Building Open Ecosystems for Collaborative Creativity

Peter Hanappe

Abstract

The fact of openly sharing creative works on the Internet may have a profound impact on the contents industry. A new ecosystem may emerge, with the potential to take over an important share of cultural production. If it is to reach its full potential, however, a better understanding is needed both of the incentives for participants and of the technical tools for supporting and stimulating this ecosystem. Social aspects and intellectual stimulation may outweigh financial rewards as the main reason why authors participate. If we succeed in accentuating these aspects, we may see the development of a collaborative creativity that is a hopeful answer to alarmist views on the commoditisation of culture.

Introduction

Recently, I have been listening a lot to *icotec*'s music. icotec is a Norwegian artist who makes Drum'n Bass music. I have about 40 songs of his on my computer, all of which I have downloaded from the Internet. I downloaded these songs legally. I did not get a "ripped" or illegal copy that someone had made available. No, icotec puts his music on the Web for free – almost four CDs' worth. Since I enjoy his music, and I assume others do too, why, then, did icotec choose to make his music available instead of signing a contract with a music label? When I asked him, he said: "... because of a very simple reason: I enjoy it greatly. I'm not so occupied with the thought of earning money from the music anymore – I guess I try to follow the flow of what entertainment on the Internet is all about, so I merely want to be a part of that".

There are many more musicians like icotec who make their music freely available. I don't have any precise figures to illustrate the size and importance of this free music phenomenon. Let me just mention two websites: ElectronicScene.com and Magnatune.org.[1] Over little more than a year, the number of MP3 files downloaded on ElectronicScene more than doubled to over 140,000 a month.[2] ElectronicScene hopes to have one million

[1] For an overview of other free music sites, see also reference [41], below.

[2] This number does not include the files that are streamed, i.e. that are played immediately without being saved to disk. The number of files streamed per

unique visitors annually by the end of the year. The site has become a victim of its own success, and access to it has currently been restricted until an improved infrastructure is in place. What is surprising is that the site is run mainly by a single person, Gideon Marken. The second website, Magnatune.org, started only in 2003, and about a year later 160 artists have made almost 4,000 songs available. Although the size of these two sites is not comparable to the size of the music industry, they are steadily growing.[3]

The Internet, as a distribution medium, challenges the established distribution channels for content. The uncontrolled sharing of content on the Internet has triggered a widespread debate on copyright. The purpose of copyright is to stimulate the broad availability of an extensive creative production.[4] It does this by giving the author of a work a monopoly. With this monopoly, the author can ensure she gets a financial return on her work. By making content freely accessible, however, an author undercuts a possible source of income. In such a situation, are there still enough incentives for authors to create works? If so, what are they?

In this article, I discuss what I call open ecosystems for creative collaboration or, in short, creative communities. I analyse the production and free dissemination of creative works in a connected society. I will try to take a broad view. There has been a lot of discussion in the press about music distribution. But distribution is just one aspect of the creative process. Instead, I think it is essential to take a step back and analyse all interactions and exchanges between participants. In particular, I will consider the incentives and rewards for authors, reviewers and the audience. Only when we have a good understanding of the whole ecosystem can we make interesting, new propositions. This text does not aim to offer conclusions or solutions. I think it is too early for that. However, where possible, I will refer to concepts found in the social and economic literature that may help in constructing a theoretical framework.

The text is organised as follows: in the next part, I discuss various issues that relate to the current discussion, including Free/Open-Source Software and the Creative Commons. I will also give a brief overview of alternative forms of *capital*, that is, alternative forms of resources that can be invested, and the returns on those investments.

The second part focuses on creative communities. First, I will analyse the incentives for authors to participate in creative communities, and secondly, I

---

month is over 80,000.

[3]In 2003 the RIAA shipped about 800 million units – CDs, cassettes, music videos, etc. – and brings out close to 30000 new albums each year [44, 52 and 5]. Compare also with Apple's iTunes Music Store, which sold 70 million songs in one year in the USA alone and offers a catalogue of 700000 songs [4].

[4]This is made clear in the initial discussion of copyright and is confirmed by subsequent statements of the American Supreme Court. See also [2].

will discuss the technological aspects and see what tools may be needed to support creative communities.

In the last part, I will present experiments designed to observe some interactions. These experiments are very tentative in their approach. From them, I hope to gain a better insight into the possibilities and requirements – but also the obstacles – associated with establishing creative communities.

1 Current topics / current state

This section discusses several issues that are relevant to the present text. First, I will review various forms of capital found in the literature of economics and sociology. Then I will analyse two distinct *ecosystems*: the traditional music-business model, and the exchanges in the Free/Open-Source Software communities. I finish this part with a short presentation of the Creative Commons project.

1.1 Forms of capital

Later in this text we will discuss incentives for authors to create works. These incentives are generally understood to be financial reward. Indeed, the copyright law was introduced to ensure such a "fair return" to authors for their work. Since I will examine an alternative form of content production and distribution, it is worthwhile examining alternative forms of capital, other than financial. Capital is any form of resources that is invested and that yields a return on the investment. Capital refers to the initial resources invested, but also to the profits made. Marx's description of the production cycle led to the classical theory of capital. According to this view, the capitalist converts money into means of production and engages labour and land to produce commodities that are sold in the marketplace in order to yield a profit. Capital then refers to the physical means of production, such as the factories and the raw materials. Over time, the definition of capital has been broadened. Of interest to us are the theories on human and social capital. The following overview is largely based on Nan Lin's text [32].

Human capital arises from an investment in knowledge and skills. Through education and work experience, a person invests in human capital. The return on the investment is obtained through the labour market where job positions and salaries are negotiated. In the classical theory of capital, labourers are replaceable and are paid the minimum wage necessary for their subsistence needs. In the human capital theory, labourers acquire skills that allows them to negotiate higher incomes that more than cover their subsistence needs. Human capital is thus an investment with expected returns.

The second form of capital discussed is social capital. Social capital is an investment in social relationships. The return on the investment is the higher chance of success when a person engages in a purposeful action. An example of such an action is applying for a job. Whereas human and cultural capital are associated with the players themselves, social capital is associated with

the player's social relations. Through these social relations, the player may access resources that are otherwise unattainable. I will say more about social capital in section 2.1.3, on incentives in creative communities.

These new theories regard capitalisation as a process that engages both players and hierarchical structures. They describe the choices made by those players to obtain better positions within those structures. These theories focus on processes that are associated with a person and in which individual actions play an important role, in contrast to the macro-level analysis of classical capital theory.

With a better understanding of various forms of capital, I will now analyse two distinct production models for creative works. The first analysis concerns the traditional music-business model. The second analysis discusses Free Software, or Open-Source Software.

1.2 The traditional music-business model

Since the invention of the phonograph by Thomas Edison in 1877, it has been possible to record sound onto a physical medium. Over more than a century, many different recording technologies have been introduced, but one thing they all have in common is that the audio recording is fixed on a physical medium. The physical media – the disks and cassettes – can be distributed and sold. They have become the basis of a new industry, the recording industry: musicians make a recording, the record company copies the recording onto disks and sells the disks through music retailers.

