Copyright Infringement of Software

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Abstract — *The evolutionary development of Information and Communication Technology has become a doubled edge knife since it has made human life console and easy, and at the same time unsafe and vulnerable. In this paper we have put an effort to search research and understand the means of copyright violation in software industry and methods of preventing.*

Index Terms — software, software copyright, Berne Convention, Copyright infringement

I. INTRODUCTION

The copyright infringement of software (as known as software piracy) refers to practices which involve unauthorized usage of computer software. Most countries have laws to prevent copyright infringement of software, but they differ from each other in practice. These laws generally grant right owners considerable freedom to control software. Still copying, illegal usage and distribution of software is widespread.

II. SOFTWARE COPYRIGHT

A. Software

For a computer to work, a set of instructions need to be given to the computer in a language that it understand. The set of instructions is called 'a computer program'. Software consists of computer programs and associated documentation such as requirements, design models and user manuals.

Here are some examples of software:

TABLE I

Software type	Description	Examples
Operating system	The computer program that organize all the computer programs	Microsoft Windows Linux
Software for general use		Web Browser, Word Processor, Spreadsheets,
Specialized software		Computer aided design Software,Software for Statisticians,Software for Accounts

A Software program consists of two codes: source code and object code.

- Source code - The computer program written by the programmer.
- Object code - The computer program written in machine language. (i.e. in 1's &0's)

A special computer program called a compiler is used to convert source code into object code. [1]

A computer program can be presented both in source code form and object code form. "So far as copyright law is concerned, both of these forms are covered by the definition of "computer program". Furthermore, the two forms are regarded as equivalent, in the sense that whoever owns the copyright in the source code will automatically own the copyright in the object code. " [1] [chapter1.2]

Computer language or the individual words which make up that language are not considered as a piece of software.

Even though the manuals that document a piece of software will be copyrighted, the rules may not be exactly the same as for software copyright. [1]

On the other hand free software is an idea, an ethic, promoted and supported by large, loose-knit group of computer programmers. Free software is allowed to be copied, used, and modified. Open source software is software distributed or made public with the source code with readable and modifiable rights. [2]

B. Copyright

A variety of intellectual property rights (IPRs) are applied in protecting computer programs. Even though in some circumstances many laws and IPRs such as the law of contract, confidentiality, trademarks and patents may apply, the most challenging IPR to protect is copyright.

Copyright is a property right. Essentially, its function is to protect intelligence and artistic work that originates from creativity, ideas, research, skills, labour, non-material efforts and attributes the creator provides. The first owner of any copyright is the author of the work. "Copyright subsists in an original literary work, including a computer program, preparatory design material for a computer program, a database and a table or compilation other than a database."[4] [pp. 1] Preparatory design materials for a computer program are flow charts, specifications, tables, program listings, screen display, menu layouts and the like. However, copyright is applied only after the work is recorded. [4]

Copyright protects source code, object code and data/record structures (as compilations and/or databases). The UK court once decided that a compilation of programs may be a

copyright work itself as combining the whole package involves considerable skill and labour. Also court remarked if a substantial part of the programmer's skill, labour and judgment went into the architecture of a computer program, then architecture is also capable of protection.

The nature of the software and its development process govern the duration of copyright for that software.

III. HISTORY OF COPYRIGHT

Although there are several strategies today to protect computer programs by copyright, it was not effectively protected in early days. The Copyright Act of 1909 protected registered copyright publications. However computer programs faced a problem in this regard since they are not published in the same way as books and other copyrightable works. According to the Copyright Office, North American Aviation submitted a tape containing a computer program for registration in November 1961 but Copyright office wasn't able to decide whether it is eligible for registration or not. In 1964, a Columbia University law student tried to establish a way to registering software programs by submitting one program on a printout and the other one on a magnetic tape. The student's tape and printout, as well as the North American Aviation tape were all registered in 1964.

"The Copyright Office concluded that a computer program was like a "how to" book, and therefore protectable by copyright just like that book, if:

1. The elements of assembling, selecting, arranging, editing, and literary expression that went into the compilation of the program are sufficient to constitute original authorship.

