati.es/article.php3?id_article=443>.

Creative Commons: Open Content Licenses to Govern Creative Works

Melanie Dulong de Rosnay

Creative Commons provides a user-friendly copyright interface to a broad public. Offering tools to encourage sharing and creativity by lowering transaction costs, Creative Commons model raises legal and practical questions regarding copyleft licenses and the development of open content-based business models.

Keywords: Creative Commons, Legal Aspects, Open Content Licenses, Practical Aspects.

1 Introduction

Creative Commons (CC, <http://www.creativecommons.org>) provides licensing tools to assist creators in publishing their work under flexible terms which are more generous for the public than the traditional copyright "all rights reserved" approach. Inspired from the GNU-GPL license (General Public License), CC proposes a copyleft license for non-software intellectual and artistic works, as well as several more restrictive licenses allowing for instance creators to reserve commercial exploitation and derivative works. The article discusses the rationale and the consequences to use terms that are more restrictive than sole copyleft and more generous than minimal copyright.

2 The Expression of Additional Freedoms

CC was founded in reaction to legislation[1] and US Supreme Court decision[2], while the GNU-GPL software license was written in reaction to restrictive End-User License Agreements (EULAS). Both licensing models are based on copyright and are intend to propose a balanced alternative to excessive solutions enforced in intellectual property.

CC tools provide several pragmatic licensing options to be freely combined by creators, empowering them to decide and express their exclusive rights directly to the public.

Some CC licenses do not match with required conditions defined for software by the Free Software Definition or the Open Source Definition[3]. These options (Derivative Nations, Public Domain dedication, Sampling suite), not so widely used according to CC licenses adoption statistics[4], express additional conditions to the core freedoms granted by the 6 generic licenses combining 3 optional elements (Non Commercial: NC, Non Derivative: ND, Share Alike or Copyleft: SA). The 6 generic licenses[6] are easy to explain and understand: a royalty free permission to use the original work for non commercial purposes, with original author attribution (BY) and without modification, from which progressive additional freedoms can be granted according to the wish of the creators and to the work specific requirements: allow commercial use, allow derivative works and if yes, request the derivative work to be shared under the same generous conditions.

3 Semantic Web Integration

The added value of CC licensing scheme compared to other open content and copyleft licenses is the three layers model. Each license is automatically generated after choosing options on a cognitive user interface[7] delivering the license under three formats:

- a license in legal language,
- a human readable version, summary of the main clauses illustrated with icons, fostering legal language accessibility by the usage of simple sentences and a standardized semiotic,
- legal metadata in RDF (Resource Description Framework, <http://www.w3.org/RDF/>).

The machine-readable code format allows information retrieval and works data mining according to their legal reusability status. Google, <http://www.google.fr/advanced_search>, and Yahoo, <http://search.yahoo.com/web/advanced>, integrated this functionality in their search engine, making it possible to look for instance for works that can

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be used commercially. The usage of legal metadata facilitates the collection and identification of derivative works and samples on a common interface, <http://ccmixter.org/>.

4 Derivative Rights Reservation

The need for a Non Derivative (ND) option can be explained by the difference between some literary and artistic expressive works and functional software code (copyleft and open source requirements allow other developers to correct bugs, update, adapt and distribute the software).

Some artists may wish to enforce their moral right of integrity and be consulted before the publication of modifications of their work. They do not want their essay or poem to be distorted, or their music to illustrate a movie which esthetics or message they might not endorse. The integration of an integrity requirement or waiver in all CC licenses is under discussion in relation to authors' moral rights.

It shall not be deduced from the Non Derivative option that any substantial alteration is prohibited. Indeed, it is possible to ask prior authorization before distributing a derivative version of an original work through a regular copyright agreement. Some right holders make a creative use of this ND option: they systematically grant a royalty-free authorization to licensees asking permission to remix their work, but want to be notified of their work creative reuse. They would like CC licenses to not include an obligation to send to the original author a copy or a link to the derivative work for information.

Some CC licensors do not realize potential negative externalities of the Non Derivative clause. Having to request prior authorization can have a chilling effect on creation, maybe not for new works incorporating only one single CC-ND work, but in the case of works incorporating multiple prior contributions (encyclopedia, video game...). Retaining the right of modification can also prevent the possibility of voluntary translations of an informative text whereas it was not intended by the original author who just wished his purpose not to be distorted.

The Share Alike copyleft clause potential could be enhanced by an obligation to provide a link to the work source. Providing MIDI and .wav files for each track of a musical work facilitates the creation of cover versions and remixes.

5 Interoperability between Open Content Licenses

Alike to the incompatibility issue between formats, devices and technical protection measures, the proliferation of open content licenses prevent easy merging of contributions licensed under different licenses. For instance, CC material cannot be incorporated in Wikipedia GNU Free Documentation License (GFDL) pages without prior authorization, and some CC licenses text is not compatible with Debian Free Software Guidelines, <http://people.debian.org/~evan/ccsummary.html>.

Efforts are being made to reduce these issues and design compatibility clauses between CC BY-SA, GFDL and Free Art License (FAL). Issues to be solved are both political and technical. FAL terms, written in plain language, are more synthetic and contains less clauses than CC BY-SA. Different methods were proposed to study and try to solve incompatibility issues. On the one hand, a clause could be inserted in the CC BY-SA in the same way as the iCommons[5] compatibility clause, authorizing licensors to distribute derivative works under the terms of a CC BY-SA iCommons national version and also under FAL and GFDL. On the other hand, it is possible to list compatibility criterias, <http://wiki.artlibre.org/CriteresDeCompatibilite>, elements that are essential to guarantee the freedom of the work and must be reflected in a license to be accepted as compatible.

6 The Definition of Open Business Models

Free and open source software business models and reputation incentives enable developers and companies to make a profit when distributing royalty-free software by selling support and services. Open Content business models are emerging, <http://www.openbusiness.cc/>, proving that it is possible to make profit without enforcing full copyright reservation and requiring creators to give up control of their rights or works.

CC Non Commercial (NC) option leaves remuneration possibilities unspecified and enables to prospect creative business models to:

- associate a royalty-free NC distribution of a version of the work with the distribution of another version for a fee,

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[1] 505 Sonny Bono Copyright Term Extension Act, <http://en.wikipedia.org/wiki/Copyright_Term_Extension_Act>.

[2] Eldred v Ashcroft US Supreme Court case 537 U.S. 186, <http://en.wikipedia.org/wiki/Eldred_v._Ashcroft>.

[3] Several free software advocates and academics reproach CC to lack of a clearly defined political position or philosophy for the Commons: Benjamin Mako Hill, "Towards a Standard of Freedom: Creative Commons and the Free Software Movement»" 2005, <http://mako.cc/writing/toward_a_standard_of_freedom.html>; Niva Elkin-Koren, "What Contracts Can't Do: The Limits of Private Ordering in Facilitating a Creative Commons" . Fordham Law Review, Vol. 74, 2005, <http://ssrn.com/abstract=76090>.

[4] Statistics based on volatile search engines results are available at <http://wiki.creativecommons.org/License_statistics> and at <http://www.openbusiness.cc/cc_stat/>. They might reflect the number of webpages marked with CC metadata but not the actual number of CC licensed works.

[5] CC licenses are being adapted to national legislations by iCommons teams, as opposed to the GNU-GPL centralized version (see <http://creativecommons.org/worldwide/>).

- distribute a work under open access conditions only at the beginning or the end of the work's expected economic life-cycle,
- negotiate side contracts additional to the CC NC license for commercial uses (broadcasting on commercial TV, illustration of a movie...) after the work release, instead of having to specify commercial conditions in advance.

The development of innovative business models for works for which remuneration is traditionally collected through authors and performers organizations is impeded by the incompatibility between CC licensing terms and the contractual statutes of most non-US collecting societies. CS members have to assign most of their exclusive rights to these organizations and do not currently have the option to grant royalty-free licenses for some uses of some of their works. This situation is also compromising the effective remuneration of non-members releasing their works under CC-NC licenses in the case of compulsory collective rights management[6].

7 The Need for Legal Clinic Services to Accompany CC Licenses Users

Using an NC option postpones the drafting of a commercial agreement to the moment it may effectively occur, and saves the burden of prior authorization request, negotiation and granting for NC uses.

However, questions sent by CC potential licensors to CC international teams confirm that CC licenses do not contribute to the decrease of all transaction and information costs, but rather just postpone some of them.

The burden of defining who is allowed (who are the rights holders) to license which work (or website subpart) under which CC license, is carried by the non-lawyer author, editor or producer. It is difficult for creators to use and complement licenses which are based on copyright law, even in a distorted but standardized way, without being aware of copyright law basics.

Some other costs are carried by the potential licensee who wants to secure the distribution of CC original or derivative works. Is my intended use commercial? Am I infringing third parties rights if the Licensor used copyrighted samples? What about my liability[7] if she did not secure the CC licensed rights with co-authors, performers, editor, collecting societies, employer?