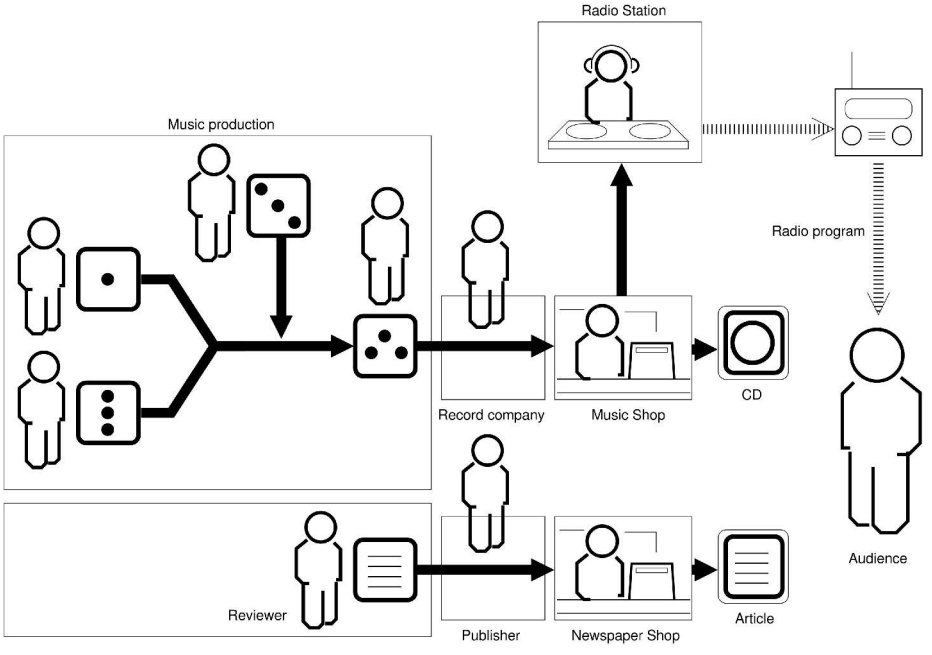


Figure 1: A simplified view of the flow of music and reviews in the traditional music-business model.

The picture I will draw of the traditional music industry will necessarily be simplified. I am interested in tracing the flow of ideas and contents, and the types of benefit to those who participate in the system. In most cases, the recording is the work of many people: musicians, composers, arrangers, song writers, sound engineers, and many more. There are many possible types of collaboration, contracts and intermediaries between these participants, but ultimately the most important contract is the one with the record company. The record company oversees the production, distribution, sales and promotion of the recordings. In parallel, the music also reaches an audience through radio stations and TV channels. The written press, radio and TV also play an important role as reviewers, by making a selection and publicising their appreciation of available music (see Figure 1).

Concerning the benefits to participants, I will discuss mainly the financial reward. The record company hands back to the authors a percentage of its revenue from a recording, i.e., the money it has obtained by selling it. From the sale of a $14.98 CD, an artist may expect an (all-in) royalty of $0.447 [28] (see also [21]). A second stream of revenue comes from performing-rights organisations, which tax radios and TVs on their broadcasts. For many artists, income from the sale of their recordings is small and probably only a few authors can live off that alone. This means that other benefits must also play an important role. The journalist is paid by the publisher, often a fixed amount for every published article. The audience is in it for the enjoyment of the music, of course, but probably not only that. Listening to music or discussing it with others – the social aspects – may be an important factor too.

I would like to make a couple of observations. First, in this model, there is little direct feedback from the audience to the authors. The audience are very much at the receiving end of the distribution channels. Secondly, even though the organisation of the music production may be very ad hoc and may involve many people, in this model the record labels play the central role. Lastly, the audience has no simple way of seeing how the recording is structured – i.e., how it was composed and recorded – nor can it reuse any of those components. The end products – the recording, the reviews, and also the radio programmes – come in a non-editable format.

In this short overview I deliberately did not mention the concerts and other public performances by the artists. The characteristics of these public performances are sufficiently different from those of the recordings to be treated separately. Certainly, concerts are part of the ecosystem, as they strongly influence record sales, and vice versa. However, creative communities – the subject of this text – may have a bigger structural impact on the recording industry than on the concert scene. In fact, while the free music phenomenon seems to increase ticket sales for concerts, it does not significantly alter other aspects of a concert (for some accounts, see [21, 42 and 33]).

Before I continue with the next section, I would like to mention the changes currently affecting the recording industry. I will start by introducing the term *excludable*, which is used by economists to refer to goods[5] for which it is possible, or not too costly, to prevent someone from enjoying that good. For example, the good "going to a concert" is excludable because it is easy to sell tickets and have someone check the tickets at the entrance to the theatre. The classical example of a non-excludable good is a lighthouse: it is too complicated to make passing boats pay a tax to cover the cost of the lighthouse and prevent boats that do not pay from passing. Lighthouses are, however, very useful. They are therefore provided as a "public good".

A musical recording on a physical medium is excludable: it is impossible for anyone to obtain the disk without being noticed, as you have to go to a music shop to buy one.[6] This changed, however, with the advent of digital audio and the Internet. It has become common to distribute music worldwide, and it is very costly to prevent someone from doing so. Music recordings are no longer excludable, which makes the old business model harder to maintain. The solutions that have been proposed to remedy the situation all aim at reintroducing excludability. A first category of solutions seeks to ensure that only the person who bought the music, and no one else, can play her copy. These solutions are based mainly on encryption technologies and try to reduce the possibility of copying a work [50, 34, 15 and 24] (see also [3 and 38]). A second category of solutions tries to make the contents "traceable" so that when the music becomes freely available on the Internet the authorities can trace the file back to the original buyer. These solutions embed some personal information about the buyer in the music, and are often called watermarking. Both solutions are generally referred to as Digital Rights Management or DRM. The introduction of DRM may come at a high cost, but when it is successful it allows the recording industry to translate the old business model to the new medium of the Internet.

1.3 Free/Open-Source Software

This section discusses a very different "business" model, that of Free and Open-Source Software, or FOSS. Although most people may not regard software as typical "content", it is nonetheless protected by copyright law. Since the FOSS philosophy is inspiring people outside the realm of software, it is important to have a better understanding of this phenomenon.

Free/Open-Source Software is software that is protected by a specific licence, a Free Software or Open-Source licence. What these licences all have in common is that they give anyone the right to use, copy, modify and

---

[5] Goods are products in economic parlance.

[6] It is possible, of course, to copy a cassette or a CD. However, this copying has always remained fairly marginal and was mainly limited to copying for friends and family. Large scale copying for retail, however, was traceable and actively pursued legally.

redistribute the source code of the software.[7] FOSS licences are legally rooted in copyright law. The author of the software claims the authorship of the source code, and the work is thus protected by copyright law. This gives the author a monopoly of the distribution rights to the source code. Using these rights, the author then guarantees the "freedom" of the code. The freedoms granted include the freedom for anyone to run the program, study how it works, adapt it to their own needs, redistribute copies, or improve the program and release these improvements to the public [47, 22].

The FOSS movements began with a philosophy and a licence, but over the past twenty years it has evolved into a complex ecosystem for software production and distribution. Consider, for example, SourceForge.net. This has become the biggest exchange platform for FOSS: it hosts more than 80,000 software projects and has over 800,000 registered developers. Consider also the *distributions*. Distributions compile and bundle software to form a coherent system.[8] The Debian GNU/Linux distribution, for example, is developed by 1,308 people, providing 8,710 software packages for 10 distinct hardware architectures.[9] The Debian project also has it own constitution and voting policy. This illustrates how much the ecosystem has evolved beyond the initial licensing scheme.

