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FREE/OPEN SOURCE SOFTWARE AND THE DIGITAL DIVIDE

Technology is neither good nor bad, nor is it neutral.
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What has software got to do with sustainable development policy? This article defines the digital divide and provides an overview of the different positions within the discourse. It will be explained why the nature of code has become an increasingly important political issue. In this respect, the pro-Linux policy of Brazil will be outlined. Software is not only about code, but about rights, control, freedom, transparency and power.

1. Introduction

> *"We are creating a world that all may enter without privilege or prejudice accorded by race, economic power, military force, or station of birth."* [1]

This quote from the "Declaration of the Independence of Cyberspace" from 1996 illustrates the beautiful hopes and shattered dreams connected to the medium of the Internet. Misery and inequality ruled in the "meatspace". But in cyberspace, everything should be different. The Internet was even supposed to promote more justice in the world. This vision has not come true. Access to information and communication technologies (ICTs) is distributed very unevenly. Poorly educated people with little financial resources have little chance to have access to the Internet.[2] Since the mid-1990s, the so-called *digital divide* appeared on the political agenda. By improving access to ICTs, it is hoped that economical, political and social development would also be promoted. This assumption is rooted in the fact that access to information and knowledge, its generation and distribution, is a central resource of power in a globally networked world.
In the first volume of his trilogy "The Information Age: Economy, Society and Culture", sociologist Manuel Castells describes how under the impact of new communication technologies, the old structures of the industrial age are being transformed.[3] In the global *network society*, it is not so much material goods but information and knowledge which are contested trade commodities, science and technology play a driving role in economic growth and fixed hierarchies dissolve into networked organizations. Castells theory is based on the assumption that technology massively influences society. These transformations have created a new relationship between poor and rich countries. Networks follow a binary logic: inclusion or exclusion. The spreading of the Internet has triggered a paradoxical development – the world is networked and divided at the same time.

2. From Digital Divide to Social Inclusion

The digital divide discourse can be separated into three arguments; the optimists claim that the new ICTs could strengthen the voice of the poor and developing nations and / or of marginalized

1 Barlow, John Perry: A Declaration of the Independence of Cyberspace. Electronic Frontier Foundation, February 8, 1996, available at http://homes.eff.org/~barlow/Declaration-Final.html.
2 Cp. UNCTAD (2004): E-Commerce and Development Report. New York/Geneva.
3 Castells, Manuel (2000): The Rise of the Network Society. Second Edition. Oxford.

groups; the sceptics believe that new technology alone will make little difference; and the pessimists emphasize that digital technologies will further exacerbate the existing inequalities between (information) poor and (information) rich.
There is not only one divide - there are multiple divides. The *global divide* refers to the divergence of Internet access between rich and poor nations, the *social divide* describes the gap between on- and offliners within the same country. There is a *gender divide*, as more men than women surf the net. In rural areas, there are fewer Internet connections than in cities. Language barriers are also part of the problem. 80% of the web content is written in English, a language understood by an estimated one in ten people worldwide. The term *democratic divide* signifies the difference between those who do and those who do not use the panoply of digital resources to engage, mobilize, and participate in public life.[4] On a more practical level, lack of hardware, electricity, bandwidth, appropriate software, computer skills or high cost for an Internet connection are part of the problem.
The original concept of the digital divide, which consisted basically in supplying mere physical access to computers and the Internet, is slowly being modified. It has become obvious that providing the underprivileged with Internet accounts will hardly solve the problem of century-old poverty. Educational and social aspects are slowly being integrated into programs aiming at bridging the digital divide.[5] The new concept is called *social* or *digital inclusion*. In this respect, the software question is gaining increasing attention.