2. The program has been published, with the required notice [which was a requirement for copyright at the time]; that is, "copies" (i.e. reproductions of the program in a form perceptible or capable of being made perceptible to the human eye) bearing the notice have been distributed or made available to the public.

3. The copies deposited for registration consist of or include reproductions in a language intelligible to human beings [source code, rather than object code]. If the only publication was in a form that cannot be perceived visually or read [say, on magnetic tape],

something more (e.g. a print-out of the entire program) would also have to be deposited." [5]

After this case, copyright of computer software (programs) has been generally accepted and nowadays most computer software contains a copyright notice, even if they are not formally registered.

In the Copyright Act of 1976, Congress made it clear that software was copyrightable. However, this act still didn't clarify the extent of the copyright protection. Therefore Congress appointed the National Commission on New Technological Uses of Copyrighted Works, referred to as CONTU, to investigate the situation and make recommendations.

CONTU recommended two changes to the Copyright Act in respect to programs. Congress adopted CONTU's recommendations, and it became Public Law 96 - 517 in December 1980. One refinement changed the definition of "rightful possessor of a software program copy" to "owner of a copy." The reason for this change was to remove any gray areas of ownership. An example of such a problematic area is where people borrowing a copy of a software program from a library might copy the program onto a computer and do not delete it when they return it. [5] [6].

IV. COPYRIGHT LAWS

Software is different from other consumer products. Hence software copyrights also slightly differs from copyrights of other products. Existing copyright laws provide the programmer considerable copyright protection. According to copyright laws someone other than the programmer can't run, compile, decompile, make copies, modify or distribute the program without permission. Even downloading an image and copying it to the hard disk is considered as a copy right infringement.[1]

To protect the programmer from illegal copying, most of the countries have introduced copyright laws. Even though the copyright laws differ in each country they tend to cover the same principles. With the time these laws were updated to protect the programmer from new threats. The following table summarizes copyright laws in some countries as well as in Sri Lanka.

Country	Copyright Laws
Sri Lanka [7]	Intellectual Property No 52 of 1979 Intellectual Property Act, No 36 of 2003
UK [8]	The Copyright Act of 1976 The Digital Millennium Copyright Act of 1998 The Copyright Royalty and Distribution Reform Act of 2004 The Satellite Home Viewer Extension and Reauthorization Act of 2004 The Intellectual Property Protection and Courts Amendments Act of 2004 The Prioritizing Resources and Organization for Intellectual Property Act of 2008 The Satellite Television Extension and Localism Act of 2010
US [9]	Copyright Act of 1790 Copyright Act of 1831 Copyright Act of 1909 Universal Copyright Convention Copyright Act of 1976 Berne Convention Implementation Act of 1988 Copyright Renewal Act of 1992 Uruguay Round Agreements Act (URAA) of 1994 CopyrightTermExtension Act of 1998 Digital Millennium Copyright Act of 1998
Australia [10]	Copyright Act 1968 The Copyright Regulations 1969Copyright Amendment Act 2006

Above mentioned copyright laws usually provide protection only for its nationals or for work first published in the country. However the computer programs and software are influenced internationally. They may be distributed easily all over the world. Therefore, there should be a global agreement on copyright protection. Conventions and bilateral agreements address the availability of protection for foreign authors and grant protection to foreign authors under the principles of national treatment. Under those agreements countries grant the same protection both internationally and locally. The major international treaties relating to copyright protection are the Berne Convention, the Universal Copyright Convention, TRIPS (Trade- Related Aspects of Intellectual Property Rights) Agreement and WIPO Copyright Treaty.

A. Berne Convention

The Berne Convention for the Protection of Literary and Artistic Works, usually known as the Berne Convention, is an international agreement governing copyright, which was first accepted in Bern, Switzerland in 1886. [12]

B. Universal Copyright Convention (UCC)

The Universal Copyright Convention (UCC) was first created in 1952 in Geneva, as an alternative to the Berne convention. [13] The symbol © comes with this convention and it details that the states that require formal registration should treat works from foreign states that are signatories of the convention as if they had been registered in the state, provided that they carry a notice which includes the © symbol and states the name of the owner.