---

[7]The distinction between Free Software and Open-Source Software is largely philosophical. For Free Software advocates, the freedom to access the source code is an ethical issue. For Open-Source advocates, this access is more an issue of praxis and methodology: "[The Open Source Initiative] is a pitch for 'free software' on solid pragmatic grounds rather than ideological tub-thumping" [23]. I will not go into details in this text. The interested reader can consult the following references: [48, 43 and 6].

[8]Distribution offers much more than just binary versions of software. A software application often depends on other software applications or software libraries. The distribution keeps a list of all these dependencies and ensures that all the correct versions of the required software is installed. It also provides installation media – CDs, DVDs, diskettes – and installation *scripts* that help the user install and configure the software and ensures that the software integrates well with the existing setup. They also provide security updates, documentation and communication channels for support and debugging.

[9]The figures are for the "stable" release. The "testing" release contains more than 15,000 packages.

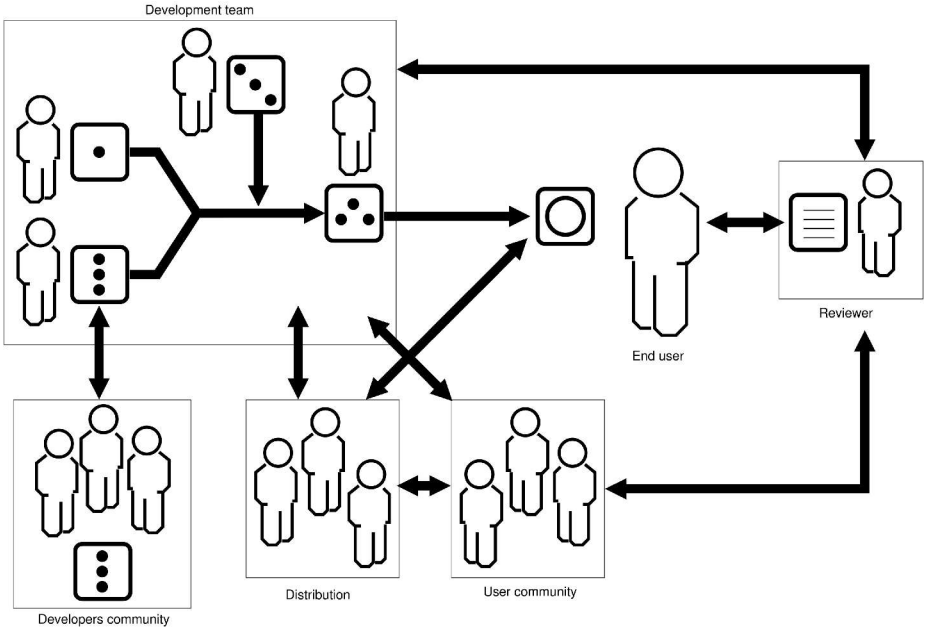


Figure 2: The various roles in the FOSS system and the relations between them.

The developers of FOSS software are often a "loosely-knit team of hackers across the Net".[10] The software is a collaborative effort but the participants are in general very clearly defined, and each developer often manages one particular module of the software. The core development team interacts with a larger development community. This community provides feedback and enhancements, and often modifies the software for its own purposes. It regularly happens that a developer from the community joins the core developer team. The software user may obtain the software directly from the core developers and may also interact with them directly. Most users, however, install the software provided by a distribution. The organisation that manages the distribution itself involves many people. These distributions may be commercial – selling the compiled software as a service – or they may be managed by a community, such as Debian.[11] The user community is often in close contact with the developers and the distributions. They provide feedback, enhancements and documentation and offer help to other users. Lastly, there are also people who review software, describing the merits and inconveniences of alternative software solutions, or documenting the complete software setups. Many of these reviews are published on the Web although commercial, paper editions are available. Interactions and exchanges between all these participants take place mainly on the Internet, through websites and mailing lists. When we look at the financial benefits for

[10] A *hacker* is a developer. The term has been misused in the media and, as a result, has gained a negative connotation.

[11] For an overview of available distributions, see http://www.distrowatch.com.

the participants, it is clear that they are not very substantial. Users may pay for a distribution but all distributions, even the commercial ones, can be obtained for free. The Hacker Survey indicates that 30% of developers are financially compensated for their contributions. These developers are mainly professionals who need FOSS for their work or are paid by their employer to develop FOSS [29]. That leaves 70% of developers contributing for reasons other than financial. I will talk about some of these incentives in section 2.1.

1.4 Creative Commons

Creative Commons was founded in 2001 and is "devoted to expanding the range of creative work available for others to build upon and share" [11]. Inspired by the FOSS licences, the Creative Commons project proposes a set of licences that authors can use for their work. Under all these licences, the work in question can be copied, distributed, displayed or performed in public or on the Web, or converted to another format. Certain other rights, however, can be reserved by the author. For example, an author can stipulate that their work must not be used for commercial purposes without their explicit consent (the *non-commercial* clause). This means that if, for example, a company wants to use a recording – released under the Attribution/Non-Commercial License – in an advertisement, they will have to negociate the contract and terms of use with the author.

It is difficult to evaluate how well the Creative Commons licences are currently being adopted. In many countries, they are being adjusted to national jurisdictions: they have been introduced in Brazil, Germany and the Netherlands, and translations for many other countries are underway. As an illustration: the BBC plans to make its archive available under a Creative Commons licence [10]. And Magnatune, mentioned earlier, publishes all music under a Creative Common licence.

2 Open Ecosystems for Collaborative Creativity

What do I mean by *open ecosystems for collaborative creativity*? In this article, I focus on two issues: 1) incentives and reward in creative communities, and 2) the technologies needed to support and/or stimulate the establishment of creative communities.

Before I start, let me try to characterise open ecosystems for collaborative creativity. The main constituents of this ecosystem are the participants and the works. On a higher level, we find the organisation of participants and the process of creating the work. First, the works. In an open ecosystem, these works can be distributed, modified, enjoyed, reused freely, possibly with *some rights reserved* as discussed in the previous section. So the content is fairly "open" and resides in a shared space. The second point concerns the participants. Compared with the ecosystem of the traditional contents industry, there is probably a freer exchange, and all participants have more opportunities to add value to the creative process. Also, the various roles in the organisation are not strictly defined or distinct. As Steven Weber puts it,

in relation to FOSS: “there is no consciously organized or enforced division of labor. [...] Users merge into the production process itself in profound way” [51]. The last point concerns organisation. It will probably be a distributed organisation without centralised control. Instead of a one-way channel from authors through publishers to the audience, there will be a more open exchange between all participants. Since the notion of a finalised product disappears, the creation process may generate multiple intermediate versions of an idea in a work rhythm that knows no stringent deadlines. This characteristic has produced a work methodology for software development that is quite different from the methodology that prevailed in commercial software development. Although these characteristics may seem very general, they represent a major shift from the established model.

A form of collaborative creativity can also be found in the development of the Web. Someone publishing a HTML page is and remains the sole author of the page. No one can modify it. However, the HTML code of the page is visible to anyone and can be reused to create new pages. The openness and decentralised nature of the Web stimulate exchange and creativity.