3. Free/Open Source Software

The world of free/open source software (FOSS)[6] has its own economy, culture and values, which are completely different from those of proprietary software.[7] This can be explained with its four main characteristics; 1. the software can be run for any purpose, 2. the source code is freely accessible, can be modified and may be used for educational purposes, 3. the software can be distributed and copied without restrictions, 4. it can be distributed and copied in modified versions.
The dominant proprietary software model, e.g. the Microsoft operating system Windows XP, does not distribute the source code and generates profit for the most part by selling licences. Source code is the "DNA" of software; it is text written in a higher programming language, consisting of commands in this language and readable by humans. Development and adaptations can only be made in this raw form.
GNU/Linux is not a toy for tech-crazy nerds any more. Corporations such as IBM or Novell Suse and countless small and medium sized companies create substantial profit with this special code, whereby the business model is not based on the levying of licence fees, but on providing service around the software. Popular FOSS-programs are the Firefox Browser, the office software OpenOffice or GNU/Linux-based operating systems such as Debian. Because FOSS comes with the source code, it offers great advantages for use in poor and economically disadvantaged countries. It is fair code.

4. Intellectual Property Rights and Software: the Brazilian Way

Brazil is the country which has explicitly promoted FOSS in recent years. The nation occupies the tenth place on the list of the world's largest economies, but there is a large internal income and wealth discrepancy.Ten percent of the population control half of the wealth and more than twenty

4 Cp. Norris, Pippa: Digital Divide (2001): Civic Engagement, Information Poverty, and the Internet Worldwide. Cambridge.
5 The misbelief that technology transfer automatically creates prosperity has a long tradition. Cp. Chatterji, Manas (1990): Technology Transfer in the Developing Countries. London.
6 This text uses the terms free/open source software equally. This is being done because there is no consensus which type of software belongs to which classification. In general, the community-freedom thought is more important in free software. "Free" refers to liberty, not to price. Open source is more frequently used in the realm of enterprises. The development respectively business model is of greater significance.
7 Cp. Grassmuck, Volker (2002): Freie Software. Zwischen Privat- und Gemeineigentum. Bonn and Himanen, Pekka (2001): The Hacker Ethic and the Spirit of the Information Age. London.

percent are living in extreme poverty. The pro-FOSS policy has its origin on a municipal and state level. Since 2003, when the Worker's Party, under president Luiz Inácio Lula da Silva, came to power, the promotion of free and open code has been integrated into national policy strategies. The government declared that eighty percent of newly purchased computers should be equipped with open source software. The existing IT-infrastructure of the federal government is in the process of migrating as well. Brazil has also become the first country encouraging any company or research institute that receives government financing to develop software to license it as FOSS. Free and open code is part of national programs aiming at digital inclusion; e.g. the program "PC Conectado" which offers computers at a discount to low-income families. These activities are all done by recommendation. The corresponding law which would make the use of FOSS in the public sector mandatory has not yet been ratified by the parliament.

Brazil's pro-Linux policy is closely linked with arguments concerning intellectual property rights (IPR). Developing and emerging nations have been complaining for years that existing copyright and patent systems do not work for their benefit, but rather reflect the interests of the developed world respectively of their big corporations.

The original idea behind intellectual property is understandable; innovators and creatives are rewarded with a temporary monopoly for their products, allowing them to charge far higher prices than they could if there was competition. Although the ideas cannot be used by others temporarily and therefore follow-up innovations decelerate society as a whole benefits because intellectual property regimes create incentives for innovation. Critics argue that the permanent extension of IPRs in terms of time and scope (e.g. for mathematical algorithms, genes or plants) has perverted the system and actually hinders innovation. Today, not the best ideas, but the most expensive lawyers succeed. In the case of poor countries, this problem is even more acute. They own hardly any patents and copyrights and lack the ability to enforce them.[8]

One of Brazil's main arguments for GNU/Linux is that it makes more economic sense to spent public funds to train the local workforce instead of transferring financial resources abroad in order to buy licences.[9] It is not a coincidence that it is the Brazilians who are focussing on new concepts concerning intellectual property. In the 1990s, even under a conservative government, they were the first to seriously threaten to ignore patents on overpriced AIDS drugs. In addition, the country has a very active, politicized GNU/Linux scene. The world's first open source ATM system was developed by Brazilians.

It would be a mistake to reduce the Brazilian IT-policy to a mere effort to fight poverty. It is rather an attempt to create commercial and social value without classic protection of IPR, but with new IPR-models adapted to digital media. The growing economic success of the open source movement indicates that the South Americans are on the right path.