C. TRIPS

Trade Related aspects of Intellectual Property rights (TRIPS) is administered by the World Trade Organization (WTO) that sets down minimum standards for many forms of intellectual property regulation as applied to nationals of other WTO Members. [7]

D. WIPO Copyright Treaty

The World Intellectual Property Organization (WIPO) Copyright Treaty, is adopted by the member states of the World Intellectual Property Organization (WIPO) which is a specialized agency of united nations in 1996.[8] This treaty has advanced law to protect information technology related products.

Sri Lanka also has signed and approved the above laws. On 20th July, 1959 Sri Lanka ratified Berne Convention. On 25th January, 1984, Universal Copyright Convention was approved by the Sri Lankan government. TRIPS were agreed on 1st

January, 1995. Sri Lanka has not signed the WIPO Copyright Treaty yet.

V. WAYS OF COPYRIGHT VIOLATION

Rapidly developing technology has given people better chances to work out their own creative ideas. On the other hand new technology has made copyright infringement much simpler and cheaper. Copyright infringement can occur intentionally or unintentionally. Unintentional infringement is known as innocent infringement, while the other situation is known as vicarious infringement, where copyrights are infringed expecting a profit. [16] First we need to be aware of how these copyright infringements occur in today's world in order to prevent software infringement. Copyright infringement occurs when the copyright owner's rights are violated. That means it does not need to copy the work exactly but there should be sustainable similarity between the suspicious work and the original work. If the creator of the suspicious work is proven to be guilty, the courts can take necessary actions to preserve the rights of the copyright holder. Before trying to figure out the ways of infringement, let's identify the rights of a copyright owner granted under Copyright Act. [16]

1. The right to reproduce the copyrighted work in copies – This conveys that only the owner of the work has the privilege of making copies of his work. If some other person make copies without the permission, then that is considered as copyright infringement.

2. The right to prepare derivative works based upon the copyrighted work – Only the owner has the freedom to modify the original work or to create a new one using the original work.

3. The right to distribute copies of the copyrighted work to the public by sale or other transfer of the ownership by rental, lease or lending – Illegal selling or distribution of songs, movies and software applications violates the owner's distribution right. But after first selling, the copyright owner doesn't have any control over the copyrighted work. This is known as "first sale doctrine". However copyright ownership is not transferred to the purchaser. When comes to software, this is bit different. The first sale doctrine is not applicable for the software that is claimed under End User License Agreement.

4. The right to perform copyrighted work publicly (In the case of literary, musical, dramatic, and choreographic works, pantomimes, and motion pictures and other audiovisual works) –Software programs comes under literary work. Even though this right is not fully developed for software, audio, video work and video games are protected under this law.

5. The right to display copyrighted work publicly (In the case of literary, musical, dramatic, and choreographic works, pantomimes, and pictorial, graphic, or sculptural works, including the individual images of a motion picture or other audiovisual work) – This is also similar to the previous law and this ensures that the owner has the right to display his work in public places. If you publish an article in your website that is in some other web site without permission, that is violation of public display right.

6. The right to perform the copyrighted work publicly by means of a digital audio transmission. (In the case of sound recordings)

Copyright infringement can be classified as literal and non-literal infringement. In general literal infringement is expressing the original work in exactly the same words. Non-literal infringement is restatement of an expression giving the same meaning in another format. Literal elements in a computer program are the source code and the object code. Documentations of a computer program such as the architecture and flow charts are considered as non-literal elements of a computer program. It is easy to identify what comes under literal infringement and non-literal infringement when you know what the literal and non-literal elements are. As an example, consider coding someone else's program in another language which will have a different code but behaves in the same manner. This scenario comes under non-literal infringement. If you are using another programmer's code it has to be properly mentioned within your code. [18] Common ways of violating copyrights in Sri Lanka is installing licensed software onto multiple computers. Most of the popular software applications used by our community, need to be purchased. They are not open source. Therefore

individuals as well as organizations tend to copy software or use illegally generated licensed keys. Even though the situation is like that, sometimes there are exceptions to the copyright infringement rules that allow reusing without legal approval. One of these exceptions is 'fair use'. According to the Copyright Act of 1976, the reproduction of copyrighted work for the purpose of "criticism, comment, news reporting, teaching ..., scholarship, or research" [16] is fair use. The same act also mentions the followings as factors that have to be considered in determining fair use.