Collaborative creativity does not mean “collaborative works”. Every author retains sovereignty over her own work and does not have to participate in discussions on it. A large body of literature exists on collaborative writing, for example. That is not what is meant in this text. Having several people writing a poem together is unlikely to yield a great result. However, having people give feedback to the poet or create new versions of the poem can be stimulating for all and may translate into a new and interesting work. Collaborative creativity, then, probably has more to do with the established practice of peer reviewing than with collaborative writing.

Open ecosystems for collaborative creativity is not the same as the Creative Commons. The “creative commons” refers to the shared works or the abstract space in which these works reside. However, putting a work in this space, i.e. publishing it under a Creative Commons licence, is not in itself enough to maximise the possibilities for collaborative creativity. Other aspects, both technical and social, should be taken into account. In the text below I will address some of these aspects. The point I want make is tha, for FOSS, a licence may have been sufficient to get the movement going. For creative works, however, we may need more than just a licence. In this text, I make a modest attempt to gain a better understanding of how creative communities may function. I will concentrate on two issues. First, I will discuss the incentives for people to participate in creative communities. Then I will focus on the technological aspects of creative communities.

2.1 Incentives in Creative Communities

When considering collaborative creativity, we need to ask what the benefits to the participants are. The following discussion in organised around the various types of capital discussed earlier.

2.1.1 Financial reward

I begin this section with two observations about FOSS. First, it seems to me that the software landscape is growing more and more polarised between commercial software and FOSS. Both commercial developers and FOSS developers defend their ground, very vocally. The result seems to be that there is almost no middle ground any more. A second observation is that FOSS did not start out with a clear business model and will probably never have one. FOSS licences do not rule out the possibility for the author of a program to sell the software and earn an income from that. But as a FOSS licence grants everyone free access to the software, income from sales only is practically impossible. If direct, financial income for FOSS writers is difficult, indirect income may be possible.[12] Even if that is the case, I think it is fairly safe to say that, although the *utility* value of FOSS is comparable to the utility value of commercial software, the revenue streams generated by FOSS are probably only a fraction of those generated by commercial software. As a result, the majority of FOSS developers never see any financial income from their work.

Does this mean that something similar may happen in the contents industry? Possibly. On the one hand, digital-rights management technologies aim at a very closed and protected delivery of content but can ensure some direct income to the artists. On the other hand, the Creative Commons provides content free of charge and, like FOSS, still has to prove that it can provide authors with a financial reward. However, it may be easier to establish a middle ground than in the case of software. First, it is important to note that it is currently not easy for musicians to earn money in the old business model either, as we have seen in section 1.2. Finding a record label to distribute the music is time-consuming, and the financial return from such a deal is often very small. Making the music available for free is not

[12] Some projects, like MySQL, sell support. Others make the documentation proprietary and sell it as a service. This is the case with jBoss. (However, the Free Software Foundation disapproves of making the documentation not free [17]). Even for companies selling support, since the core product – the software – comes almost at no cost, customers may be less willing to pay more for the extras [9]. Companies benefit from FOSS probably because of the reduced budgets for writing and maintaining their own software. According to Eric Raymonds, more software is written for use than for sale [43]. If this is the case, using FOSS may reduce the internal costs of software development. Also, making the software a commodity may help to increase revenue from complementary products such as hardware or support services [46]. This seems to be the strategy of both Apple and IBM.

necessarily a big financial loss for many musicians. As icotec says: “Another reason [for making music available for free] is that it’s simple, it doesn’t require too much time for my part – I only need that time for composing new music and to upload it as MP3 files”. (For a discussion on this issue see also [7 and 8].) However, if the traditional music industry can reduce the cost of transactions and contracts, they may be able to deliver the same advantages but still guarantee some income [25].

A second point, which may prove to be less important than I think it is, is that right from the beginning Magnatune.org has made it possible for the audience to buy an album even if it is freely available – they can even set their own price, between $5 and $18. However, the fact that this option has been introduced from the start, and in an organised way, may make it easier for people to adapt to this mentality. Some FOSS developers include a PayPal link on their website and ask for contributions (SourceForge now adds a “donate” link on the project pages), but for FOSS this option seems much harder to introduce so late in the day. People also feel a very different attachment to content and to software. Some people may have very strong feelings about the software they run on their computer, but for most other people software is nothing more than a utility. Creative works, however, are valued mainly for the experience they provide. Providing better-quality audio recordings, for example, may be a service for which people are willing to pay (“Water is free, but a lot of us drink bottled water because it tastes better” [20]).

Public funding schemes may also gain in importance. Although there are many political and financial hurdles blocking the transition to generalised public funding schemes, some do already exist, which should simplify future extensions [16, 14]. There are also some interesting alternative propositions, such as the Street Performer Protocol or the Potato System. These solutions are largely untested, but they do leave some terrain to be explored [26, 19].

Designers of peer-to-peer file-sharing applications are also studying how to introduce micro-payments.[13] Peer-to-peer applications struggle with “free riders”, people who take advantage of the system but do not contribute to it. This work may yield new solutions for payments on the Internet [1, 37, 35].

Using the non-commercial clause in the Creative Commons licence, authors can retain the right to stipulate that a work cannot be used freely for commercial purposes. If someone wants to use it for commercial purposes, she has to negotiate a contract with the author. Commercial uses include advertisements, commercial films and commercial CDs. It may also include use on commercial TV and radio, or in bars or shops.

Although the fact that content is freely accessible seriously reduces the possibilities of making direct income, the situation may not be hopeless. There are still many possibilities to be explored.

---

[13] Micro-payments are not necessarily financial: they can be a service – for example, providing disk space for others, or doing some computation.

2.1.2 Skills and human capital

The Hacker Survey by the Boston Consulting Group questioned 684 FOSS developers on their motivation for participating in software projects. The top two reasons given by the hackers were that the code they wrote for the project was intellectually stimulating, and that it improved their programming skills. Ninety-two per cent of the interviewees mentioned that the increase in their personal knowledge base was the most important benefit of participation [29]. This is an important fact. It suggests that many creative people are not "in it just for the money". Rather, it suggests that learning, skill improvements, and fun can be important stimuli to participate. Similar arguments may hold in the creative domain. icotec seems to indicate as much: "Many musicians work together as well, doing remixes and listening to each other. That, I think, is one of the best parts of the ElectronicScene community. [...] I try to participate in this community as much as I can, and for some 30 % of my new music I seek feedback from other musicians using the forum. This is rewarding as I get feedback on both a technical and a musical level. I also try to listen to and actively share my opinion with other musicians on their music, as much and as often as I can".

2.1.3 Social capital

Social capital is the ability to access resources through social connections. If social capital is an important benefit of participating in creative communities, then what kind of resources does it provide access to? To give an example, Linus Torvalds, the originator and main developer of the Linux kernel, was invited to take a job at Transmeta after Peter Anvin had suggested this to the company's management [49]. Although the offer was not triggered by an explicit action by Linus Torvalds,[14] it is an indication that the social network of FOSS developers may be useful for finding jobs. This is related to, but not the same as, the human capital discussed in the previous section. Before the managers of Transmeta could assess Torvald's skills, someone had to point him out to them and say: "There's a valuable person for your organisation". This flow of information is facilitated by social networks, and is one of the reasons why social capital works.