CC addresses the direct relationship between the creator and the public. Understanding how to complement CC licenses by side contracts for intermediaries (aggregators, distributors, editors...), drafting these side-contracts referring to the CC license chosen by the author in an additional contract as well as including an authorization to distribute the work under CC conditions and determine a remuneration, is not simple either.

As with most legal notions, the Non Commercial legal concept is fuzzy and subject to legal interpretation. It is not always easy to define if a given usage is commercial or not[8]. Some licensors realize that using an NC option constituted a barrier to the reuse of their works: it is not very likely that isolated blogs entries have a market value; their author may after some time decide to use a less restrictive CC license in order to allow syndication by commercial journals. The definition for Non Commercial deserves further work, <http://lists.ibiblio.org/pipermail/cc-licenses/attachments/20060110/02d7a271/NonCommercialGuidelinesclean-0001.pdf>, as the doubt over whether a use constituted a commercial use or not may increase transaction and information costs, unlike the CC organization purpose to lower these costs by granting prior authorization to the public for some uses represented by standardized icons[9].

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[6] Collective administration of rights can be required by the law (i.e. cable and satellite transmission) or due to practical reasons (music broadcasting). The Lower Court n° 6 of Badajoz, Spain, ruled in February 2005 that a bar owner did not have to pay a remuneration to the SGAE (Spanish music collecting society) for the use of CC-licensed music: <http://creativecommons.org/press-releases/entry/5829>.

[7] For details on the question of liability and trust, see section 2 in: Herkko Hietanen, Mélanie Dulong de Rosnay, "Legal Metadata for Semantic Web Applications: Case Creative Commons", Symposium on Digital Semantic Content across Cultures, Paris, the Louvre, May 2006, <http://www.seco.tkk.fi/events/2006/2006-05-04-websemantique/presentations/>.

[8] Mikael Pawlo, "What is the meaning of Non-Commercial", en Danièle Bourcier, Melanie Dulong de Rosnay (eds.), International Commons at the digital age, Romillat, (2004), <http://fr.creativecommons.org/articles/sweden.htm>.

[9] Mozilla browser provides a plug-in allowing to display the icons expressing the licensing options present in any CC tagged webpage, see mozCC at <https://addons.mozilla.org/firefox/363/>.

Scientific Publications: The Role of Public Administrations in The ICT Era

Roberto Di Cosmo

ICT (Information and Communication Technologies) have radically changed the ecosystem of scientific publishing and have sparked a growing conflict of interest between the publishing houses on the one hand and all the other players on the other. After an in-depth analysis of the minimum requirements of a scientific publishing system and the divorce that is taking place between authors, users, and publishing houses due to the ICT driven revolution, this article describes what the scientific community can do, and in fact has already started to do, to free themselves from the now unjustified yoke imposed by the publishing houses. But all of this would be in vain without an immediate, clear, and determined intervention from Public Administrations, which we would ask to have the political courage to define public policies in order to place in the public domain what has been out of it for too long. We ask this for the sake of the common good, and have put together a specific proposal that would require no extra funding and that would not be limited to the so-called 'hard' sciences, but would aim to address a problem that has already spread to all areas of research.

Keywords: Copyright, Open Access, Public Policies, Scientific Publishing.

1 Introduction

In official speeches, in the media, even in corridor conversations, we often hear people singing the praises of ICT[1] in the most extravagant terms. These technologies, they say, provide all we need to make our students more intelligent and our researchers more competitive.

We can only rejoice in the fact that there is finally an awareness of and a willingness to deploy technologies that, for the first time in the history of Humankind, have the potential to allow knowledge to be shared without distinction between north and south, rich and poor. Information and communication technologies provide us with the ability to globalize this miraculous phenomenon that is the transfer of knowledge from teacher to student, this unique moment when the giver not only enriches the receiver without impoverishing himself but, on the contrary, is enriched by the exchange with his students. But it has to be said that, when all the talking is done, the day to day use of ICT in research and education does not always redound to the benefit of researchers, teachers, and students. The truth of the matter is that, if the great promises offered by ICT are actually to be delivered, a radical change is required in the way a number of activities essential to research and education, and especially to scientific publishing, work. Such a change cannot occur without a clear awareness of the radical difference there is between the requirements and purpose of scientific publishing and those of the world of 'entertainment' publishing.

Until the use of ICT became widespread, scientific publishing was essentially a paper-based activity, a relatively costly process that was mostly in the hands of private companies. A happy combination of circumstances meant that their economic interests did not interfere too much, and in fact sometimes coincided, with the interests of the researchers, who are at the same time producers and consumers of scientific articles.

The generalized availability of computer-based tools for creating and disseminating scientific documents at a trifling cost has completely changed the outlook. Let us take scientific typography as an example: prior to the 80s the typesetting of a scientific formula was a long and expensive process that required a lot of shuttling back and forth between author and publishing house, whereas today most scientific publishing worldwide on the subject of computing, mathematics, or physics uses the freely available TEX system, the result of ten years' research by Donald E. Knuth[2]. Thanks to this system, the creation of typographically impeccable articles is within reach of everyone and the only trace of the previously sky-high cost of typesetting is to be

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[1] Information and Communication Technologies - as nobody wants to run the risk of appearing to be an ignoramus on the subject, the term NTIC (New Information and Communication Technologies) is no longer used.

[2] One of the founding fathers of modern computing.

found in the $ and $$ symbols which Knuth, who was well versed in traditional typography, used as delimiters of mathematical formulae: in TEX a formula such as $\int_a^b f(x)dx$ is produced by typing `$\int_ab f(x)dx$`, and the same formula in display mode,

$$\int_a^b f(x)dx$$

traditionally much more costly, was produced by typing `$$\int_ab f(x)dx$$`. However, as you can imagine, producing the second formula was no more of an effort for me than producing the first. This is also why the cost of producing quality scientific journals has been falling steadily; however, subscription rates of journals produced by private publishing houses are still shooting up[3]

In this article we try to identify the minimum requirements that a scientific publishing system should meet and explain how the emergence of ICT has revealed a divergence of interests between authors, users and publishing houses of scientific journals and has shattered the former fortuitous agreement that bound them together.

Such an analysis is essential if we are to understand why a change is necessary and whether the intervention of Public Administrations, through public policies, is desirable and, if so, in what form.

2 What Is Scientific Publishing?

The world of scientific publishing is very different, indeed fundamentally different, from the world of entertainment publishing. To begin with, for teacher-researchers and researchers the *publication* of the results of their research form part of their *purpose*, which means that the scientific community is a community in which everyone is not only a reader but also an author. More important still is the fact that publication is essential for *the advance of science*: the benefit expected from a publication is not a direct financial return on the 'sales' of an article but rather the broadest possible dissemination of its content so that the latest scientific discoveries may be available to other scientists as quickly as possible. And as the scientific community places such importance on *peer recognition* and researchers are judged by the influence of their publications, any barrier to the dissemination of an article creates a real "lost profit" for the author. This is why in all copyright transfer agreements the scientific publishing houses take great pains to explain, without ever really succeeding, that this transfer is made to 'speed up' the dissemination of the scientific article in question[4].

In this scenario, the sale price of an article is a *barrier* to the dissemination and therefore a *defect*: an ideal system would be one that permitted all scientific articles to have the widest possible dissemination at the lowest possible price. Such a system would not be so very different from Napster, Gnutella, Kazaa, or others like eDonkey, which are currently causing the Hollywood entertainment publishing lobbies (and not only them) to cry out in desperation, which proves, in case any doubt still remained, that scientific publishing and entertainment publishing are two very different activities.

2.1 What Does Scientific Publishing Need?

Having established the special nature of scientific publishing, we now need to consider what the scientific community *expects* from a publication system.

It is not difficult to draw up a shortlist of minimum requirements that a researcher would such a system to meet:

■ **Evidence of priority:** publication should allow us to establish the priority of a discovery.

■ **Integrity:** publication should ensure that no alteration is made to an article after its release[5].

■ **Widespread unimpeded dissemination:** publication should, as the word implies, be public and as accessible as possible, because

- the more disciples a researcher has, the greater his or her worth

- research is more effective if there is fast and unimpeded access to publications and their scientific content.

■ **Very long-term archival:** since the dawn of Humankind, the corpus of scientific and literary knowledge is considered to be part of the heritage of Humankind and as such should be preserved for all posterity: catastrophes like the burning of the library at Alexandria must not be allowed to happen again.

■ **Unique identifier:** the fabric of scientific knowledge

[3] A collection of very informative statistical tables on this subject are available at AMS's website (*American Mathematical Society*) [1]; see also Ted Bergstrom's studies [2].

[4] The argument used by the publishing houses runs more or less along these lines: "*if you scientists transfer us your copyright, we will be able to respond quickly to any requests from people or companies wishing to copying your work, which relieves you of the tiresome administrative burden of managing your copyright yourselves*". Naturally they are very careful to stress that the management of those rights is not at all tiresome if permission to reproduce the work in any form is granted from the outset. This is something that generally interests the author of scientific articles, whose most secret desire is for his or work to be copied, read, studied, and quoted by millions of students and researchers. Obviously some rare cases of plagiarism need to be dealt with, but the transfer of copyright to the publishing houses has played no part in resolving the few cases of plagiarism that this particular author has come across. Instead the scientific community itself has administered its own justice, by ostracizing the plagiarists and demolishing their academic reputation, a considerably harsher penalty in our world than to be found guilty of copyright infringement.

