

SEMINAR PAPER

COST COMPARISON BETWEEN PROPRIETARY AND OPEN SOURCE SOFTWARE

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List of Abbreviations

BSD – Berkeley Software Distribution

EULA – End User License Agreement

GIMP – Image Manipulation Program

GNU – GNU's Not Unix

GPL – General Public License

IBM – International Business Machines Corporation

IT – Information Technology

MIT – Massachusetts Institute of Technology

NDA – Non-Disclosure Agreement

OS – Operating System

OSS – Open Source Software

PC – Personal Computer

PERL – Practical Extraction and Report Language

PHP – Hypertext Preprocessor (originally Personal Home Page)

RAR – Roshal Archive

TCO – Total Cost of Ownership

U.S. – United States

ZIP – Zone Information Protocol

1 Introduction

Before I started working on this seminar paper, I did not realize that so many versions of software exist. I differentiated the software only by one criterion, the price. So, either I have to pay for the software, or I don't. I have also noticed in my surroundings that many people do the same, and when it comes to the IT, they only distinguish between software and hardware.

In the first research phase I was overwhelmed by many software terms and software types. There are Open Source Software, Proprietary Software, Closed Software, Shareware, Freeware, Free Software, BSD License, MIT License and many more terms. This leads to the question, aren't Free Software and Freeware the same thing? No, they are not same, and the reasons for this will be discussed later. But how should I make the right decision on what software to buy, when I can't even distinguish between the different software versions. For this reason, this work should give an overview to which software versions are available on the market and where differences are between them.

The first chapter is about Open Source Software. This chapter begins with the most important events in the history of Open Source. After a brief historic outline, the Open Source Software is defined and distinction to Free Software is drawn. After that, the most important licenses are presented. To get a better overview of what the Open Source Software can be, some examples are listed. Finally, the advantage and disadvantages of this type of software are listed.

The next chapter begins with the history of Proprietary Software. After that the Proprietary Software, as well as Freeware and Shareware are described in detail. Like with the Open Source Software, different licenses are listed here. Lastly, a few examples are shown, and the advantages and disadvantages of this software are listed.

In the last chapter a cost comparison between Open Source and Proprietary Software is presented. Here it is explained which costs are important when you have to buy a software.

Abstract

When searching for the right program or operating system, there are many options to choose from. But what one does not know is that all these programs, applications and others belong to either one or another software category. Basically, there is a choice between Open Source Software and Proprietary Software. But beware there are also differences within these two categories. This raises the question of which one should be chosen. The entire decision depends on your own or your business needs. To answer this question, we will compare both software. This comparison in this paper will enable the reader to better understand the two alternatives.

2 Open Source Software

2.1 History of Open Source Software

The history of Open Source Software goes back to the beginnings of the computer industry in the fifties and sixties. At that time revenue was generated with the sale and maintenance of hardware. However, by the end of the sixties, the software industry became more and more important, and it was no longer a byproduct. The Unix operating system was launched in the seventies by AT&T. Even though the software was free, users were forbidden to share or to change it. And it didn't take long for AT&T to start charging for the system patches. At that time, in early eighties, not only the software firms but also the computer manufacturers started charging for the software licenses. They also have restricted new software developments by means of copyrights, trademarks and leasing contracts. (Wikipedia, n.d.)

In the seventies, the MIT lab had a printer that regularly jammed. Therefore, the staff programmer Richard Stallman and others at the lab altered its source code so that when the printer had some issues it would send a message to everyone, who would be printing at that moment, that the printer is jammed and needed to be fixed. When the MIT lab got a new printer, Stallman asked for its source code, but they refused to give it to him, because it was a company secret and they signed an NDA. (Neary, 2018)The companies decided from now on only to share their executable machine code and no longer the source code. Stallman was not happy with this decision because he was no longer allowed to modify the source code. This whole situation led him to start the GNU Project in 1983, a completely open operating system. He created this two years after he launched the Free Software Foundation. (Wikipedia, n.d.)

In general, the idea behind a free software was for Stallman that programmers could use the software however they like but also on the other hand to change its source code and to share it with others. The Stallman code was published under the GPL, GNU Public License. (Gasser, 2019) Through the GPL he created Copyleft, which guarantees that everyone who uses and develops the code has the same rights as the initial author. Copyleft was invented to ensure that software stays free. To be a free

operating software operating, GNU was missing an important element, a kernel. Therefore, Linus Torvalds invented the Linux kernel and published it under GPL. Together with GNU Project and the kernel, the GNU/Linux operating system was born.