A last issue I would like to address is the role of *gatekeepers*. Gatekeepers decide whose works are produced, promoted or performed. Gatekeepers are the producers, the radio programmers, the gallery owners, and so on. Staying on good terms with these decision-makers can be important for an artist's success. The promise of the digital networks as an open distribution medium is that anyone can now publish their work, bypassing gatekeepers and reaching the audience directly. Worldwide distribution is now within the reach of anyone, and there is a new opportunity for artists to be heard and to have their works broadcast. They can effectively

[14] Following Nan Lin's definition, the action of obtain the job position should have been a purposeful action initiated by Linus Torvalds in order to count the connection with Peter Anvin as part of Linus' social capital.

build up a reputation within a social network. This reputation, and a stronger tie with the audience, may result, for example, in higher ticket sales for their concerts. This phenomenon has been given by many musicians as one of the main reasons why they are in favour of free music distribution [21, 42, 33].

2.1.4 Other observations

Although giving content away free makes it difficult to obtain any material returns, it can be an interesting investment for human or social capital. I am not saying that financial reward is impossible. However, I find it worth exploring the idea that there may be other reward systems, possibly based on social or human capital, that can provide enough incentives for authors. Such reward systems probably do exist. The question then is, is there a way to make them more tangible? Human capital – knowledge and skill – is "traded" in the labour market, and software developers can browse job offers to get an idea of the demand for certain skills. For content creators, such skills are probably harder to assess and evaluate. Social capital is even harder to measure. There are attempts to measure reputation, in particular for business transactions [31]. Technologies exist for evaluating sellers and buyers, such as on eBay. Trust, accountability and reputation are widely discussed in the literature on Internet applications [18]. However, it is still unclear how to apply these approaches to creative production. Do we actually want to make social capital explicit, and put a figure on the value of our social relationships? According to Lin, someone who is high up in the hierarchy of one type of resource has easy access to other types of resources. That means that if someone has a good deal of human or social capital, access to financial capital may be easier. If this can be confirmed, then there may be no need to measure human or social capital explicitly.

Since, in the Western world, the material needs of the majority of people are satisfied, it may seem possible for human, cultural or social capital to become more important than financial capital. Nan Lin writes: "[W]e are witnessing a new era in which social capital will soon supersede personal capital in significance and effect" ([32] p. 214). Jeremy Rifkin seems to agree: "[I]n a society that has conquered material scarcity, immaterial values take precedence and the quest for self-fulfilment and personal transformation becomes the goal. In such a society, the right not to be excluded from a 'full life' becomes the most important property value a person holds" ([45] p. 239).

2.2 Technologies to support Creative Communities

In the previous section I discussed the incentives for authors to participate in creative communities. The emergence of FOSS communities owes much to the availability of inexpensive digital communication technologies and other tools. Without a doubt, technology also plays an essential role in the ecosystem of collaborative creativity. On the one hand, there is the technology needed for the creation itself – this includes authoring tools, but also standardised formats and descriptive languages. On the other hand, there

are the technologies that enable the sharing and retrieval of content. I will discuss some of the necessary and/or desirable elements of both parts in the next two sections.

2.2.1 Authoring

The availability of a common development language, such as the "C" programming language, and development tools, such as **gcc** and **make**, has certainly contributed to the establishment of the FOSS community. It makes a difference when people who are working together have access to the same tools. Lawrence Lessig stresses that by providing a "neutral platform, open source invites a different kind of innovation" [30]. A neutral platform for content creation is probably essential too.

Before discussing this issue further, I have to make a brief excursion into file formats. It is important to understand the difference between a flat, binary file format and one that retains the structure of the data. When a digital work is created, whether software or content, it is generally distributed in a binary format, such as MP3 audio files or software executables. This binary file was assembled from various elementary data sources that have been organised and combined by the author to yield the final work. For software, we call the initial description the source code, which is stored as human-readable text files written in a programming language. For content, there are a plethora of languages and formats in which to store the description of a work. Several efforts have been made to define standardised languages for describing content. The Motion Picture Experts Group (MPEG) and the Web Consortium are working on several such standards. If the works are accessible in the editable format, we begin to see the same phenomenon as what has happened with HTML and FOSS: people start building upon each other's work.

I will now list the characteristics of those descriptive languages I consider important for supporting collaborative creativity. First, the specifications of these languages have to be open and standardised. They must be unambiguous and completely specified, so that applications built to render these files all produce the same output. There should be some facility for building version control systems (see also below). For this, textual file formats are easier than binary formats. Since we want to be able to combine content from various sources, it should be possible to incorporate links to external sources.

Descriptive languages alone are not sufficient. Alan Kay said in an interview about the Web: "[T]he people who did web browsers I think were too lazy to do the authoring part" [27]. We need open, reliable authoring tools and players. These authoring tools should not be reserved solely for the authors, as it should be easy for anyone to make changes to a work.

2.2.2 Exchange platform

Uploading files to a website is the most straightforward way of making content available. For an effective, large-scale distribution, the use of a well-

designed exchange platform is essential. This exchange platform also handles the communication between participants, file-sharing, reviews, user comments, authorship management, meta-data, version control, usage statistics and, possibly, the reputation system.

First, we need tools for communication. Many artists may choose not to communicate, but we should at least make sure that communication is easy when it is desired. These communication tools may be used by the audience to give feedback to the authors. For many artists feedback may be a source of inspiration in their work, but for the audience it is motivating, too. As an example, the German band Einstürzende Neubauten has put up a website where fans can follow the progress of their music creations [36].

As is common practice in software development, content creators may benefit greatly from version control. This version control is very important (imagine FOSS without version control!).[15] If reuse is to be promoted, and the primary way of reusing material is to link to it rather than to copy it, then the author has to have a guarantee that the original link will provide the same content, even if the original author continues editing it. So an author provides a link not only to some content on the web, but to a particular version of that content.[16]

Like version control, authorship management should be a fundamental feature of the exchange platform. The goal of authorship management is to ensure that a work, or a part of a work, is credited to its authors and that this link is difficult to erase. At present, in FOSS, the authors of a project ensure the correct crediting of all authors whose work or contributions they use. This is done manually. If creative communities are to flourish, this management should be done transparently by the authoring tools. In addition, it should be possible at any time to query a work and obtain a lists of all the contributors to it. Search engines and database tools can be built that trace the lineage of a work. It is important to note that, even under FOSS, authorship is well defined. Even though everyone can obtain the source code and can make changes to a private copy, or propose changes, access to the official copy of the source code is well protected and its authors are clearly defined. However, this credit information is not registered in a structured way. There is no search engine that will retrieve all the FOSS projects in which a developer has participated, and what exactly she has contributed. Most FOSS projects maintain a file, generally called **A**UTHORS, in which all participants in a project are mentioned. But this information is coded

---

[15] Version control for contents may be even more important than for software because software developers usually write code that uses a specific *application programming interface*, or API. It is the version of the API that is important, even if the implementation of the API changes. For contents, any modification will change the end result.

[16] If some form of version control was embedded from the start in the specifications of the Web we may have had less problems with broken links.

relatively freely, and as far as I know no attempts have been made to build a searchable database of contributors.