[5] This does not prevent any number of revisions being made, but it must be possible to make a clear distinction between the article as it was published on its date of release and any subsequent altered versions.

is an *ante litteram* Web that, as we have seen, is a long-term undertaking, one in which dangling pointers cannot be allowed to occur since the consequences of such broken links are far more serious than any that may result from the every day disappearance from the Web of so many ephemeral pages.

Before the emergence of ICT, these needs were reasonably well covered by traditional scientific publishing, with the indispensable contribution of the libraries, as we will come back to later, but this is no longer the case. In order to understand this change we need to look at how the roles of authors and publishing houses have evolved, before and after the arrival of ICT.

3 Authors and Publishing Houses: A Marriage Of Convenience Heading For Divorce

Before ICT, the roles in scientific publishing were clearly split between the scientists on the one hand and the publishing houses on the other. Let us remember how things used to be some years ago.

3.1 Authors, Publishing Houses, And Libraries Prior to ICT

Due to the very nature of scientific publishing, all scientific work was carried out by *the scientific community themselves*; it was they who had always performed the basic activities which are the real added intellectual value of this kind of publication:

■ **Content creation:** By content is meant the results of research work disclosed by its authors, who at the same time are the scientists who obtained these results. Most often these are the results of research funded directly or indirectly with public funds although in some cases it may be research funded by private companies. However, the author has heard of no case of research having been funded by the publishing houses.

■ **Reviewing and evaluation:** these activities, better known as refereeing or peer reviewing, can only be performed by recognized experts in the relevant field(s). Without wishing to enter a debate that goes beyond the scope of this article of this article, there is a difference of stature compared with literary 'criticism': owing to the increasingly specialized nature of science today, a scientific publishing house cannot simply rely on a number of in-house 'reviewers' as they alone could not guarantee the scientific quality of articles from such a wide range of subjects: biology, mathematics, computing, physics, etc.

■ **Scientific control:** the "editorial line" of a scientific journal is decided by the editorial committee which, for the same reasons as above, is made up of recognized scientific experts in their respective fields.

3.1.1 The Role of Publishing Houses before ICT

Before ICT, the publishing houses provided scientists with a number of ancillary services that were highly appreciated by the community, in particular:

■ **The typesetting** of articles, which was very costly at the time and was responsible for the high price of scientific journals.

■ **The dissemination of articles** among the scientific community was mainly facilitated by journals, to which libraries would subscribe at the request of their users.

■ **Evidence of priority and integrity** were (and still are) implicitly ensured by their release on printed paper, which provided the essential **unique identifier** necessary to build a coherent and lasting edifice of knowledge.

Finally, the prohibitive cost of publication acted (and continues to act) as an implicit **filter.** In practice the cost factor limited the number of publications in circulation and the number of articles published, which provided an 'external' mechanism for quality evaluation in the manner of a "programme committee", which was highly appreciated by some colleagues.

3.1.2 The Essential Role of Libraries

The way the situation is currently developing, *libraries*, together with authors, are the victims of the economic parasitism of publishing houses. And a librarian may often be more aware of this problem than most authors, since authors do not have to deal on a daily basis with the dramatic need to cancel, against their will, subscriptions that have become to too expensive due to the latest change in commercial policy of this or that publishing house.

At this point it is important to remember that, even before the notion of publishing house existed, libraries have always had two fundamental and vital roles. On the one hand they provide researchers with easy access to an important corpus of documents, access which has certainly been made even easier by the arrival of ICT, with its digitization and online availability certainly. But libraries have also guaranteed the **long-term archival** of knowledge since their inception, largely with public funding. As surprising as it may seem, many publishing houses do not maintain complete archives of their publications. A short while ago a major publishing house contacted university libraries to ask their permission to digitize documentary collections made up of journals whose copyright was held by this same publishing house and of which they no longer had a single copy!

In the race towards total technology it would be unwise to forget the importance of long-term archival and the classification of works, tasks which have been performed by libraries since the dawn of humankind and for which right now we have no electronic alternative.

3.2 What Changes with ICT?

With the arrival of ICT, and in particular of TEX and LATEX, and thanks to the generalization of the use of Internet, a number of tasks that had previously been performed exclusively by traditional publishing houses are now becoming the responsibility of the authors:

■ **Typesetting:** to a large extent it is the authors who are now responsible for typesetting, in the styles imposed by the publishing houses.

■ **Dissemination of articles** can now be carried out by

anyone, since ICT provides cheaper, faster, and much more effective means than traditional journals (web pages, meta-archives – [3][4] and in France [5][6]).

■ **Evidence of priority** is increasingly provided by adverts in mailing lists and the unique identifier is included in the servers of the best known publications, such as ArXiv.

■ **Filtering** of publications is on the wane in publishing houses: under the tyranny of business logic, publishing houses are obliged to offset the drop in the average circulation figures of journals (as a result of the growing specialization of research fields and their spiralling cost) with a veritable explosion in the number of journals published[6]. Paradoxically, the same business logic that pushes up the price of journals (and therefore reduces their dissemination and, ipso facto, their use) has ended up acting as a catalyst for the proliferation of journals.

If we compare the situation before and after the arrival of ICT, we can see that now scientific publishing houses are actually nothing more than mere *printers,* and this is the term we shall use to refer to them from now on. They now have nothing more to offer to the scientific community than what is intrinsically printed publication: on the one hand, a guarantee of integrity and on the other, a barrier (albeit imperfect) to the proliferation of publications due to their being prohibitively expensive. Is this enough to justify their existence for much longer?

This reshuffle has brought to light a number of underlying conflicts which have always existed between the interests of the authors and those of the printers who, we should remember, require authors to transfer, wholly and free of charge, the **copyright** of their work before they will accept an article for publication, when a simple non-exclusive permission to publish would be more than sufficient. When this practice first began, as authors had no other means by which to disseminate their work, nobody raised any objection. Soon the printers' hypocrisy reached lyrical heights in the wording used to justify these copyright transfers in the forms that the authors had to sign: we were told that copyright transfer was necessary to "*facilitate a more widespread dissemination*" of our work.

Now that ICT provides other effective means of dissemination, printers have had to abandon their lyricism for less ambiguous wordings, a more moderate example of which is set out below[7]:

"*The Author may publish his/her contribution on his/her personal Web page provided that […] it is clearly pointed out […] that the copyright for this contribution is held by [the Publisher]. From the Publisher's point of view, it would be desirable that the full-text version be made available from the Author's Web page only after a delay of 12 months following the publication of the book, whereas such to delay is not required for the abstract.*

The Author may not publish his/her work anywhere else *without the prior written permission of the publisher unless it has been changed substantially*"

This form of exclusive transfer of copyright is shown up for what it is: an obstacle to the free dissemination of scientific knowledge which in certain cases is tantamount to a **private appropriation** of publicly funded research.

4 Barriers to Change

One may then wonder why scientists continue to publish in traditional journals and this is where another latent conflict of interest rears its head: a scientist will always want to publish his or her articles in prestigious journals (or conference proceedings). However, while the prestige of a journal is based on the quality of its editorial committee (made up, as we have said, by scientists who are totally independent of the publishing house), the 'title' of the journal is registered in the name of the printer who owns it

It is therefore impossible for an editorial committee to appropriate this title, the stamp of quality by which a given scientific community identifies itself.

Editorial committees are thus the hostages of the printers in every respect. To escape from this influence requires an effort that not everyone is prepared to make, although there are milestone examples such as the case of "Journal of Logic Programming" (JLP), whose editorial committee left Elsevier en masse in late 1999 to join *Cambridge University Press* and set up "Theory and Practice of Logic Programming" (TPLP), a publication reborn from the ashes of "Journal of Logic Programming" which disappeared as a result of this defection and was replaced on library shelves by the new title which took over the numbering of the old JLP [7].

The printer is becoming increasingly less the useful and essential tool to drive scientific process that it once was and more a dangerous parasite of the system Printers impose absurd limitations on authors (a good example is the obligation for non-US authors to abide by such laws as the DMCA, *Digital Millennium Copyright Act*, if the printer is based in the USA or, worse still, the rejection of articles by scientists resident in any country under US economic embargo[8]):

■ they unashamedly raise the price of their journals in pursuit of the maximum possible profit (see *Declaring Independence* in [10] for an analysis of price trends between 1996 and 2000), thereby leaving libraries no option but to cancel their subscriptions and so provide an inferior service to the scientific community,

■ they claim property rights over rights that they have plundered from their true authors (photocopies made in an academic or research library are subject to an annual royalty payment to a copyright collection society[9]),

■ they charge for reading online the selfsame articles that they prohibit from appearing on the author's web pages.

[6] It is very edifying to see the year, volume and issue numbers of such a famous series as *Lecture Notes in Computer Science*.

[7] This text is taken from a form that the author had to sign recently.