5. GNU/Linux: Sustainable Digital Development Policy

5.1. Skill Transfer

GNU/Linux offers interactive access to knowledge and information engineering skills of the most developed countries. People from economically disadvantaged regions can learn locally and obtain new skills at very low cost. The philosophy and mechanisms of the FOSS community imply that pupils can very quickly become teachers. The newly learned skills can help in finding a job or to sustain small and medium-sized businesses. In addition, the so-called *brain drain*[10] can be counteracted.

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8 Cp. Stiglitz, Joseph E.: Intellectual Property Rights and Wrongs. Daily Times, August 16, 2005, available at http://www.dailytimes.com.pk/default.asp?page=story_16-8-2005_pg5_12.

9 Cp. Emert, Monika/ Amadeu da Silveira, Sérgio: "Geisel einer proprietären Lösung." Brasilien forciert Open Source als Lösung für Entwicklungs- und Schwellenländer. Interview. In: c't 02/2004, pp. 44-47.

10 *Brain Drain* describes a widespread phenomenon in poor countries. Talented and well educated people, in this case programmers, have to leave their home countries since they have no chance to find work or adequate training there.

5.2 Price and Total Cost of Ownership (TCO)

In a country like Vietnam, the cost for proprietary software (operating system Windows XP together with Office XP) equals roughly sixteen month's salary.[11] With GNU/Linux, there's only the distribution costs. Critics argue that installation and support costs are high and difficult to calculate. While TCO is an issue one has to take into account that in developing nations labour is not a high cost factor. But more importantly, the local software market can be fostered and, besides, proprietary software needs support as well.

5.3 Technological Independence

A great proportion of proprietary software is developed in the richer world respectively controlled by its corporations. But the mere import of software intensifies the very dependencies which are supposed to be overcome. Software is more a process than a product – in order to keep it usable, it has to be developed continuously. Thus support, updates and upgrades have to be bought continuously. In the proprietary software world it is a fairly common business model to initially sell software at a loss or even give it away for free in order to develop a user base. Initial losses are recouped in the future because the customer cannot easily adopt other solutions; the data is locked in the proprietary system. As a result, users have to pay premium prices for new versions of software, often coupled with high annual licencing costs.

Within the complex of technological independence, free standards, protocols and data formats are very important. They are in the interest of consumers and businesses, allowing genuine market competition, giving users options and choices. Closed standards, protocols and technical secrets foster monopolies. Only if open standards and data formats are implemented is it possible to renew hardware without taking software into account. Replacing software without having to reformat data or change hardware would also be possible. (Of course, proprietary software can use open standards and protocols, but much of it does not.)

Another advantage of FOSS is that GNU/Linux operating systems can be run on old computers. Proprietary operating systems such as Windows rely on the newest processor generation and are thus of little use for owners of older and thus poorly performing IT-infrastructure. Companies cease to offer support for older proprietary operating systems; e.g. as it is the case for Windows 95, 98 or 2000. With FOSS, the source codes are freely available. Provided that computer specialists are available, the systems can be supported as long as the hardware works. The costly race, where the newest hardware requires the newest software and vice-versa, does not have to be played.

5.4 Localization

There are over 6.500 languages in the world. But proprietary software is being produced only in those languages and writing systems which promise to be economically profitable. Changes cannot be made because the source codes are not available. Because FOSS comes with the source code it offers the opportunity to translate the software into any language; e.g., the Cambodian NGO "Khmer Software Initiative" is creating software in Khmer in order to allow Cambodians to take part in the information era:

> *"We believe that in order to enter a digital world without forfeiting its culture, a country must do it by using software in its own language. Software in a foreign language exacerbates the Digital Divide, makes basic computer training difficult and expensive, closes computer-using jobs to people with little economic resources, impoverishes local culture, and blocks computer-based government processes, as the local language script cannot be used in databases."* [12]

[11] Cp. Ghosh, Rishab Aiyer: License fee and GDP per capita. In: i4d 10/ 2004, p. 18-20.

[12] Khmer Software Initiative: Vision. Khmer OS, http://www.khmeros.info/drupal/?q=node/1.

