

Open Source: Toward Innovations through Educational Development in China

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Abstract – This paper describes the author's personal viewpoints toward open source software, particularly for the educational development in China. The current status of China is presented to explain why open source is critical within the Chinese educational domain. We believe that open source is suitable not only for financial reasons, but also because it will provide an efficient solution for China to establish an innovative environment whilst promoting intellectual capacities. The benefits of using open source are ideal for the current situations in the Chinese educational system. In this paper, one example is given about the promotion activities of the open source software Scilab (SCILAB(c)INRIA-ENPC) in the Chinese educational domain since 2001. Activities demonstrate that open source ideas and practices will have a great impact in China. Lessons and progress are demonstrated from these activities. The final goal of the Chinese educational development is to increase innovation in society as well as to be the main contributors of open source software in the future.

I. WHAT HAS HAPPENED RECENTLY ABOUT THE EDUCATIONAL DEVELOPMENT IN CHINA?

Education, one of the most important Chinese traditions, has undergone rapid growth in the mainland of China since the 1980s. According to the data for the Year 2003 [1], the population of students are:

In primary schools: 116.89 million.

In secondary schools: 66.90 million.

In high schools: 32.43 million (which is after second schools).

In universities: 11.09 million.

The future goal for China is to become a lifetime learning society [2]. This ideal means that more people will enter lifetime learning programs in the future. In this big educational development program, the Chinese government recognize well the importance of development and applications of information technologies. The following two examples demonstrate the perspectives or progress in the mainland of China:

- In 2000, the Chinese Ministry of Education started a program called “*Internet to Every School*” [3]. Through this program, at least 90% of schools in the mainland of China will be connected *via* internet by the end of Year 2010. If some schools in the more remote areas are unable to carry out this goal before that time, they must provide some multimedia facilities for their mathematics teaching and training.

- In 2003, the Chinese Ministry of Education issued a new documentation called “*Standard for High-school Mathematics Teaching*” [4]. According to this standard, in 2006, most high schools in the mainland of China should include some contents on computer algorithms for their mathematical studies.

The programs clearly indicate that computer software will play an important role for the Chinese government to perform their goals. However, in software applications, one story, described below, demonstrates another challenge in China:

- In April 2003, the Educational Department of Shanghai Government received a letter from Microsoft. In this letter, Microsoft suggested that the middle schools and primary schools in Shanghai should buy the copyright software if these schools use Microsoft's products for their training materials. After receiving this letter, the Educational Department sent a formal letter to all schools in Shanghai. The final result was that all Microsoft's products were removed from the training list in these schools [5].

How to find a solution of overcoming the difficulties like this in the educational domain is still a big issue in China. Currently, misunderstandings exist about the applications of software, including for open source software. In this paper, we will discuss several questions and solutions to the current status of Chinese education. The objective of this paper is to share our understandings and experiences towards the “open-source software” (OSS, or open source) ideas and practices with the researchers and educators in the world. We want to demonstrate that although China does face difficulties with regards to many aspects, one solution seems simple and applicable, that is, pursuing innovations through OSS for educational development.

II. WHY IS “OPEN-SOURCE” CRITICAL FOR EDUCATIONAL DEVELOPMENT IN CHINA?

OSS usually means that a software source code is open, and can be freely downloaded from internet. Moreover, it gives users freedom to run, modify and redistribute the program. “Open source” is by no means a new idea if we trace it back to the underlying principle. The direct objective for OSS is to share knowledge with others.

Without “*knowledge sharing*”, this world can never be civilized. On the other hand, we believe that the principle of OSS is an important foundation laid down by the educational system. Many papers explain the importance of using OSS in the educational domain [6,7]. In this paper, we focus only on its justifications in the background of Chinese situations.