[8] This has been the subject of much debate and set off a furore of protest among the scientific community in 2003 and 2004 [8][9].

In short, in the fields in which ICT are expected to deliver the promise to narrow the digital divide between libraries, countries, and continents by building the new universal, digital Alexandria, the printers are doing everything in their power to widen the existing rift solely for their own profit and contrary to the interests of *all* the other players.

Even from a strictly cynical and selfish point of view, it must surely be very interesting for privileged nations to ensure that the foreign students who are increasingly more important to their research can access the latest results and the most comprehensive documentation in their countries of origin, where they necessarily receive their initial education. However, the economic interests of the publishing houses prevent this from happening.

5 A Plethora of Initiatives

The ongoing divorce between printers and the scientific community (at the same time users and creators of the knowledge marketed by the printers) is even starting to have repercussions. For some years now there has been evidence of a growing mobilization of researchers and librarians, examples of which are the Budapest petition [16], the debate launched by "Nature" [17], the statement by the *Cornell University* library[10] [18][19] and, in France, the press release drafted by the sub-committee of the *Science Société* Group of the French Science Academy dated December 9, 2001.

Regardless of the positions of either party, the liveliness of this debate only goes to confirm the seriousness of the situation: everyone recognizes that scientific publishing has to undergo a profound change if it is to continue to be of use to the research community. Meanwhile, a plethora of initiatives are underway:

■ Libraries are pooling their "purchasing power" to negotiate better rates with printers, such as the Couperin consortium [20]

■ A proliferation of electronic scientific journals do not need printers to exist (examples in [21])

■ There are various virtual library projects including projects involving the digitization of ancient texts such as Numdam [22]

■ In Japan the pioneer project CiteSeer [4] has become a benchmark project for an entire community by meeting the needs of researchers with a system that automatically discovers, indexes, and archives scientific articles that are available on the Web before analysing the references between articles, thereby allowing researchers to follow the thread of a number of ongoing lines of research

■ Finally, there are large number of researchers who act individually as if copyright transfer to printers did not exist and therefore operate as "outlaws".

A good example of how the requirements of scientific publishing can be broken down and carried out by different agents is the case of preprint server, the best known of which is ArXiv [3]. This server, originally created to store and provide a unique identifier to preprints (articles that have not been subject to peer review by the scientific community) has become a privileged medium for overlay journals, electronic journals whose 'issues' are made up of references to articles deposited in ArXiv (see [23]). In this way, guarantee of quality and priority is provided by the editorial committee (as in, "Annals of Mathematics" for example), while dissemination, archival, and a unique identifier are all provided by ArXiv [3].

6 A Plan for The Future

If we want scientific publishing to change and adapt to this new era, we need to be looking for a scenario in which all the requirements of the scientists are met, without having to sacrifice the basic requirement of free access to knowledge.

Solutions within reach ...

Technical solutions already exist for most of the requirements we have identified. Here are a few of them (though the list is by no means complete):

■ **Priority, integrity:** in order to establish the priority of discovery any means of 'depositing' a version of the article on its publication date is valid. 'Depositing' does not need to be made by any physical means such as the physical printing of a journal.

Overlay journals are a clear example of a virtual 'deposit': the author sends an article, it is reviewed, and its final version is deposited in ArXiv which assigns it a unique identifier, cited by the electronic journal. This means that, while the journal exists (and it always will exist if it has been long-term archived), there will be proof that that article was published on that particular date and exactly as it appeared in the journal[11]. There are also private commercial initiatives that are looking into the idea of a 'stamp' certifying the priority and integrity of an electronic document[12].

■ **Widespread, unimpeded dissemination:** the adoption of a free licence specifically intended for scientific works[13] is essential if authors are to achieve the unimpeded dissemination of their works rather than blindly transfer-

[9] In France this would be the CFC (*Centre Français d'exploitation du droit de Copie*), a private association which has agreements on behalf of authors and publishing houses with a large number of institutions, including secondary schools [11] and universities [12][13][14] (with some recent exceptions for primary schools) in accordance with copyright law, Art. L. 122-10 : (L. n. 95-4 of January 3, 1995, art. 1). It is clear that this law primarily affects books, but the royalty fee is calculated on the basis of the number of pupils/students and not on the type of document photocopied, which could equally well be a journal. Neither should we forget that in the world of scientific publishing the revenue obtained by the author of a book is often, albeit not always, insignificant and that after a number of years books are no longer reprinted.

[10] One of the largest private university libraries in the world.

ring their copyright to private publishing houses.

In this respect there are a great many initiatives, including one from the very heart of the United States, a country that is hard to accuse of being prejudiced against private companies, whereby any work wholly financed by federal funds *cannot* be protected by *copyright* and automatically passes into public domain. Furthermore, another recent initiative, the so-called *Public Access to Science Act*[14], aims to extend this exclusion to any research work receiving significant funding from public sources.

It is easy to imagine a similar exclusion in other countries and not only the USA; in fact, in the UK this has already occurred and the copyright of such work resides with the British Crown.

■ **Very long-term archival:** the ideas of a unique identifier and very long-term archival are very closely linked in this immaterial world we are constructing at the moment. On the one hand, there is not much point in having a unique identifier of a work of which there is no copy; on the other, it is not very practical to have an unstructured mass of data in which it is impossible to locate a work by a unique identifier.

This is a problem that is not unique to scientific publications. National archives, the public documents of which in France are legally obliged to be preserved for an indeterminate amount of time[15], are faced with the same problem, and it would no doubt be possible to cooperate with them to find the most appropriate technical solutions (let us not forget that, according to French legislation, many scientific documents, such as doctoral theses, are considered to be public documents subject to national archival).

We would stress that, in spite of all the publication servers like ArXiv, very long-term archival is based on the mass duplication of publications, while the unique identifier is provided by the internal unique identifier in ArXiv plus the reference to ArXiv.

It is also worth stressing that the "online journal / printed paper journal" dichotomy that sometimes crops up in discussions about scientific publishing is gradually disappearing thanks to the dissemination of new technologies. There are now some marvellous devices on the market[16] which allow us to produce, on demand and instantly, whole printed books at a competitive price compared with traditional printing, if we limit ourselves to small print runs[17].

This opens up some interesting possibilities: if companies such as BooksJustBooks in the United States offer the general public the opportunity of printing quality books with short print runs at an unbeatable price, it is obvious that in fields like scientific publishing, in which print runs are often very small, we could think seriously about doing the same. If Donald Knuth has given us the means to almost effortlessly produce beautifully typeset scientific articles, printing on demand will now provide us with the means to print those articles at a low cost[18].

And if the combined machinery of a university, or a group of Universities, is not enough, there is still no need to contract the services of a 'publishing house', as a simple 'printer' can provide all the necessary services.

... and the need for a strong political will

Thus it would appear that everything is in place for an evolution towards a new world of scientific publishing; a natural and inexorable evolution towards freer and more open publishing.

But it is not that simple: there is still a tough nut left to crack, which is the existence of an increasingly important body of scientific work, the copyright of which is still being captured daily by private publishing houses. There is a pressing need to freely return this corpus to the community, a corpus which private publishing houses have misappropriated.

Make no mistake about it, this is a flagrant abuse and one which is too often forgotten. Take for example the case of the work of Ramanujan, that peerless mathematician who sadly died young in 1920, whose notebooks, containing a treasure trove of mathematical hypotheses that to this day are still not entirely elucidated, are published and sold in five volumes at the prohibitive price of more than 90 euros each[19]. What we need is for millions o copies to be published and distributed all over the globe in the hope that they will inspire a new Ramanujan.

As this is a huge legal problem, it is difficult to foresee a solution without a strong political from the Public Administrations will to reaffirm the priority of the general in-

[11] This does not prevent any number of revisions being made, but it must be possible to make a clear distinction between the article as it was published on its date of release and any subsequent altered versions.

[12] An example of this type of initiative can be found in [24], which proposes depositing a digital signature with copyright protected works.

[13] It is not a good idea to blindly adopt licences such as the *Free Documentation Licence*, which are appropriate for documentation but not for scientific works.

[14] See details in [25].

[15] As provided for in paragraph L. 212-1 of Book II, Title I, Chapter 2, of the Public Property Code published in the Official Gazette 46 of February 24, 2004, page 37048, text 3 [26][27], "*public archives, whoever they may be held by, must be preserved indefinitely* ".

[16] Xerox's DocuTech series was the pioneer but nowadays Xerox is no longer the only manufacturer to offer this type of solution.

[17] What is meant by "small" has changed over time, but at the time of writing this article "small" means around 400 copies, well over the print run of a great many specialized scientific works.

[18] Except for certain scientific fields that require colour printing, which is much more expensive.

terest over the private interests of this or that publishing house.

Because it is no longer possible to go on letting scientific journals and conference proceedings be published as if they were commercial works.