1. The purpose and character of the use, including whether such use is of a commercial nature or is for non-profit educational purposes.
2. The nature of the copyrighted work.
3. The amount and substantiality of the portion used in relation to the copyrighted work as a whole.
4. The effect of the use upon the potential market for, or value of the copyrighted work. [16]

Making Braille copies or audio copies for blind people or excerpting for teaching materials is not considered as copyright infringement according to fair use. Otherwise use of material for higher education purposes will be much harder. Also there is a time period during when the creator of the work has its ownership. After that period copyright protection expires and the work will be included in the public domain. [17] Anything that is in the public domain is free to be used without permission. Some works are considered as non-copyrightable works. [17] Names, titles, short phrases and slogans come under this. Any name, title or a slogan can be used in your own work and that will not be counted as copyright infringement but sometimes names or titles of a product may be protected under trademark laws. In that case you can't use it without the permission of the trademark holder.

VI. COPYRIGHT INFRINGEMENT PREVENTING TECHNIQUES

With the rapid growth of ICT, "copyright violations in the software industry" has been growing ominously over the past decades as we have discussed above. As the copy right violation and piracy of software has become a major drawback towards the industry growth, national and international laws and policies come into the act of preventing copyright infringement in software.

Digital rights management (DRM) is one of the key access control technology introduced in order to limit undesired content and usage by the provider. DRM attempts to give control to the seller over their software products after it is delivered to the consumer. DRM technologies are used by hardware manufacturers, publishers, copyright holders and individuals to protect their digital properties.

World Intellectual Property Organization (WIPO), European Union and several other organizations which have been established with the purpose of digital right management has introduced laws and acts such as Digital Millennium Copyright Act (DMCA), end user license agreements (EULA), Uniform Computer Information Transactions Act (UCITA) etc.

Extending the copyright for longer period also increase the life of software. For example older US software legacy systems have their copyrights expiring in 2030.

Other than organizations each and every individual developer and their development teams have been practicing their own prevention methods to overcome copyright infringement of their software products. Developers encrypt their code in order to hide software implementation from other parties.

Moreover, when a customer (end user) purchases software he/she has to accept a set of license agreements where developers provide quality delivery to the customer while ensuring their own copyrights are preserved. To prevent piracy of widely used software, customer is required to purchase a license key from the developers to utilize the genuine software. Otherwise, the customer is not permitted to use the software or update it. Unauthorized users can even be charged for committing piracy and illegal usage.

When "Open Source Software" is taken into consideration, occurrence of copyright infringement is very less as they have enabled all the rights to acquire the software and use it freely. Anyone can access open source code, edit it to enhance or make software and use that. As these open source software are freely available, no copyright violation or piracy is encountered as a portentous case regarding these kind of software.

[14] [15]

VII. CONCLUSION

Software copyright is a debatable topic among programmers. While anti-copyright group suggests that copyright should be abolished or be replaced with only GNU license, major commercial software developers insist governments on improving copyright laws. GNU license is a copyright license

itself and if copyright is to omit from law then GNU won't hold any value. This might cause an immense growth in software piracy cases where software creator will not be able to seize his rights, which in turn would discourage software creators. If copyright laws are to be tightened, the right holders might get the advantage over software users. Policies like checking for valid license number before granting usage might be risky in critical software systems like medical equipment handling systems or space craft handling systems. Also current DRM and other technologies don't precisely identify difference between 'fair use' and piracy. Thus there can be conflicts in copyright management. Most of the widely used commercial software has been developed in US or in some western country. Critics in developing countries consider having to pay western countries for usage of software as an indirect technology transfer tax on their country, preventing technological advancement. Sometimes developing countries refuse to accept or respect copyright laws because of this and it is a great threat on careers of software engineers, programmers and software developers.   Thus governments should take actions to protect copyrights of software but these actions should be fair in the sense that they would encourage software development and authorized software usage.

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