In recent years, the community of OSS developers and users in China has grown rapidly. One good example is the Working Group of Linux with Japanese and Korean communities [8]. However, OSS is still far from being mainstream in China when considering the percentage over the total number of computer users (<5%). For the majority of computer users, OSS still seems to be a new concept in China. Although some users may know this type of platform, misunderstandings and habits may lead to them choosing pirated copies of software rather than OSS.

Another driving force for using OSS is from the Chinese government. The Ministry of Sciences and Technology and Ministry of Information Industrials have put encouraging policies of research and development toward OSS. For example, Chinese 863 High-tech National Program has initiated a program in 2002 called “*Reduction of Digital Divide in the Western Region of China*”, in which OSS is a main theme. Significant progress has been achieved from this program. In addition, some local governments have also adopted OSS. In comparison, unfortunately, the Chinese educational department seems quite behind in its supporting role to OSS.

Since 2004, some universities and local governments in China have started a so-called “*Copyright Software Movement*”. From this movement, they suggested that educators and officers remove the illegal software by purchasing copyright software. It is interesting to find that the movement is quite in keeping with the “*Fighting Piracy Movement*” carried out by some software companies.

“*Fighting Piracy*” is an important task in China. However, this should not be set as an objective but rather a starting point (Fig. 1). The finishing point, or ultimate goal, should be “*Innovation*” for human development. It is clear that “*Fighting Piracy*” does not result in the unique outcome of purchasing copyright software, however, which is the recent trend from the “*Copyright Software Movement*” in China. Therefore, we consider this movement may mislead our education society. “*Is it possible for the majority of Chinese schools and universities to follow a solution of purchasing copyright software*”? The answer can be seen immediately if we look at some basic data in China. About 80% of the school age population live in the countryside and sub-urban

in China. Further information about the overall status of China will enable a better understanding about the meaning of these percentage data.

According to the information given by the World Bank for Year 2003 [9], the mainland of China was ranked 118 and 133 based on the data of “*Atlas Methodology*” and “*Purchasing Power Parity*”, respectively. In general, a quite gap still exists in China for reaching the average living standard in the world . Moreover, China demonstrates a high degree of differences between rural and urbanized regions concerning its development. “*One China, Four Worlds*” [10, 11] gives an exact, yet simple, description into the current status about the mainland of China. Whilst only a few cities fall into the “*First World*”, the majority of regions and populations in China belong to the fourth world. The term “*Fourth World*” is used to stress that a large part of the population has a much lower income than the average according to the World Bank's data. In the study by Hu in 2001, more than 50% of the Chinese population falls into this category[10]. “*If that population were a country, it would be the third largest in the world and rank 141st in terms of per capita income*”[11]. According to the study in [10], the “*Digital Divide*” will become a more serious problem in China if no policies and measurements are made by the government. However, even if we want to speed up the applications of information technologies, the financial shortage for the majority of regions of China is a big problem. Obviously, purchasing copyright software seems to be impossible for most Chinese schools, except in certain cases or in very few schools.

Most of all, however, OSS will be the best path for educational development even if we have no more financial difficulties. OSS is fully compatible with innovation goals. In addition to reducing costs on both the initial software license and later upgrades, the greatest benefits of using OSS over proprietary software in the educational domain are always true for any country:

- 1) Speeding up distribution and improvement of knowledge (including software),
- 2) Stimulating teachers and students toward innovation,
- 3) Enhancing collaborations between teachers and students,
- 4) Providing more flexibility and independence for software localization,
- 5) Promoting software use in the public domain as public goods.

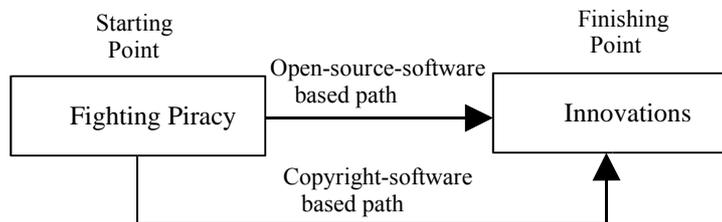


Fig. 1. Two paths of software use for reaching innovations.