For this reason it is essential that politicians, and in particular politicians who have been researchers, take a close interest in this matter. But it must be clearly understood that we do not need the involvement of politicians in order to address simple commercial issues (the negotiation of subscription fees) or technical issues (the digitization of works or the creation of archives like ArXiv). What is the use of bringing subscription fees down sporadically when it is something the library federations can do for themselves? What is the use of proposing wonderful digital library projects[20] whose content, due to a preoccupation with "*respecting copyright*", would not be accessible, thereby violating one of the basic principles of libraries[21] ?

Where the intervention of politicians (French, European, and from all over the world) is indispensable and pressing is to regulate the basic issue of free access to the results of public research, something that will require a strong political will to be achieved.

Let us then call on our governments[22] to act without delay to:

■ Put a stop to the acquisition by publishing houses of copyrights on scientific works. This conjures up visions of a complex legal framework to prohibit the transfer of copyright to publishing houses or to convert such a transfer into a simple, non-exclusive transfer, but there is a much simpler, more effective and, better still, proven solution: we can follow the example of the United States that was mentioned earlier in this article. We propose that any article resulting from research work conducted by or for a Public Administration should pass automatically into the public domain (according to French law this would be equivalent to pledging the property rights, the only ones of interest to the parasites of the system, but not the moral rights, which would remain intact and are what interest the researchers: right of paternity, right of integrity of the work, ... and right of retraction). US journals explicitly provide for this case and neither US federal government officials nor British government employees are asked to transfer their copyright[23] .

The simple transposition to European law of the copyright exclusions that are applied to federal US government officials (and to British, Canadian, and New Zealander government employees) would be sufficient to prohibit the acquisition of rights on most of the research work performed in Europe, where scientific research is mostly public funded . A solution adapted to European law could certainly be considered, but what is absolutely clear is that Public Administrations should move fast to establish the rules.

■ Cancel the transfers of rights on the vast corpus of articles already existing; it is true that, in the case of obligatory transfers with no payment involved, or even a payment in the opposite direction, a could perfectly well declare these transfers null and void, but the issue is too important to let individual legal proceedings decide its fate.

■ Reinvest in research the public money that is now the squandered on paying the high price for limited access to knowledge that has already been paid for out of public funds.

There is no excuse for not acting, and every day lost is one day too many.

Translation by ***Steve Turpin***

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[20] See an example in [28].

[21] Actually the Google Print initiative only plans to show summaries of works still under copyright, particularly for scientific works.

[22] Most particularly those states that have not yet done so, unlike the USA and the UK.

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High Performance Computing

High Performance Computing Technology, Applications and Business

Luigi Brochard

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High Performance Computing (HPC) was born in the mid 70's with the emergence of vector supercomputers. It has then evolved according to technology and business enlarging progressively its scope of application. In this paper, we describe the fundamental concepts at the core of HPC, their evolution, the way they are used today in real applications, how these applications are evolving and how application and technology are transforming business.

Keywords: Cell, HPC, Multicore Processor, Parallel Computing, SIMD.

Technology

Technology is playing different roles in High Performance Computing. One role is to provide ways to build faster systems to solve larger problems and provide better or cheaper simulation or analysis. A second one is about changing the way systems are built or used and somehow extending the scope of applications of High Performance Computing. Two first paragraphs present the technologies used to address those two goals. Third paragraph presents a state of the art HPC system today.

Two basic concepts and a few basic acronyms

Two basic concepts are at the core of the technologies used in HPC:

- Segmentation. This technique allows a complex operation (like floating point addition or multiplication which is traditionally executed in several processor cycles) to be decomposed in several simpler sub-operations which are executed in a pipelined manner by an execution unit which has been segmented in several stages of simpler circuits, each of them execut-

Author

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ing one sub-operation of the decomposed operation. At a given time each stage of the segmented unit is working on a different operand in the pipeline, the output of stage i being the input of stage *i* +1.

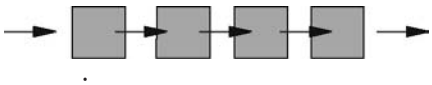

Figure 1: Segmented execution unit.

■ Therefore a complex instruction (or task) can be executed in a single cycle when the "pipeline" has been properly filled which implies an operation is not executed on a single operand but on a stream of operands, This implies a start-up time to fill the pipeline before the first result is produced and the assumption the start-up time cost is amortized by the duration of the operation on the stream of operands. Under such conditions, segmentation is a way to reduce the cycle time of an operation, increasing the number of FLOPs (Floating Point Operation per second) produced by the execution unit.

■ Duplication. By duplicating execution units, the same operation or several operations can be executed concurrently, increasing the number of operation executed per cycle if the operations are independent or more precisely if the output of execution unit *i* is not the input of unit *j*. Under this assumption, each execution unit is working simultaneously producing as many results as executing units, leading potentially to systems which performance would be limited only by the amount of execution units.

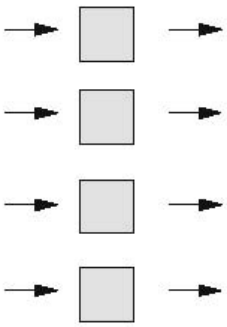

Figure 2: Duplicated execution units.

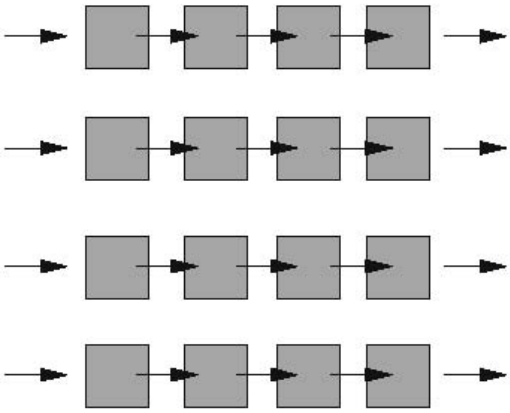

Figure 3: Multiple segmented execution units.

■ Those two concepts can of course be merged in systems integrating multiple segmented units.

■ Basic acronyms were introduced in the late 70's [13] to differentiate different kinds of parallelism. We give here the definitions of these acronyms since they will be used several times in this article:

1. SIMD: Single Instruction Multiple Data, where a single instruction is executed on a stream of data, like on avector
2. MIMD: Multiple Instruction Multiple Data, where multiples instructions are executed concurrently on different data or streams of data
3. SPMD: Single Program Multiple Data, were a single program is executed concurrently on multiple processors working on different data or streams of data. SPMD is an extension to Flynn's taxonomy and has been introduced in the late 80's to present the most commonly used programming model on MIMD systems.

Segmentation and pipelining

Segmentation has been used both in hardware and software. In hardware, this technique was introduced first in vector computers which created super computing in the late 70's-early 80's with the CDC and Cray systems [19] Such vector units were used to run applications with a very percentage of Floating Point Operations (FLOP) working on stream of operands called vectors and improving dramatically the speed of processing by reducing the cost of a floating point operation to nearly the cost of an integer operation. The compiler was generating specific vector instructions to make use of the vector units working on vector registers and producing optimally one FLOP per cycle. Then to get faster, those systems introduced several vector units, using the duplication concept, producing several FLOP per cycle, the vectors being chopped in as many chunks as vector units. Later on, systems like the Cray 2 [19] introduced longer pipelines with more stages in the vector execution unit, reducing further the cycle time and increasing the clock speed.

Vector processor were the first to use such floating point execution units where a single instruction was working concurrently on multiple data, which was then referred as SIMD [Fly].

This technique was also applied in the 80's to the RISC microprocessors [39], in the early 90's by IBM with the POWER architecture [34] and also by Intel later in the early 90's to the Pentium microprocessor to introduce very high clock speed microprocessors [33]. As in the vector systems, the Floating Point units were pipelined but without the use vector instructions nor vector registers, the compiler generating a sequence of instructions working on a stream of scalars and executed in a pipelined manner.

The same technique was later applied to a larger type of instructions when INTEL introduced SSE in the late 90's with the Pentium III to work on Multi Media Instructions (MMX)

to boost graphics and games on its systems. It was then extended to SSE2 and now SSE3 [45].

Apple and IBM did the same with the Altivec/VMX units in the G5 and PowerPC 970 [1]. With such units and instructions, the microprocessors introduced on top of its General Purpose Units (originally working on 32 bits , then extended to 64 bits), and its Floating Point Units (working on 64 bits) , Multimedia Units working on 128 bits and capable of generating 4 × 32 bits results simultaneously, therefore increasing dramatically the number of FLOP per cycle.

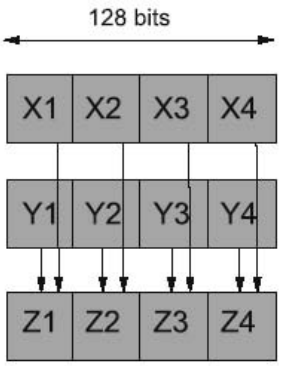

Figure 4: Four 32 bits operations in a VMX unit.