Authorship information is a form of meta-data. Meta-data is data about data. For example, the title, the names of the authors, the genre, and other descriptions of a work are all meta-data. It is important for meta-data to be available and easily accessible. Meta-data is necessary for searching and accessing a work in large databases, for relating one work to another, and for allowing users to create a personalised view of a contents database [40]. If a considerable number of works, or parts of works, become available, it becomes increasingly difficult to find and value a work. In that sense, the value of a work is dependent not only on its content, but also on the amount and quality of its meta-data.

Reviews and user preferences are another form of meta-data. The use of user preferences for searching content is generally called Collaborative Filtering. Another form of reviewing is peer reviewing, which is widely used in the scientific field. Peer reviewing also works for software and it is regarded as one of the main factors contributing to the quality of FOSS. Is peer reviewing possible for content? In my view, there are two sides to the answer. The first thing to note is that, in software development and science, it may not always be possible to say if one proposal is better than another, but at least it is possible to point to flawed, incomplete or unclear proposals. For software as for science, there is some notion of "better": "better functionality" for software or a "better model" for science. But for content? I do not think that there is an easy answer to that. And this makes peer reviewing more difficult. However, it is often the discussions between "experts", among other factors, that give a work a place in a culture. So some form of peer reviewing is important and should receive a central place in any exchange platform.

The distribution of the content itself may require specific technologies. Traditional client-server technologies are costly and do not scale well with increasing numbers of clients. It is desirable for a creative community to be built using peer-to-peer technology [37]. Content distribution networks, such as FreeCache, or file-sharing networks using peer-to-peer technologies, such as BitTorrent, may be appropriate solutions. Distributed file systems, such as OceanStore and PAST, also handle persistent storage and version control, which is desirable, as noted above.

Open ecosystems encourage the reuse of content, but this openness must be compensated for by better authorship management. This trade-off works as long as the authorship management is effective and/or participants play by the rules. For these reasons there have to be tools that allow participants somehow to "monitor" the exchange platform to ensure that everyone plays

fairly. Clearly, the exchange platform will have to be open and will have to publish all possible information to its members.[17]

3 Projects

In this section I will present two projects. These projects have quite a small scope and are designed mainly to test some of the concepts of collaborative creativity. Through these projects, I hope to gain a better understanding of creative ecosystems. The key question is whether creative communities are possible at all. If so, we may hope to gain an insight in the social interactions that define collaborative creativity, and the technology that supports it.

The first project, called Fofito, is an attempt to give visitors to an exhibition the opportunity to express their views and leave a trace of their visit. The second project, called EcoScene, which is still being developed at the time of writing, aims to create a small, contained ecosystem of music production based on the FOSS philosophy.

3.1 The Fofito project

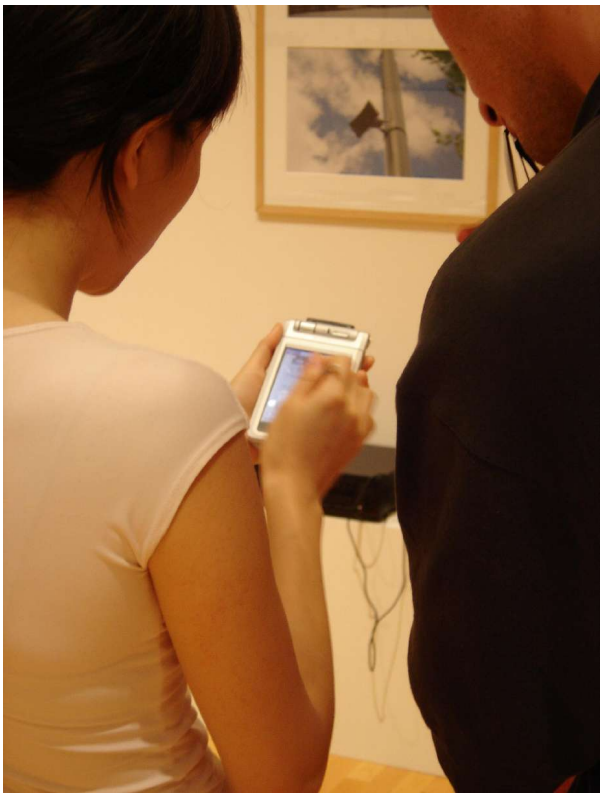
The Fofito project is a collaboration between Luc Steels and the author. We first experimented with the project at the exhibition "Social Capital: Forms of Interaction", organised by the Whitney Independent Study Program in New York, USA. The project is an experiment in audience participation and feedback. We put ourselves at the receiving end of the traditional distribution channel and investigate possible user contributions. Using new technologies, we try to engage visitors in the loop of the creative process so that they can become an active part of it. Cécile de Varine makes the following observation about visitors talking about the works in a museum [12]:

> L'objet exposé devient le receptacle d'une multitude d'interprétations. Les formes composées des tableaux organisent à leur manière l'ordre d'un discours culturel en chantier, en cours de construction. Comme des cathédrales de mots, les regards parlés construisent du sens, interprètent, déplient les oeuvres... [...] Mais que deviennent toutes ces paroles, tous ces regards qui se construisent et circulent entre oeuvres, visiteurs et médiateurs? Il n'en reste bien souvent pas trace dans la littérature des musées. [...] Comment prendre en considération et rendre compte des regards singuliers ou collectifs de ceux qui viennent au musée confronter leur expérience du monde et leur compétences aux objets exposés?

In the project we give visitors to the exhibition a chance to express their views on the works displayed and to participate in the discussion around them. The tool we developed allows the visitor to take pictures of the works

[17] For the need for monitoring, see also Elinor Ostrom's work on common-pool resources [39].

and annotate them with text. It also allows them to browse the pictures and texts that have been previously entered by other visitors.



People can borrow a hand-held device or personal digital assistant (PDA) during their visit to the exhibition. In the near future, we assume that visitors will have their own electronic devices with which they can participate, probably their cell phones. The PDA is connected to a local server over a wireless network (WiFi or 802.11b). The server hosts a website with information about the exhibition. The website is organised in three sections, entitled *expo*, *catalogs*, and *you* (see Figures 3 and 4). The first section, *expo*, provides information about the works on display in the exhibition. Each one has a dedicated web page displaying a picture of the work, naming its authors and giving its title and technical information aout it. The page also provides links to the *catalogs* that discuss the work. A list of all available catalogues can be found in the second section of the website. A catalogue is a list of pages with pictures and text. A page can be related to a work, in which case it will show the title of the work and the names of the artists. Navigation through the information on the website is very straightforward and intuitive. The third section, entitled *you*, concerns the visitor's input. Every visitor has her own catalogue, which can be edited in this section. The PDAs we used have a built-in camera that the visitors can use to take photos in the gallery. These pictures can then be annotated and inserted into their catalogue. The interface developed for the Fofito project can be used in several ways. It could be used to keep a personal record, a memory, of the visit to the

exhibition. It could also be used to express a point of view that complements the works of the artists or the texts of the curators.

Figure 3: Two screenshots of the Fofito interface. On the left, the *expo* section which displays the list of artists. On the right, the *catalog* section with the list of available catalogues. The first catalogue in the list is an electronic adaptation of the official catalogue by the curators. The other catalogues are those made by the visitors. Note that the website was developed to be viewed on PDAs, which is why the screenshots have a slim shape.