Whilst China is growing fast in both educational and information domains, a proper selection of pathways will be important in reaching the goal directly. Considering the current situation in China, we believe that the “Open-source-software based path”, instead of the “Copyright-software based path”, will present a direct solution to our goal for innovation.

III. WHAT PROGRESS HAS BEEN MADE IN THE PROMOTION OF OPEN-SOURCE SCILAB IN CHINA?

Educational software has become an important platform for learning and training in many Chinese schools if they are located in cities. Computer literacy is also a necessary skill for our students since many jobs need such skills in the labor market. Within most engineering universities, for example, one commercial software, Matlab (copyright by Mathworks in US), is extensively used for teaching since it is a general tool for scientific computing. However, due to its expensive license fee (more than 1000 Euros per license for the main

body of Matlab, and the extra fee for each individual toolbox), many users in the mainland of China adopt an illegal method for obtaining this software.

Since 2001, LIAMA (*The Sino-French Laboratory in Computer Sciences, Automation and Applied Mathematics*) together with INRIA of France and other Chinese universities began to promote Scilab in China. Scilab is OSS developed by INRIA and ENPC of France [12]. It is also a general tool for scientific computing with many functions and user friendly interfaces. The direct objective of this promotion is to strengthen the research exchanges and collaborations between Chinese and French researchers *via* the platform of Scilab. The final goal is to promote information societies within both countries for long-term collaborations in wider areas.

Up to now, several activities with regards to this promotion have been made with great success. For example, we have organized four “Sino-French Scilab Workshops” at Beijing (2001), Shanghai (2002), Xi'an (2003) and Xiameng (2004), respectively (Figs. 2-3). Three “Scilab Contests” were held nationally (Fig. 4).



Fig. 2. “The First Sino-French Scilab Workshop” in Beijing (2001).



Fig. 3. “The Third Sino-French Scilab Workshop” in Xi'an (2003).



Fig. 4. Award Ceremony of “The First Scilab Contest” at “2002 Euro-China Forum on Information Society”.

Scilab has been well received by Chinese universities. The scientific spirit of Scilab is greatly appreciated by Chinese people. The statements below, given by the founding director of LIAMA, Prof. Songde Ma, exactly reflect our understanding toward Scilab:

“For basic scientific computing software, it should have been widely used by students, professors and researchers. However, due to the high price of commercial software, many researchers have worked on the development of free software. They should receive respect and encouragement from our society and government. With its 'open source' feature, SCILAB will attract Chinese researchers to join the team for its development. ... For the bright future of mankind, we need to work together in producing and sharing scientific results” [13].

In order to share the “*Be Proud of Developing Open Source*” passion with our Chinese students, the present author designed a pin badge, a proud puffin (Fig. 5), in the first Chinese Scilab book [in 13] for promoting OSS. This symbol was accepted formally as the “*Scilab Mascot*” by the Scilab Consortium during the “First International Conference of Scilab in 2004”, and also received more explanations from French researchers [14].



Fig. 5. Scilab Mascot for encouraging the spirit of OSS in scientific computing education.

IV. WHAT HAS BEEN LEARNED FROM THE PROMOTION OF OPEN-SOURCE SCILAB IN CHINA?

Whilst progress has been made from the dissemination activities in the past, we believe that the promotion of Scilab is not limited by its narrow sense of computer software applications and developments. Lessons have been learned mostly from its underlying principle of “sharing knowledge” ideas in OSS. We summarize these lessons and progress as follows:

A. A good environment for intellectual properties should be established within the Chinese educational domain.

China is currently facing a great challenge with regards to protecting intellectual properties. This problem may be due to its cultural understanding about knowledge-related materials. One famous character in Lu Xun's novel, written in 1919, reflects well the problem. In this novel, a poor scholar, Kong Yiji, was caught by others for stealing a book. Kong Yiji argued that “*Taking books for a scholar cannot be counted as stealing*” [15]. This argument seems to imply that books should be free for readers in some sense. In the modern society, however, China needs to establish a good environment for intellectual properties. The current piracy status in China impedes innovations for better human intellectual development. From the dissemination activities, we recognize that fighting piracy will be a long-term task in

China. To compete this challenge, the educational domain will play a critical role. Chinese educators and administrators should put therefore more effort into guiding our young students to pursue innovation through other means than piracy.