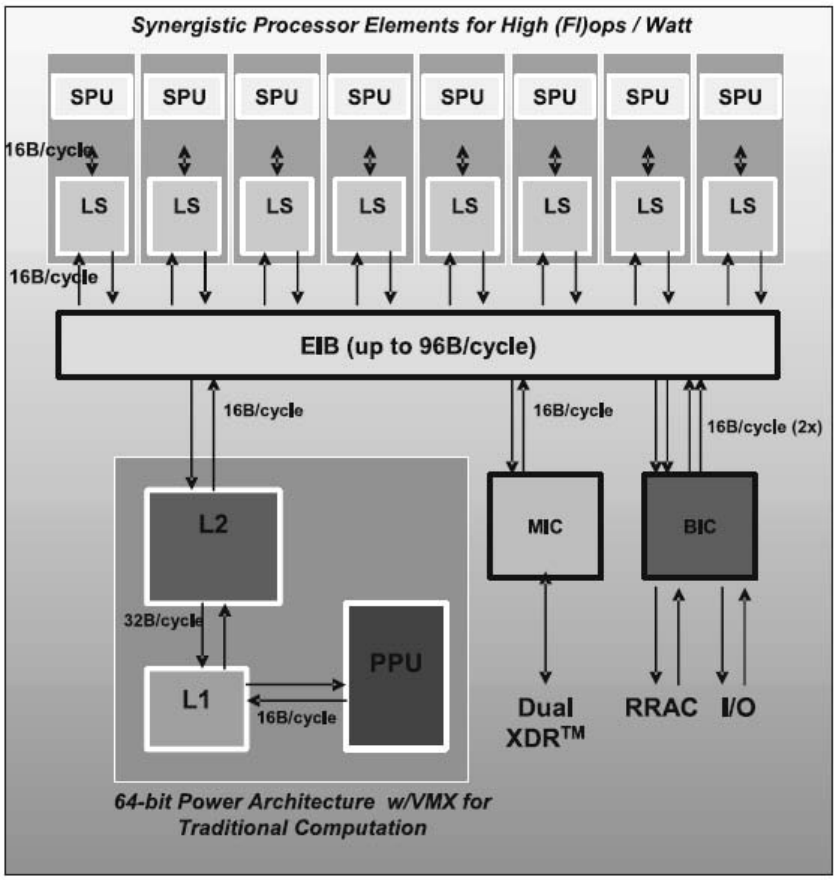

Figure 5: The Cell processor chip.

Very recently, arrays processors reused the same concepts at a higher degree and the Cell processor [3] introduced by Sony, Toshiba and IBM also. Cell processor, also called Cell Broadband Engine (CBE), consists of a standard PowerPC processor with its own VMX capabilities called the PPE (Power Processing Element) and 8 SIMD units called SPEs (Synergistic Processor Element) each capable of eight 32 bits FLOP per cycle leading to 64 × 32 bits FLOP per cycle for the SPEs plus 4 × 64 bits FLOP and 4 × 32 bits FLOP per cycle for the PowerPC for an approximate peak performance of GFLOPs (one GFLOP is 10^9 FLOP per second) with a 4GHz clock speed.

Duplication

This technique was first used to introduce multiple executions units in the same CPU (Control Processing Unit) like multiple vector units under the control of a single fetch/decode instruction unit [19].

Then multiple CPUs each with their own fetch/decode instruction unit but sharing the same memory subsystem were introduced leading to multiprocessors also called now SMP (Symmetric Multi Processors) since all processors behave identically with no master in charge of some specific operations. Multiprocessing capabilities were found originally in multi cabinet systems like the Cray XMP and later on multi modules systems [19].

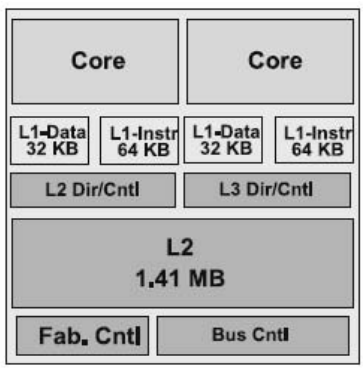

Figure 6: The POWER4 chip.

It's only recently that multiprocessors have been implemented on a single module using multi chip modules and even more recently on a single chip using dual core chips.

IBM POWER4 [35] was the first chip to introduce dual cores late 2001.

AMD introduced dual core Opteron mid 2005 and INTEL late 2005 with the new generation of Itanium processors and Xeon dual core chips scheduled early 2006.

This trend has been amplified with the Cell processor which has 1+ 8 cores on a chip and by the Niagara chip from SUN [46] with 8 cores.

This increase in the number of cores per chip is related to the clock frequency crisis since clock frequency improvement, which was since a few years the main cause of microprocessor increased performance, is now becoming limited by electrical power

consumption and heat dissipation [15].

Another very important trend in the mid 80s was the appearance of multiprocessor systems where each processor had its own memory giving birth to distributed memory processing and very highly parallel systems by opposition to shared memory multiprocessors.

First such systems were academic prototypes like the Cosmic Cube [6], followed by commercial system proposed by INTEL with the iPSC/1 based on the 80286 microprocessor, and by NCUBE with the Ncube/1 based on a proprietary processor leading to the first distributed memory MIMD systems [20]. Thinking Machine was following another path proposing the first massively parallel computer, the Connection Machine 1, known as CM/1, built around 64 000 1-bit proprietary processor used in a SIMD manner [7], extending it to 256 000 processors with the CM/2, and later followed by the CM/5 which was a MIMD distributed memory system built on standard microprocessors.

With these new systems, a totally new programming paradigm emerged where each processor accessing data from another processor had to request it through a message passing interface, while in standard shared memory multiprocessors, access is transparent with explicit synchronizing being required only to modify shared variables.

At this time each system had its own proprietary operating system, message passing library and interconnect.

Although a bit cumbersome to program, this new paradigm lead to a huge development effort from both system and application perspectives and permitted to reach new levels of performance using hundreds of processors while shared memory multiprocessors were limited to ten processors or so. To reduce the programming complexity of this type of MIMD distributed memory systems, SPMD programming paradigm became, and is still today, the standard way to program these systems.

These programming models are discussed in the next paragraph.

From message passing to clusters and GRIDS

The introduction of distributed computers in the mid 80s came along with the introduction of a new programming paradigm called message passing where at this time each system had its own proprietary message passing interface as well as processor and interconnect.

In the early 90's, the first versions of PVM (Parallel Virtual Machine) [37] were released, introducing a de facto standard bringing a common message passing library across different systems. This helped developers to parallelize their applications and port them on different platforms. Then in the mid90's, MPI (Message Passing Interface) [22] became the first standard message passing interface created through a user forum which was progressively adopted and ported on all parallel systems first with distributed memory and later with shared memory, leading to a universal programming model where the same MPI program can be executed on any parallel system. Along with the standardization of the messaging passing interface, commoditization of basic processor technology helped the diffusion of distributed memory systems. Proprietary processors developed specifically for parallel systems disappeared leading the way to large volume microprocessors incorporated in large volume products like workstations, PCs and servers.

Those two major events along with the introduction of interconnect which can be connected to any systems through the standard PCI interface (like Ethernet, Myrinet, Quadrics,... and now InfiniBand) created the cluster era which is the prominent form of supercomputing according to TOP500 which lists the 500 most powerful systems installed worldwide [41].

In the late 90s/early2000 a new idea emerged built on the foundations of clusters and distributed computing. As soon as an application is capable of running on distributed memory systems using a standard programming interface built onTCP/IP protocol, what prevents these systems to be in different locations? Therefore as soon as the programming model is ubiquitous, an application can run on any system in any location, and a user can submit a job without knowing the location of where it will be executed. The GRID paradigm was born fuelled with the introduction of tools like Globus and Legion [17].

The different components of a cluster

We'll describe now the main hardware and software components of a cluster.

Hardware components

The main hardware components of

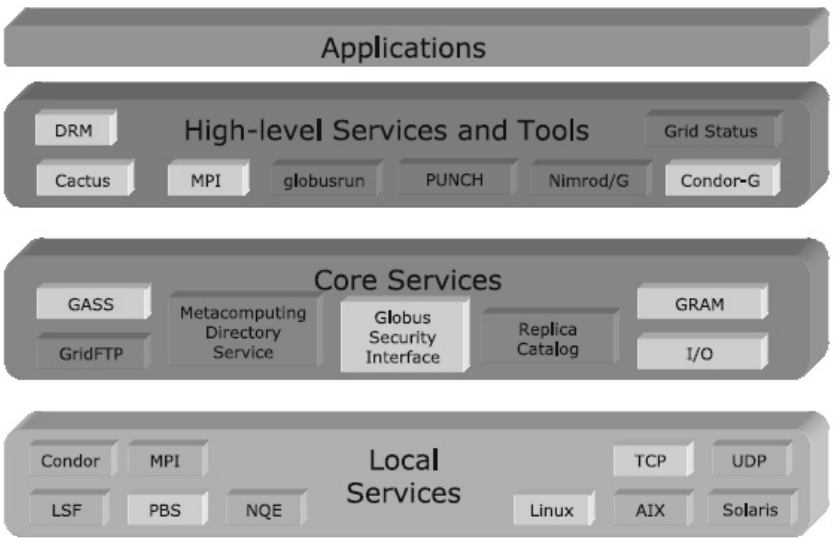

Figure 7: Globus architecture.

a cluster are the nodes and the fabric interconnecting the nodes. Those choices are usually dictated by the application characteristics and we describe them in the next paragraph.