During the dot-com years, using the free software became a favorite choice. The popularity gained the following: the Apache web server, the MySQL database and programming languages PHP and Perl. In 1997, the publication of an essay entitled The Cathedral and the Bazaar by Eric S. Raymond led Netscape to release their source code for Communicator. But the characteristics of Free Software was not attractive for the companies such as Netscape. That is why the term Open Source was born. (Wikipedia, n.d.)

2.2 Definition of Open Source Software

Open Source Software

What is Open Source Software? One speaks of Open Source Software when the source code is openly accessible to everyone. This software can be used and changed for free by anybody who knows how. (Upcounsel, n.d.) According to Bruce Perens, these are the criteria that define an OSS:

- **Free Redistribution:** The license must not prevent anyone from selling the software and it must not charge any license fees for it.
- **Source Code:** The software must have a source code that is freely accessible to everyone.
- **Derived Works:** The license must permit users to modify and derive works from the primal software.
- **Integrity of The Author's Source Code:** Only if the original code may be distributed with the patch file, is it allowed to restrict the distribution of the modified source code.

- **No Discrimination Against Persons or Groups:** Everybody can use it, nobody should be excluded.
- **No Discrimination Against Fields of Endeavor:** The license is not allowed to restrict for what the software is used for.
- **Distribution of License:** All rights associated with the original license remain valid even if the program is redistributed. An additional license is not required for this.
- **License Must Not Be Specific to a Product:** The license is not allowed to refer to a specific distribution.
- **License Must Not Restrict Other Software:** The license may only have restrictions for OSS and not for other licensed software that are distributed together with them.
- **License Must Be Technology-Neutral:** The license is not allowed to require an individual technology or interface. (Wikipedia, kein Datum)

Free Software

Many of us think that Open Source Software and Free Software are the same, but no they are not. Free Software is software that allows users to use study, modify, copy and distribute it freely. The term “free” applies to freedom not the price. That means that Free Software doesn’t have to be always free of charge. (GNU, n.d.) Free Software is defined through four freedoms:

- **Freedom 0:** The software may be used for any purpose.
- **Freedom 1:** To have access to source code, to understand the software and eventually to modify it.
- **Freedom 2:** The software may be copied and distributed.

- **Freedom 3:** The copies of the modified version of the software may be distributed.

If one of these freedoms is missing, the software is considered non-free. (GNU, n.d.)

2.3 Open Source Licenses

Simply explained, licenses are those that make the source code of software freely available. Therefore, there is a long list over 80 open source licenses that you can select according to your needs. The licenses can be roughly divided into two categories, namely copyleft and permissive. (Goldstein, 2019) The difference is that with copyleft, the rights granted by the license must be preserved even if the program (source code) is modified. On the other hand, permissive licenses have only minor limitations for the users. (Salter, 2020) Here are a few most popular ones:



Figure 1: GNU General Public License (GPL)

Source: <https://resources.whitesourcesoftware.com/blog-whitesource/open-source-licenses-explained>

- **GNU General Public License (GPL):** This license is the most popular one among other open source licenses. GPL falls in the category of copyleft license. For example, Joomla and MySQL were published under this license. (Moqod, 2019) If the software is published under this license, the creators must publish

its source code and allow the users to modify and redistribute it. (Goldstein, 2019)



Figure 2: The Apache License

Source: <https://resources.whitesourcesoftware.com/blog-whitesource/open-source-licenses-explained>

- **Apache 2.0 License:** This license falls into the category of permissive license. The software under this license can be freely studied, used, changed or distributed. It also can be used in proprietary and commercial project. For example, Swift and Firebase were published under this license. (Moqod, 2019) The license also require that a copy of the original license must be included in a notice file. The other users must always include this file. (Salter, 2020)

BSD

Figure 3: BSD License

Source: <https://resources.whitesourcesoftware.com/blog-whitesource/open-source-licenses-explained>

- **BSD License:** The BSD License falls into the category of permissive license and commercial use is allowed. But the copyright notice of the initial software is

not allowed to be removed. For example, Django and React are licensed under this license. (Moqod, 2019) The software code can be published in source or in binary format. However, the initial creators don't have the obligation to hand over the source code. During redistribution from source code the BDS License has to be included in the notice. (Wikipedia, n.d.)



Figure 4: MIT License

Source: <https://resources.whitesourcesoftware.com/blog-whitesource/open-source-licenses-explained>

- **MIT License:** The MIT License is a permissive license. With this license, users have complete freedom regarding the software, but they must include the content of the initial MIT License and copyright notice. (Goldstein, 2019) For example, Angular.js and jQuery are licensed under MIT License. (Moqod, 2019)

2.4 Examples of Open Source

In this paragraph, a few examples of Open Source Software are given.

- **GIMP:** GIMP is a free image editing program. This program is also an alternative to Adobe Photoshop. It has many filters and tools, which can be used for artistic editing. (Humpa, n.d.)