Figure 4: Two screenshots of the Fofito interface. On the left, a detail of a page in a catalogue. This page has been linked to a work and the work's artist and title are displayed. On the right, the *you* section, which allows a visitor to edit her catalogue.

The wireless network and the web server provide a shared space, making all contributions visible to everyone. This shared space is not limited to the gallery. It is accessible from outside the exhibition space and visitors can continue their participation at home, adding more pictures or texts, or showing their input to friends and family. The website remains visible at http://fofito.csl.sony.fr.

It is still quite difficult to draw any conclusions from this experiment. Overall, reactions were positive. After overcoming an initial hesitation, most people enjoyed taking photos of the works on display. Many were intrigued by the novelty, although some preferred not to use it because they did not feel comfortable with the technology. Some people started using it creatively, but only a few people used it to write down an opinion. This may be due in large part to the fact that the textual input on a PDA is still awkward, especially when it is used for the first time. Most people contributed by

taking pictures. In fact, most people took straighforward pictures, much like those you find in an official catalogue. This is perfectly acceptable. Taking the pictures – however "normal" they may be – is the first step to looking at a work from a different angle. It is a first, important step towards re-interpreting and re-appropriating the works on display. However, several people took more personal pictures.

The interface, which is developed in standard HTML, makes file-browsing to select the pictures and switching between the camera application and the Web browser less intuitive. As a result, I helped most visitors to upload the pictures and create the new pages in the catalogue. However, these problems can easily be solved by using a specifically designed interface. If the Fofito system was not readily used as a medium for expression, this was partly due to these shortcomings in the software. The feedback we received from the visitors was encouraging enough to convince us that such devices and interfaces could become a new means of interaction with museums and artists.

3.2 The EcoScene project

The EcoScene project is an attempt to create a small, contained ecosystem for music production. It focuses on the creative process and the possibility of exchanges between authors, reviewers and audience.

In this project, three composers work for two months on a music project of their choice. The only constraint is that their work, even while it is being composed, is made visible to all other participants in the project. The works are stored in their structured formats – that is, not as an audio file (an MP3 file, for example) but in an editable format. All intermediate versions of their work are kept, and remain available to anyone. During the project, an audio file is produced, however, to simplify listening to the music with simple players. The composers are free to reuse any sounds or material of another composer, but a record of what material is being reused has to be kept. The composers remain the sole authors of their work and are encouraged, but not obliged, to participate in the discussions on their work.

A music critic is invited to review the music regularly and to write down his impressions in a blog. And, of course, several people participate as an audience. There is a mailing list to which everyone is subscribed – composers, reviewer and audience. Anyone from the audience can also have a personal web page for the project, on which they can post their comments. Reuse of the musical material is not restricted to the composers: anyone from the audience can also start making modifications to their personal copy and publish it on their web page.

At the time of writing, the project is still being worked out. It is scheduled for autumn 2004, so as yet we have no conclusions to report. From the beginning, however, it was clear that to generalise such a project it would be very difficult to define a common music platform accessible to everyone. This indicates that it is far from easy – indeed, it is almost impossible – to

define a common description language or authoring tool for music. Readers can follow the evolution of the experiment at http://ecoscene.csl.sony.fr.

4 Conclusion

The following are some of the points I would like to make:

- New forms of content creation and distribution are seeing the light of day, particularly in music. Inspired by FOSS, they allow free access to content. “Free” should be read not only as “gratis” but also as in “freedom”.
- It is not clear how sustainable or important this phenomenon is. In the end, there will have to be enough incentives for artists to participate.
- Financial incentives may or may not be possible. This issue is currently receiving a good deal of attention in the media. Chances are that some intermediate solution will arise.
- Instead of concentrating on financial awards, I find it interesting to consider other forms of rewards, such as human capital and social capital. For many people, the social and learning aspects may be reason enough for participating. Can these forms of rewards be made more tangible? Can they become more important than financial rewards?
- To stimulate these other forms of rewards (human capital, social capital), new technologies and tools may have to be developed. I have discussed some of them.
- Judging by our experience so far, people seem excited about the idea of participating but are still uneasy about doing so. Also, technology still appears to be a barrier for the “general” audience today. Composers also seem interested, but are perhaps still a little uneasy about working in the open. They may feel uncomfortable having to discuss in public how and why they create something.

To conclude this text, I would like to comment on some of the discussions on the experience economy. Rifkin wrote an alarming book, *The Age of Access*, in which he casts doubt on the experience economy and the future of culture [45]. He quotes Herbert Schiller, professor emeritus of communications at the University of California at San Diego, as saying: “speech, dance, drama, ritual, music, and the visual and plastic arts have been vital, indeed necessary, features of human experience from earliest times. What is different is the relentless and successful effort to separate these elemental expressions of human creativity from their group and community origins for the purpose of selling them to those who can pay for them” (p. 140). Rifkin adds, “access will no longer be based on intrinsic criteria – traditions, rights of passage, family and kinship relations, ethnicity, religion, or gender – but rather on the affordability in the commercial arena. ... [C] apitalism is making its final transistions into full-blown cultural capitalism, appropriating not only the signifiers of cultural life and the artistic forms that

interpret those cultural signifiers but lived experience as well" (pp. 140 and 144). And there does indeed appear to be such a tendency. Pascal Nègre, president of Universal Music France and of the Société civile des producteurs phonographiques,[18] states in an online interview: "Je revendique à 100% la marchandisation de la culture. Le seul endroit où la culture n'est pas marchandée c'est lorsqu'elle est d'Etat... Je n'ai aucune fascination pour l'art mussolinien, stalinien... L'art choisi par les princes" [13].

In my opinion, there are more options available to us than submitting culture to the control of either commercial or government institutions. A third solution lies within the realm of communities themselves. And FOSS has shown that this solution can be powerful indeed. If creative communities develop, the experience economy may take on a very different appearance from that described above. Rifkin comes to the conclusion that "the commercial sphere is offering something it cannot, in the final analysis, deliver: access to a life of deep communion and personal transformation" (p. 247). Instead of the commoditisation of culture, culture will probably stay what it was all along, a "complex web of shifting patterns that link people".[19]

5 Thanks

This work is funded by the Sony Computer Science Laboratory. I would like to thank Luc Steels, François Pachet and Atau Tanaka for the many discussions we had, which have greatly contributed to this text. Kudos goes to Marleen Wynants for her confidence and feedback on the article. Special thanks also to Howie Chen, Leta Ming, Allison Moore and Nadia Perucic of the Whitney Museum Independent Study Program for allowing me to set up camp in their exhibition space, and to icotec and Gideon Marken for taking the time to reply to my inquiries and for making the music available.

References

[1] Aytan Adar and Bernardo A. Huberman. Free riding on gnutella. *First Monday*, 5(10), 2000. http://www.firstmonday.dk/issues/issue5_10/adar/.

[2] Patrick Aichroth and Jens Hasselbach. Incentive management for virtual goods: About copyright and creative production in the digital domain. In *Virtual Goods 2003*, Ilmenau, Germany, May 2003. http://virtualgoods.tu-ilmenau.de/2003/.

[3] Ross Anderson. 'Trusted computing' frequently asked questions, 2003. http://www.cl.cam.ac.uk/ rja14/tcpa-faq.html.

[4] Apple. itunes celebrates its first anniversary; over 70 million songs purchased, April 2004. http://www.apple.com/pr/library/2004/apr/28itunes.html.