Node. The node is the main element of a cluster since it provides the computing power. Main characteristics of a node are its floating point and memory performance and capacity. Sustained floating point performance on a given application, measured in FLOPs (Floating Point Operation per second), depends on many parameters. The most basic factor is the peak floating point performance and the processor ability to sustain most of this peak performance on real applications. Peak Performance of a processor is simply the number of floating point operations per cycle the processor can achieve in theory times the processor frequency. For a long time processor frequency had been the major driving force of microprocessor performance.

But due to the power dissipation limit [15], which is now one the major inhibitor to higher processor frequencies, processor designers have been working on processor architectures which can produce more FLOP per cycle. To increase the number of FLOP per cycle a processor can achieve, segmentation and duplications concepts described earlier have been very much used. For example by increasing the number of cores and pipelines in a processor, the number of FLOP per cycle can vary from 2 FLOP/cycle for a single core standard x86 processor to 4 FLOP/cycle for a single core POWER or IA-64 processor, to 8 FLOP/cycle for single core PowerPC970 with VMX or a dual core POWER or IA-64 processor, to 16 FLOP/cycle for dual core Power PC970 with VMX and up to 64FLOP/cycle for the Cell processor. How an application can benefit from the processor architecture depends on the compiler efficiency and the application characteristics since for example an application doing a lot of conditional statements may hardly benefit of these features. Another feature is the number of cores or CPUs per node (or SMP). From a performance point of view, performance of a node will increase with the number of CPUs if the memory bandwidth and capacity of the node scales accordingly.

Memory capacity per node can be an important characteristic since some application needs a large amount of memory per processor (and even more per node) to run efficiently. Memory performance can also be very important for some applications since memory performance has been increasing at a much slower rate than processor performance. For example some HPC applications benefit very little from the hierarchical cache structures like L1, L2 and L3 caches which have been introduced to hide the memory latency or poor memory bandwidth since either the access pattern to memory is random or the application reuses poorly the data from cache. In both cases, some architecture characteristics like prefetching (to anticipate the access of data from memory fetching it ahead from memory to L3, L2 and L1) or multithreading (to run two or more threads simultaneously to better utilize the processor resource while one thread is waiting for data to come from memory) can be very important to increase the sustained performance on an application.

Finally price/performance can also be important criteria. Indeed, if an application have been parallelized and can make efficiently use of a large number of processor, using many cheaper nodes is sometimes a better option than using fewer expensive ones, although the cost of the interconnect has also to be taken into account.

Interconnect. As we have just seen, applications which have been parallelized can use a some number of nodes integrated in a cluster though an interconnect. This interconnect between the nodes is the vehicle which transports the messages between the tasks insuring the coherency of the computation. It plays an important role since the parallel efficiency of the application and its overall performance depends on its characteristics, and larger the cluster larger is the impact.

There are today several types of interconnect which can be used in a cluster and we will classify them depending on the type of interface used to plug the adapter in the node.

Some adapters use a standard PCI (or PCI-X, PCI-Express) interface and can therefore be connected to different type of nodes. In this category we find Ethernet (Gigabit Ethernet and now Ethernet 10Gigabit), Myrinet2K and Myrinet10G from Myricom

[25], QsNet I and QsNet II from Quadrics [38] and InfiniBand (4X and 12X) proposed by several vendors [4, 47].

Some adapters and interconnects will use an interface specific to a given processor or node. In this category we find Pathscale [32] and Cray XT3 Scalable Interconnect [49] using the HTX slot of the AMD Opteron servers, HPS from IBM using the GX slots of the POWER4 [18] and POWER5 servers [36] and NUMAlink from SGI for the Altix systems [27].

A new approach which is emerging is to use a standard interconnect like Ethernet or Infiniband, and use specific adapter (and protocol) to provide better performance (usually smaller latency) than using the standard adapter and protocol interface. Infinipath from Pathscale is an example of a low latency Infiniband adapter and protocol [32]. Low latency Ethernet protocols are also emerging [12].

All those interconnects have different point to point latency and bandwidth, collective communication performance and scalability (capacity to build a large efficient interconnect). Depending on the application characteristics which may or may not need some of those characteristics, the initial large choice of interconnect will narrow down to a very few which best fit functionality and price/performance.

Software components

The software components of a cluster are the basic operating system, compilers and libraries which run on a single node and the management software, the parallel environment, scheduler and file system which run on the whole cluster.

The basic operating systems used in HPC clusters are today Linux and UNIX, with some presence of Windows. The choice regarding the operating system is usually enterprise or application driven. We won't discuss

here the pros and cons of each of them knowing Linux is becoming the operating system of choice for HPC clusters due to the many Open Source software available, UNIX is used in large production environment and Windows in some GRID environment because of its ubiquity on the desktop.

Management software hides the complexity of managing many different systems to reduce the administrative task and to better control the cluster.

For example, the capability to create events that will trigger automatically an action if the condition is raised, is an important feature which not only simplifies the management of the system but also increase its stability and fault tolerance. Progressively many solutions have appeared in this area of management, some being licensed products specific to a vendor or a system like CSM [5], some being Open Source like Ganglia [14], OSCAR [29] or Rocks [40]. Key differentiators between those solutions are about fault tolerance and resilience.

Parallel environment provides the user with tools to develop and execute parallel applications on the cluster. All of them include now a version of MPI and the key differentiator is in the quality of the tools and the performance of the MPI implementation. As for the management software, there are some licensed products specific to a vendor or a system like IBM Parallel Environment [30] or SGI Message Passing Toolkit [24], some being Open Source like MPICH [23] and more recently OpenMPI [28].

Global file system and global parallel file system have become a very important component of the cluster as clusters run production jobs which work on large amount of data. could not scale well on clusters where IO was managed by NFS. As we have seen for the management and parallel environment software, some solutions are Open Source like PVFS [31] or Lustre [43] , some are licensed products like IBM GPFS [16] or SGI CXFS [8]. A new trend is also emerging in this area of global file system where geographically distributed clusters need to access transparently and efficiently the data wherever they are [9].

HPC applications

From the mid 80s to the mid 90s, many applications were ported to parallel distributed memory systems using the message passing libraries available at that time. Then, as standardization and commoditization was taking place in the late decade, those applications have been ported on clusters using MPI.

Many of these applications have been now ported to GRIDs but there are also some new applications which have emerged in GRID computing and didn't exist before. HPC applications can be classified into several categories according to the above distinction.

Classic applications

Those applications have been using HPC resource since its early days. Most of them have evolved from vector to parallel systems and again to clusters enabling finer and cheaper simulations. Those applications have been used by large public research or industrial customers to simulate real systems (flow around a body , engine combustion, structural analysis, crash simulation, chemistry, material science ...), to forecast the behavior of complex systems (weather prediction, climate modeling ...) or to analyze large amount of data (seismic processing, image and signal processing, encryption/decryption ...). Depending on the application characteristics, these applications run today on:

- Clusters of SMPs with high speed interconnect. In this category we find mostly applications of the first and second type (simulation and forecast). The type of node (number of CPU per SMP, type of processor) and the type of interconnect used in the cluster will be made according to the choices described in the previous paragraph.
- Clusters of SMPs with Ethernet interconnect. In this category we find mostly applications of the third type (data analysis) which are for the most part applications that are inherently parallel (also called embarrassingly parallel) and can therefore run a on cluster of SMPs with few CPUs per node and a high latency interconnect. In this category we find also applications that have not been parallelized on distributed memory systems and can only run on an SMP preferably with large amount of memory and no need of high speed interconnect.
- Vector multiprocessors. In this category we find applications in the three types above (simulation, forecast and data analysis). Usually these applications have not been parallelized on distributed memory systems or are efficient enough on a vector system to make it price competitive with clusters. Few applications still run on these systems since many of them have already migrated (or are been migrated) to clusters of SMPs.
- Massively parallel systems. In this category we find mostly applications of the first and second type (simulation and forecast). These applications have been highly optimized on distributed memory systems and scale so efficiently they can run on a very large number of processors (typically a thousand or more). Due to the performance those applications can reach on such systems [2, XT3], those applications solve problems which are totally out of reach of the all above systems. In some cases, the applications running on massively parallel systems are "modern" applications, as described below.

Modern applications

Modern applications are applications which didn't use any HPC resources 25 years ago but do it today because either HPC systems available at that time didn't perform well enough for these applications or the type of problem they were solving could be solved on a personal computer. And they use HPC systems today because the systems available now enable those application to solve new and important problem. Some of those applications belong also to a new type of parallelism called "ensemble" computing where the same program is run on many different data sets to perform searching or pattern matching like in biology/bioinformatics area, or to perform stochastic calculations like in finances area. This type of applications leads to very large amount of computation and very few communication and therefore suits very well clusters of small SMPs or even to GRIDs of personal computers.

Sal Oppenheim [42] is an example

of cluster computing in finance doing risk exposure evaluation, Novartis [26] in GRID computing applied to bioinformatics doing virtual screening and Magna Steyr [21] in GRID computing applied to automotive doing clash analysis.