- **Ubuntu:** Ubuntu is a Linux distribution and is a free operating system. This operating system can be tried out live without having to install it first. (Chip, n.d.)
- **Mozilla Firefox:** Mozilla Firefox is a freely available web browser. Since 2002 it has been one of the most used web browsers. (Humpa, Chip, n.d.)
- **OpenOffice:** OpenOffice is an alternative to the Microsoft Office. With this program texts, tables and presentations can be opened, edited and created. This program package also contains a database and drawing program. (Heise, n.d.)
- **PHP:** PHP is a programming language that is used for web development. Furthermore, PHP is suitable for beginners. (PHP, kein Datum)
- **Perl:** Like PHP, Perl is also a programming language. Numerous web frameworks are written in Perl. (Perl, n.d.)
- **WordPress:** WordPress is a free content management system. The users of WordPress can easily create websites without specific programming skills. In the past it was mainly used to create blogs, but nowadays it can be used to create e-shops, online magazines, news portals and more. (IONOS, 2019)
- **Joomla:** It is used for the creation and maintenance of the websites. (reDim, n.d.) Like WordPress, Joomla is also a free Content Management System and is written in PHP. (Wikipedia, kein Datum)
- **InfraRecorder:** With InfraRecorder you can burn and copy CDs and DVDs for free. (Infrarecorder, n.d.)
- **MyPaint:** MyPaint is a program that can be used for digital drawing and painting. Also, graphics tablets can be used with this program. (MyPaint, n.d.)
- **LightZone:** LightZone is a free alternative to Adobe Lightroom. With LightZone images and photos can be edited. (Chip, n.d.)

- **Notepad++:** Notepad++ is an alternative to Windows Notepad. It is a text editor that is used for writing the code for a website. (Heise, n.d.)
- **Chromium:** Chromium is web browser for Windows, Linux, Android and macOS. This browser is not meant for end users. Chromium is based on source code from Google Chrome. (Moßmann, 2019)
- **Inkscape:** Inkscape is a program with which vector graphics can be created. (Inkscape, n.d.)
- **Calibre:** Calibre can be used to read, manage and create e-books for free. (Wikipedia, n.d.)
- **Thunderbird:** Thunderbird belongs to the free mail clients. With this program emails can be sent and received. (pcmagazin, 2019)
- **LibreOffice:** If you do not want to pay for Microsoft Office, you can use its alternative LibreOffice, which has the same functions, and on top of that it is free. (Computerbild, n.d.)
- **VLC Media Player:** It is a multimedia player where music and videos can be played. (VideoLAN, n.d.)
- **Android:** Android is an operating system for mobile devices and tablets. This operating system is based on Linux. (Wikipedia, n.d.)
- **MySQL:** MySQL is one of the best known open source database systems. Facebook, YouTube and Twitter are among the customers who are using this database. (MySQL, n.d.)

2.5 Advantages and Disadvantages of Open Source Software

This paragraph shows some advantages and disadvantages of Open Source Software.

Advantages:

- **Cost:** Open Source Software can be downloaded by users free of charge. (Garcia, 2019)
- **Source Code:** With Open Source Software, the source code is freely accessible to everyone. (Emily, 2019)
- **No Vendor Lock-in:** There is no vendor lock-in for Open Source Software as the source code is freely available for users. The Open Source Software users are not bound to a specific software company. (Garcia, 2019)
- **Support:** Open Source Software developers are part of a large community. The Community is full of users that contribute their part to improve the source code. (Garcia, 2019)
- **Better Quality:** The Open Source projects are permanently worked on to develop them further. Therefore, they will receive updates and new features more often than Proprietary Software. (Emily, 2019)
- **Better Security:** Because of the large community that Open Source has, it is possible for developers to quickly find the security flaws and to fix those flaws even before one of the end users notice it. (Garcia, 2019)

Disadvantages:

- **Lack of Warranty and Support:** Users are not entitled to any warranty claim and support from the developer. (Gruber, 2009)
- **No Reliance on Further Development:** How far the Open Source Software will develop depends on the community because they do it voluntarily. (Gruber, 2009)
- **High Training Effort:** Very often the necessary know-how is lacking when it comes to the use of Open Source Software. Therefore, Open Source Software need a special training. (Gruber, 2009)
- **Compatibility Issues:** To run Open Source Software you need certain drivers. Compatibility problems can occur if you do not have the right one. (Milin-Ashmore, 2019)
- **Hackers:** On the one hand having source code freely available for everybody is an advantage, but on the other hand, it can be a disadvantage because the code is also available to hackers. (Milin-Ashmore, 2019)