B. OSS provides the best means for innovation, particularly for Chinese educational development.

Many Chinese computer users justified their piracy behavior by arguing that commercial software developed by Western countries are too expensive; or, open source software does not work well. In the Scilab dissemination activities, we demonstrated *via* using Scilab that “*Why rely on illegal software? Using open source, one can develop better*”. Several toolboxes developed by Chinese graduate students confirm this statement. For example, in the author's class entitled “*Introduction to Intelligent Control*” at Beijing Graduate School of Chinese Academy of Sciences, my Master student, Zhong Li, developed a “*Genetic Algorithm Toolbox on Scilab (GATS)*” in 2003. This toolbox presents better functions than the similar existing toolboxes for genetic algorithms in Matlab, e.g., by including a function for parallel processing. In 2004, I distributed GATS to the other graduate students for their computer projects. Many students learned more from this toolbox and also improved on it in several aspects. Without relying on the illegal use of Matlab, about 50 graduate students in my class did their computer projects based on Scilab or GATS. Another good example is given by the Scilab Team of Xiameng University. This team consists of more than 10 university students from different grades. One innovative work they performed was “*Scilab Anywhere*”[16]. Using this toolkit, one can submit calculations to the web server and receive both data and graphic results through the internet. This toolkit, working for both Linux and Windows platforms, presents a promising innovation from Chinese students. We believe that innovation from student works provides a stimulating example for other students, and an OSS platform serves this function better than working on commercial software.

C. For an efficient promotion of OSS, scientific computing software Scilab is introduced into schools and universities.

For most Chinese students, OSS is known only by name. In fact, scientific computing software, like Scilab, will be the best platform for students to know and apply OSS in their class studies. Since 2001, we started the Scilab dissemination process within universities, as many professors and students use scientific computing software. From September 2004, Scilab was introduced into Chinese high schools in certain provinces. This successful progress is due to the People's Educational Press selection of Scilab as the software platform for the mathematic textbooks. According to the Press information, about 200,000 high-school students in Shan Dong Province used this textbook. In addition, the Capital Normal University developed Scilab toolboxes in mathematics and physics for high schools. An open and flexible platform, like Scilab, will provide a great

penetration power for Chinese people to adopt information techniques. On the other hand, this platform is also helpful for Chinese teachers and students to work at an international level for better software and educational developments. The potential benefit of using OSS from high schools will be significantly great to promote innovation society in China.

D. Encouraging policies should be made in the Chinese educational domain for OSS.

From the Scilab promotion activities, we recognize that the Chinese educational domain has missed studies and practices of OSS in many aspects. "Open source" should be encouraged and promoted through national policy making by the Ministry of Education. Many successful experiences of OSS in the educational domain can be learned from other countries [17-18]. For example, the Indonesian government, including the Ministry of Education, proposed open source movements not only for government administrations, but also for educational applications [17]. For reduction of "Digital Divide", China needs to pursue an innovative approach for establishing the eco-environment of OSS. OSS should not be considered only as a computer tool, its principle and sprits should be fully adopted for all basic educational activities, e.g., the sharing and collaboration of data, information, lecture notes, experiments, and all other educational resources. On the other hand, how to promote software industries in joining the educational development will be one of the most important issues. The final goal for China is not aiming at being main users of OSS in the world, but being the main contributors for a better and innovative world.

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