An example of GRID computing designed for collaboration and resource sharing is the World Community Grid (WCG) [48], a global humanitarian effort (launched by IBM and several scientific, philanthropic, and educational organizations), which applies the unused computing power of individual and business computers to humanitarian efforts. The WCG's first undertaking is the Human Proteome Folding Project, which hopes to identify the proteins that make up the human proteome in order to better understand the causes and potential cures for diseases such as malaria and tuberculosis.

Future applications

Future applications are not in production today because either they would be too costly to be implemented or some of the technologies needed are not mature enough.

One example of such applications is the real time control and optimization of large and complex systems leading to better business decisions or better utilization of natural or industrial resources like electricity, gas, petroleum or water. Based on real time information gathered from different source including sensors, very complex optimization which are now done periodically based on historical data will be done in the future in real time to better control and quicker reaction to changes in the system. Such real time optimizations require enormous amount of computation which are today impossible not only for cost reasons but also due to the lack of real time data.

More generally, new applications will emerge at the convergence of major technologies like digital data acquisition, computational science and computer architecture.

Business

The most usual way HPC impacts business is when technology and application lead to new solutions enabling much more computation per euro or dollar, bringing cost down and more calculation at constant budget. All classic applications are in this category: seismic processing where better simulation enables more accurate prediction where to drill for oil, crash simulation where finer simulations reduce the development cycle to design cars complying to stronger safety requirements. These examples show how HPC can directly enable more efficient business. HPC can also enable safer environment like in weather forecast where a better prediction help prevent natural disasters and therefore reduce the cost of related damages.

Another way to impact business is by creating new technologies enabling new populations and new uses of High Performance Computing.

The best example of such new technologies is GRID computing and web portals. GRID computing technology enables new calculation to be performed because a community is putting together a set of resources than can then be used to perform some large HPC calculation. SETI@HOME [44] or WorldCommunityGrid.org [48] are examples of such a community on the Internet. This paradigm can be applied also to the Intranet of a company. Pharmaceutical company Novartis did boost its bioinformatics research using the cycles of its unused PC is an example of Intranet GRID computing. Magna Steyer did the same to reduce the development cycle automotives by allowing clash analysis to be performed interactively enhancing design quality and speeding up design cycle. Web portals enable also new users to access HPC resource through simple web interfaces. GRID computing and more generally Virtualization can be applied to better utilize existing resources that have been installed in different locations for geographic or historic reasons and can be integrated as a global resource. Using such technologies each department, branch or subsidiary of the enterprise can access independently of its location all the resource of the enterprise increasing the productivity and the resilience of the HPC service.

High Performance Computing can also transform business by introducing new business models. Computing as a service which has been introduced in 2004 by IBM with DCCoD (Deep Computing Capacity on Demand) [10] has been a major step. In this offer a customer is buying computing resources on a remote system which he does not own nor manage. He can therefore adjust its computing resource to its needs as costs are based on a cpu/hour rate. This approach was then followed by some other HPC vendors.

A step further is to propose the application and the computing resource "on demand". In this case the customer is buying both the software license and computing resource according to its business needs. A few ISVs (Independent Software Vendor) are starting to propose such solutions like SmartOps, QuantumBio, RenderRocket and Exa Corporation [11].

Conclusion

High Performance Computing has been evolving tremendously since its appearance in the mid 70's moving from a monolithic and costly solution to a pervasive technology enlarging progressively its scope of application and transforming industries in the way they do business Those evolutions are due to the convergence and interaction of many technologies (semiconductor, microprocessor, system architecture, software, middleware and application). This trend will go forward with the integration of new technologies like real time data acquisition, creating new paradigms and new business.

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Informatics Profession

The Changing Landscape

Karen Price

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There are few aspects of business today untouched by the impact of technology. This has immense implications for the role of the IT professional. No longer tucked away in a basement, today's IT professional operates at the heart of the business. The author looks at developing professionalism through skills.

Keywords: Changing Roles, IT Professionalism, Skills.

With this changing role comes an increasing need for IT professionals to demonstrate high standards of professional competence and achievement. Professionalism is linked inextricably to skills.

e-skills UK is the employer-led Sector Skills Council for IT and telecoms. We bring employers together with government, education and other stakeholders to address important IT skills issues no party can solve on its own.

What are these important skills issues and how do they contribute towards establishing IT as a recognized and valued profession?

If we look at IT performance at its best, we find IT professionals with sophisticated technical knowledge able to understand and communicate the business benefits of IT.

We find people who can effectively develop and implement IT strategy, in the context of business competitiveness and opportunity. We find people who can run projects and support a company through IT-enabled change. All this demands a broad and sophisticated skill set covering technical, business and personal skills.

The education and training sector has an essential role to play in developing the knowledge and skills IT professionals require. Around 80 per cent of IT professionals employed in 2005 will still be part of the workforce in 2012.

It is vital that they are encouraged and able to develop their skills throughout their career. At the same time, employers need to work together with education and government to ensure that young people in full time education acquire the IT-related skills and knowledge that meet future business needs and provide rewarding careers.

The changing skills landscape

To establish a world leading IT profession, we need to identify the areas of knowledge and skills required by IT professionals over the next five years and beyond, and look at how we can best meet those needs. Is the education system designed to help young people develop the right skills for employment? Are qualifications world class and respected? Do employers understand the training needs of their staff and how to address them? Does government policy support emerging employer skills needs?

e-skills UK and Gartner have undertaken a major review of the IT skills landscape in the UK. This work revealed the key trends impacting on the IT workforce over the next decade and the associated implications for skills.

The key trends identified include the increasing globalization of business – with outsourcing and geosourcing impacting greatly on the profile of the IT profession in the UK; increasing technology standardization; the implementation of new channel strategies; remote and collaborative working; an increasing focus on privacy and security; and the transformation of IT into a utility-style service.

The boundaries between an IT manager and a business manager are becoming less distinct. IT professionals can find themselves embedded

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within business units, and business managers can find themselves working in IT departments. This has far-reaching implications for the structure of IT departments within companies and the potential career paths open to individual IT professionals.

Addressing skills needs

The study undertaken by e-skills UK and Gartner underpins the e-skills UK Sector Skills Agreement for IT – a ten-year vision supported by a three-year action plan to meet future skills needs and close the UK's productivity gap with major international competitors.

The work of e-skills UK focuses on four strategic objectives: improving the attractiveness of careers in IT; preparing the future IT workforce for successful employment; helping the current IT professional workforce to meet the changing needs of the market; and addressing skills infrastructure matters through policy influence and the reform of standards and qualifications.

Qualifications reform is at the heart of the 'professionalization' of IT. IT professionals and their employers need access to valued and respected qualifications and continuing professional development that meets their needs and career aspirations.

As the custodian of the UK's National Occupation Standards for IT & telecoms, e-skills UK is developing the overarching Sector Qualifications Strategy for IT, which will provide a coherent framework for all IT-related qualifications.

The role of SFIA

e-skills UK has worked with BCS, the Institution of Electrical Engineers and the Institute for the Management of Information Systems to develop the Skills Framework for the Information Age (SFIA). It is a recognized and comprehensive classification of the skills required by IT professionals. It includes descriptions of what should be expected at different levels of expertise.

In November 2005, e-skills UK introduced the SFIA Profiler, an online skills management tool that allows companies to navigate easily through SFIA while benefiting from SFIA's universally recognized definitions and skill descriptions.

To prepare a future workforce that meets high professional requirements, we need a world class education system that reflects employer needs in terms of technical and business knowledge and employability skills.

e-skills UK has developed the honours degree in Information Technology Management for Business (ITMB) in partnership with employers such as IBM, Dell and Morgan Stanley. Now in its inaugural year at four universities, ITMB has a strong focus on team work and managing real projects. Graduates will enter the workforce able to make an immediate contribution to business productivity and success.

e-skills UK is also working with employers, education and qualification bodies to develop the new Specialised Diploma in the IT line of learning for 14 to 19 year-olds in full-time education. The Diploma will comprise a challenging and business-relevant programme of learning that effectively prepares young people for higher education and IT professional and business-oriented careers.

And to address the ongoing challenge of attracting talented people from all sectors of the population into IT, the awarding winning, after-school Computer Clubs for Girls (CC4G) are transforming the attitude of a generation of 10 to 14 year-old girls to technology. By 2008, CC4G will have reached 150,000 girls in 3,600 schools.

Conclusion

The role of the IT professional is changing. Whether working within the IT industry or in an IT role in another sector, IT professionals need to complement advanced technical knowledge with the business, communication and team working skills that enable them to operate effectively at the heart of the business. Education and training are vital in achieving this.

e-skills UK and Gartner reviewed the IT skills landscape in the UK. These are the key trends impacting on the IT workforce over the next decade and the associated implications for skills:

- Globalization of business.
- Technology standardization.
- The implementation of new channel strategies.
- Remote and collaborative working.
- An increasing focus on privacy and security.
- The transformation of IT into a utility-style service.