5.5 Digital Preservation

Data and knowledge (be it firmware, content from databases and CMS-systems, or any other digital document) stored on proprietary systems is lost, at the latest, when the company responsible ceases to provide a support service and does not release the source code. The use of proprietary formats and systems makes the long-term preservation of digital data difficult. While physical objects can easily be preserved in archives, museums or libraries, electronic publications present new challenges. Data preserved on digital media become inaccessible in a very short time. This results from the short durability of the physical carriers, rapid media- and system changes, IPR-barriers and by the use of proprietary data formats. By using open program code, there is the possibility to keep such information accessible. In poor and developing countries, access to knowledge is still even more difficult when compared to the developed world.

5.6 Security

GNU/Linux has a reputation to be less vulnerable to viruses, trojans and computer worms. This can be explained with its development model: programming errors and security holes happen – but with FOSS, there is a higher probability of bugs being found and fixed. "Given enough eyeballs, all bugs are shallow" is a popular saying in the community.

5.7 Transparency

Its transparent character makes FOSS a first choice for eGovernment applications. Whether or not sensitive data and the right of privacy are protected with proprietary software is not clear. Locking away the source codes turns software into a black box. In this respect, the discussion about "Trusted Computing" is important. If the user is not able to control what the software is doing on his computer there is always the possibility of abuse.[13] Since proprietary software does not offer the possibility for modification possible abuse cannot be prevented. With FOSS the situation is different; of course, this kind of program code can be written in a way which violates privacy rights. But there will always be programmers resenting this and who, thus, will change the source code. In this respect, FOSS is democratic. Furthermore, the extreme case of (illegal) governmental and corporate surveillance can also be prevented.

6. Why Does GNU/Linux Only Play a Marginal Role in Developing Nations?

There are many impressive arguments as to why one could work with the penguin and the GNU. So why is this option being integrated at only a very slow pace (if at all) into programs aiming to bridge the digital divide? Why is Brazil's position in this issue a much talked about step? There are two obvious reasons: Microsoft was there first and the big disadvantage of proprietary software (the huge costs) can easily be overcome by using illegally copied software. But this does not present a sustainable solution. Dependencies simply continue. The main idea behind bridging the digital divide should not only be to rapidly provide access to the information age, but a means to fight the real problem – poverty. In this respect, free code offers great advantages.

A number of reasons make the mainstreaming of FOSS in poor and developing nations difficult. One has to take into account that the Internet has only been a mass medium for about ten years. Thus, the problem of the digital divide is even younger. Differentiated solutions are being formed, positive and negative practical experiences have to be integrated into theory and future concepts.

6.1 Software-Policy as a Blind Spot

Activists who lobby for free software in developing nations often hear the following sentence: "Our task is to fight poverty. Why should we migrate to a new system?" Politicians and NGOs speak

[13] Cp. Hauser, Tobias: Finger weg. DRM-Systeme in der Praxis. In: c't 06/2003, p. 234.

extensively of building up physical IT-infrastructure and how ICTs could serve as an enabler for development. That the blocking out of the software question reproduces exactly the same circumstances which are supposed to be overcome is just entering the discourse. There is very limited awareness that software controls human initiated data flows and thus, influences human behaviour. *Code is law,* the famous dictum of Stanford law professor Lawrence Lessig,[14] is not very known outside of technology aware groups.
The virtual, technological character of software accounts for the fact that code, in general, does not get much attention. Although software serves as an interface between man and machine, it is simply not noticed. Most people do not develop an emotional relation to it. A comparison with the Creative Commons initiative clarifies this issue. Creative Commons allows copyright holders and consumers of music, texts or films to exercise their rights in a more flexible manner. Creative Commons is very popular on a global scale. Stars such as the Beasty Boys lobby for it. It has helped to promote the “Open Access” movement as well. But this initiative has existed since only 2001 – the Free Software Foundation (FSF) was founded in 1984. It is hard to imagine that the New Yorker Hip Hopper would promote free code as well. For the most part, only male programmers are engaged in FOSS advocacy. In contrast to Creative Commons, there is a clear absence of broad support. In contrast to software, we develop emotional feelings towards works of art. Everybody has a song that he or she really loves. The right book at the right time can change a life. But software is only used. It is difficult to explain that free software is an essential part for sustainable development.
Software has a technological nature. In use it unfolds social, political and cultural power. Manuel Castells has called it the "language of the information age".[15]