[5] Moses Avalon. Nielsen rating system at odds with riaa's claim of "lost sales". *Music Dish*, April 2004. http://www.musicdish.com/mag/index.php3? id=9452.

[6] Joe Barr. Live and let license. *ITworld.com*, 2001. http://www.itworld.com/AppDev/350/LWD010523vcontrol4/.

[7] Yochai Benkler. Coase's penguin, or Linux and the nature of the firm. *Yale Law Journal*, 112, 2002. http://www.benkler.org/CoasesPenguin.html.

[8] Yochai Benkler. "Sharing nicely": On shareable goods and the emergence of sharing as a modality of economic production. *Yale Law Journal*, 114, 2004, forthcoming. Electronic version: http://benkler.org/SharingNicely.html.

[9] John Carroll. Open source: Supply and demand. *ZDNet UK*, June 2004. http://comment.zdnet.co.uk/0,39020505,39157438,00.htm.

[10] BBC creative archive pioneers new approach to public access rights in digital age. Press Release, May 2004. http://www.bbc.co.uk/pressoffice/pressreleases/stories/2004/05_may/26/creative_archive.shtml.

[11] Creative commons. http://creativecommons.org.

[18] The recording industry association of France

[19] Taken from Wikipedia, the collaboratively developed encyclopedia (http://www.wikipedia.org).

[12] Cécilia de Varine. Regards parlés. In *L'Exposition, un média*, Volume 9 of *Médiamorphoses.* INA, 2003.

[13] Le Journal du Net. Pascal Nègre (universal music france): "Je ne crois pas à l'avenir à moyen terme du peer to peer", January 2003. http://www.journaldunet.com/chat/retrans/030117_negre.shtml.

[14] Peter Eckersley. The economic evaluation of alternatives to digital copyright. In SERCIAC, editor, *SERCIAC*, Northampton, Massachusetts, June 2003. Society for Economic Research on Copyright Issues.

[15] FairPlay. http://en.wikipedia.org/wiki/FairPlay.

[16] William Fisher. *Promises to Keep: Technology, Law, and the Future of Entertainment*, Chapter 6: An Alternative Compensation System. Stanford University Press, 2004. Currently in print. An electronic version of the chapter is available at http://www.tfisher.org/PTK.htm.

[17] Free Software Foundation. Free software and free manuals. http://www.gnu.org/philosophy/free-doc.html.

[18] Tyrone Grandison and Morris Sloman. A survey of trust in internet applications. *IEEE Communications Surveys*, 2000.

[19] Rüdiger Grimm and Jürgen Nützel. Security and business models for virtual goods. In *ACM Multimedia Security Workshop*, pages 75-79. ACM, 2002.

[20] Janis Ian. Fallout – a follow-up to the internet debacle, 2002. http://www.janisian.com/article-fallout.html.

[21] Janis Ian. The internet debacle: An alternative view. *Performing Songwriter Magazine*, May 2002. http://www.janisian.com/article-internet_debacle.html.

[22] Open Source Initiative. The open source definition. http://www.opensource.org/docs/definition.php.

[23] The Open Source Initiative. Frequently asked questions. http://www.opensource.org/advocacy/faq.html.

[24] Intertrust. http://www.intertrust.com.

[25] Fred Kaplan. D.i.y. meets n.r.l. (no record label). *The New York Times*, 4 July 2004.

[26] John Kelsey and Bruce Schneier. The street performer protocol and digital copyrights. *First Monday*, 4(6), 1999. http://www.firstmonday.dk/issues/issue4_6/kelsey/.

[27] David Kirkpatrick. A pc pioneer decries the state of computing. *Fortune*, Thursday, July 8, 2004. http://www.fortune.com/fortune/fastforward/0,15704,661671,00.html.

[28] M. William Krasilovsky and Sidney Shemel. *This Busines of Music: The Definite Guide to the Music Industry*. Billboard Books, 2000.

[29] Karim R. Lakhani, Bob Wolf, Jeff Bates, and Chris DeBona. The hacker survey. Technical report, Boston Consulting Group, 2002. http://www.osdn.com/bcg/.

[30] Lawrence Lessig. *The Future of Ideas: the fate of the commons in a connected world*. Vintage Books, 2002.

[31] Richard Lethin. *Peer-To-Peer: Harnessing the power of disruptive technologies*, chapter on Reputation. O'Reilly, 2001.

[32] Nan Lin. *Social Capital: a theory of social structure and action.* Cambridge University Press, 2001.

[33] Brian Mansfield. When free is profitable. *USA Today*, May 2004. http://www.usatoday.com/tech/webguide/music/2004-05-20-file-sharing-main_x.htm.

[34] Microsoft. Windows media drm. http://www.microsoft.com/windows/windowsmedia/drm/default.aspx.

[35] Dejan S. Milojicic, Vana Kalogeraki, Rajan Lukose, Kiran Nagaraja, Jim Pruyne, Bruno Richard, Sami Rollins, and Zhichen Xu. Peer-to-peer computing. Technical Report HPL-2002-57, HP Laboratories Palo Alto, March 2002.

[36] Einstürzende Neubauten. http://www.neubauten.org.

[37] Andy Oram, editor. *Peer-To-Peer: harnessing the power of disruptive technologies*. O'Reilly, 2001.

[38] Andrew Orlowski. Biometric drm is 'empowering' says ivue maker. *The Register*, June 2004. http://www.theregister.co.uk/2004/06/11/biometric_drm_interview/.

[39] Elinor Ostrom. *Governing the Commons: the evolution of institutions for collective action.* Cambridge University Press, 1990.

[40] François Pachet. Content management for electronic music distribution: The real issues. *Communications of the ACM*, April 2003. http://www.csl.sony.fr/downloads/papers/uploads/pachet-03a.pdf.

[41] Jon Pareles. No fears: Laptop d.j.s have a feast. *New York Times*, September 10, 2004. http://www.nytimes.com/2004/09/10/arts/music/10INTE.html.

[42] Andy Raskin. Giving it away (for fun and profit). *Business 2.0*, May 2004.

[43] Eric S. Raymond. The cathedral and the bazaar. http://www.catb.org/ esr/writings/cathedral-bazaar/.

[44] RIAA. Year-end marketing reports on u.s. recorded shipments. http://www.riaa.com/news/marketingdata/yearend.asp.

[45] Jeremy Rifkin. *The Age of Access*. Penguin Books, 2000.

[46] Joel Spolsky. Strategy Letter V, June 2002. http://www.joelonsoftware.com/articles/StrategyLetterV.html.

[47] Richard Stallman. The free software definition. http://www.gnu.org/philosophy/free-sw.html.

[48] Richard Stallman. *Free Software, Free Society: Selected Essays of Richard M. Stallman*, chapter entitled "Why 'Free Software' is better than 'Open Source'". Free Software Foundation, 2002. Available online at http://www.gnu.org/philosophy/free-software-for-freedom.html.

[49] Linus Torvalds and David Diamond. *Just for Fun*. HarperBusiness, 2001.

[50] Trusted computing group. https://www.trustedcomputinggroup.org.

[51] Steven Weber. *The Succes of OpenSource.* Harvard University Press, 2004.

[52] George Ziemann. Riaa questions validity of own information, 2003. http://www.azoz.com/news/0023.html.