6.2 Economical and Cultural Reasons

The analogue and virtual world function according to different rules. In digital data spaces one main condition of economics does not apply: *there is no shortage.* FOSS-programmers take advantage of this characteristic. Free flows of information are part of their philosophy. But those practices do not fit into the classic economy and value systems, they even question them. In capitalism, everything has a price tag, and gratis goods such as software do not fit into traditional patterns of thinking. Programmers who decide to give away software for free are not treated with respect, but with suspicion. The media portrays important personalities of the scene, such as GNU-founder Richard Stallman or Linus Torvalds, initiator of Linux, as exotics at best, but they are hardly taken seriously. The situation is completely different with Bill Gates. The Microsoft founder is a brilliant business man and this has made him a celebrated icon of the world economy.
Activists for free software spend a great deal of their time on public relations. Prejudices are to be eradicated, trust has to be created. Georg Greve, president of the FSF Europe, tells the story of how the organizers of an international policy congress once asked him to be the last speaker. They were concerned that his GNU/Linux presentation could destroy the beamer.
The principle of organization of FOSS and its economy and philosophy sounds adventurous for outsiders: individuals, scattered around the world, writing software together (often for free), which is often of better quality than its proprietary competitors. GNU/Linux can be used for commercial and non-commercial purposes alike, it is created in loose networks, and although sometimes corporations are involved, there are no traditional superiors. The fact that software production based on cooperation is just an economic technique adapted to digital media is just starting to enter people's minds. For many, this free cooperation is an ethical lifestyle as well. Because this model has proven to be successful, it is being applied in other areas, for example, the Human Genom Project is working with similar networked structures, but this development is only just beginning.
In addition, the culture of openness is one of the main reasons why the Internet became a success story. Only because its protocols were freely accessible was Tim Berners-Lee able to design his

[14] Lessig, Lawrence (1999): Code and Other Laws of Cyberspace. New York.
[15] Castells, Manuel: Innovación, Libertad y Poder en la era de la Información. Software Livre, January 29, 2005, available at http://www.softwarelivre.org/news/3635.

World Wide Web. And only because he released it in turn to the public did it spread so quickly around the world. Companies and individuals alike could read the source codes of websites, copy them, and make their own pages and develop new business models.[16]

6.3 Cooperation Between the GNU/Linux-Movement and NGOs and the Public Sector

The cooperation between the FOSS-scene and civil society groups working in digital divide related issues has only just begun. When in December 2004 news got out that Microsoft and UNESCO will work together in the future, it hardly provoked critical reactions. A set of reasons complicates the exchange between hackers and professional helpers. NGOs often say that they have to train their clients on proprietary systems, as free systems, especially in the desktop area, are not common. They cannot teach skills which the local labour market does not demand.

Public initiatives and NGOs often get into conflicts of interest. Most programmes in the "Information and Communication for Development" area depend on sponsors providing hardware, software and technical know-how. Proprietary companies have far greater capacity to satisfy this need than the GNU/Linux movement or open source companies. One of the most generous sponsors is Microsoft. In 2004 the corporation donated more than forty-seven million US dollars worldwide plus software licences with a value of 363 million dollars.[17] The world's richest foundation with capital of twenty-eight billion dollars, the "Bill and Melinda Gates Foundation"[18], is mainly engaged in health care, but it also funds technology projects, often in cooperation with Microsoft.

As part of its programme "Education", the foundation provides public libraries of poor regions with IT-infrastructure. As an official partner of the Chilean government, it has supplied the country's entire library system with Internet Access Points.[19] Such public-private-partnerships allow the inclusion of economically disadvantaged people in the information age. But one has to take into account that by cooperating with proprietary corporations such as Microsoft, potential future customers get used to their products, and proprietary standards, protocols and formats are enforced.

In the end, this social commitment might better serve the economic interests of the donor than those of the recipients. Microsoft has a history of violating antitrust laws and is known for notorious business practices. With his essay "Who benefits from the Digital Divide?"[20], Brendan Luyt has written a critical essay on digital development policy that is well worth reading.

Brazilian activists for free software report that Microsoft systematically approaches NGOs in order to offer funding. Political decision makers thinking about migration have excellent chances to receive increasing attention from Microsoft lobbyists as well. In addition, it is striking that in countries where GNU/Linux gains a noticeable market share, cheaper and trimmed-down Windows versions are soon made available for sale. *Software has become a political issue.*

It would be good to see more cooperation between open source companies and digital divide-initiatives in the future.

7. Free/Open Source Software = Development and Growth?

Despite all its compelling characteristics, free and open code does not automatically equal growth and development. It is of little use to only point out its advantages for poor and developing coun-

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16 Cp. van Schewick, Barbara (2004): Architecture and Innovation. The Role of the End-to- End Argument in the original Internet. Unpublished Dissertation. Technical University Berlin.

17 Microsoft (2005): Microsoft Community Affairs. Microsoft, June 30, 2005, available at http://www.microsoft.com/mscorp/citizenship/giving/.

18 Baier, Tina: Ein Manager für Afrika. Bill Gates betreibt mit seiner Stiftung Entwicklungshilfe wie ein Geschäft und investiert dabei mehr Geld als die WHO. In: Süddeutsche Zeitung, March 18, 2005, p. 12.

19 Bill & Melinda Gates Foundation: BiblioRedes Offers Technology Access for All in Chile. Gates Foundation, available at http://www.gatesfoundation.org/Libraries/InternationalLibraryInitiatives/LibraryProjectChile/default.htm.

20 Luyt, Brendan: Who benefits from the Digital Divide? http://www.firstmonday.org/issues/issue9_8/luyt/index.html First Monday, Volume 9, Number 8 (August 2004).

tries. There have to be local structures securing its use, maintenance and development. Free/open source software is often organized in loose networks, and support is delivered via mailing-lists or Internet. This informal support challenges institutions of the public sector and companies only used to working with fixed structures and responsibilities. They have to plan for the long-term and demand guarantees. Often, the free projects cannot or do not want to offer such services; e.g., Debian does not have a service telephone number. Support is guaranteed only when FOSS-service companies or specialists are locally available and this is the only way that GNU/Linux can establish itself as an alternative to proprietary products. The creation of a free, open IT-infrastructure is a long process.

Free/open source software has still a reputation of being to complicated for the average user. This has its reasons. Installation and graphical user interfaces adapt to standards set by proprietary systems, but "Clicky-Blinky" is still not regarded as being very sexy. Open Source programmers tend to program with themselves as an intended audience, rather than the general public. Contradictory to the openness and liberality of the GNU/Linux movement is the fact that programmers and users alike are almost all male. Very few woman decide to join the community in order to learn and pass their knowledge on. So how is GNU/Linux supposed to become mainstream?

Again, the Brazilians are further ahead than the rest of the world. GNU/Linux run telecentros[21] have proportionally more female users. The South Americans are proud that they managed to integrate many non-hackers into the movement. But even in Brazil free program code is far away from being really part of social and political institutions. The local FOSS-scene is concerned that the pro-Linux policy could end as soon as the Lula government leaves office. In order to prevent this they are intensively engaged in convincing the broad public and conservative parties of the advantages of free program code.

The greatest free software is useless if nobody outside of the community develops enthusiasm for it. Hopefully, the Brazilian way will serve as an inspiration for others.

8. Conclusions

A large share of the world's material resources is located in the southern hemisphere. Citizens of poor and developing countries have not benefited from this situation because the exploitation of these resources is mostly controlled by corporations from post-industrial nations. Knowledge and information, as well as systems for controlling the distribution of non-material goods, are also concentrated in the North. In contrast, free/open source software belongs to everybody.

Its fair conditions of use and development have the potential to induce a more even distribution of (digital) wealth. Software consists not only of information – it functions as a key to knowledge of all kinds. Knowledge is a valuable good: it grows by sharing.

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[21] Public Computer- and Internet Access Points.

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