3 Proprietary Software

3.1 History of Proprietary Software

Up until 1969, it was common practice to lease rather than sell the huge and expensive mainframe computers. Manufacturers did not separate hardware and software, they saw them as a whole package, and for this reason they did not charge extra for service and software. Moreover, the source code was freely available until then. Everything changed with an antitrust lawsuit brought against IBM in 1969. This lawsuit has had a strong impact on IBM, namely it has led IBM to offer hardware and software separately. As a result, software became an independent product. Computers based on standardized microprocessors were also responsible for the spread of proprietary software. In the seventies and eighties, the manufacturers started to keep their source code a secret. However, the U.S. Copyright Act of 1976 changed the legal nature of software. The company Microsoft is known as a pioneer of the development and distribution of proprietary software. (Wikipedia, n.d.)



Figure 5: Mainframe IT

Source: <https://mainframeit.com/about/>

3.2 Definition of Proprietary Software

Proprietary Software

The counterpart of Open Source Software is Proprietary Software. Proprietary Software can be defined as Closed Software, because unlike the Open Source Software, where the source code is freely available to everyone, here the code is kept secret here. The use and redistribution of the software is restricted by vendor through software patents, copyright law, license agreement, EULA and trade secrets. (Wikipedia, n.d.)

The following points apply to Proprietary Software:

- Examination and modification of software is not possible due to unavailability of the source code or trade secrets.
- Redistribution of software is not possible due to license agreement EULA.
- The right of use is granted by a license. (Wikipedia, n.d.)

Shareware

Shareware allows users to copy, redistribute and test the software free of charge. But Shareware Software can only be used for a limited period of time. In the trial period, usually 30 days, users can test the software and decide if they are satisfied with it. If they are satisfied and the trial period has expired, the users have to pay a license fee in order to continue to use the software. In practice, users usually first get a demo version of the software, and then when they have paid the license fee, they get the full version. (Renner, Vetter, Kett, & Rex, 2005)

Freeware

Freeware is not the same as Shareware nor Free Software. Freeware Software are completely free of charge, but like the Shareware Software the source code is not

available because is kept proprietary. For example, Microsoft Internet Explorer is a Freeware. (Linfo, 2005)

3.3 Proprietary Software Licenses

Through software patents, copyright, license agreements EULAs, trade secret and manufacturer-specific, unpublished standards software becomes proprietary. (Wikipedia, n.d.)

- **Software Patents:** Patents can be used to protect software ideas. But only software with technical character/function can be protected by patents. (Otto & Bertschinger, 2019)
- **Copyright:** Generally Proprietary Software are protected by copyright. Through copyright only the implementation, such as the source code and machine code, is protected. Technical functions on the other hand do not fall under copyright protection. Therefore, the same technical function can be copied without breaking the copyright law. Patents are those which prohibit copying the same software functions. (Otto & Bertschinger, 2019)
- **End User License Agreement:** The End User License Agreement states what the user can and cannot do with the software and how are they supposed to use the software. This agreement is between the end user, also the purchaser, and the manufacturer, as well as the seller. Before users start installing software, they are presented with a text box containing the EULA, which they must read and confirm. It is important to confirm the displayed text, because without the consent, the software will not be installed. This process, consent before installation, is categorized as a click-wrap license. In case of shrink-wrap license, if the user tears the wrapper or breaks the seal, he agrees to the EULA. (Karlstetter, 2018)
- **Trade Secret:** With help of trade secret, a source code of software is kept a secret. (Wikipedia, n.d.) In order to keep some information as a secret, (such as

the source code) non-disclosure agreements (NDAs) are signed. (Wikipedia, n.d.)

3.4 Examples of Proprietary Software

In this paragraph a few examples of Proprietary Software are given.

- **Microsoft Windows:** Windows is a proprietary operating system designed by Microsoft and it is still the world's most used operating system on PCs. In 2014, many have switched to Android smartphones, which has increased their sales, and as a result Windows has lost majority of market share. Not only Android, macOS is also their competitor. Through the years, there were many generations of Microsoft operating system. For example: Windows 1.0, Windows 9x, Windows NT, Windows XP, Windows Vista, Windows 7. The latest version on the market is Windows 10. (Wikipedia, n.d.)
- **Microsoft Office:** Microsoft Office a proprietary software that has word processing, spreadsheet, presentation and database program. Besides Windows, Microsoft Office can also be installed on macOS. It primarily consists of the programs such as, Word, Excel, PowerPoint, Access, OneNote, Teams, Outlook and Publisher. (Wikipedia, n.d.)
- **Windows Media Player:** The users of Windows Media Player can listen to music, play videos and view photos. This media player can also be installed on macOS. Although this the Windows Media Player has been replaced by Groove Music, it is still a part of Windows OS. (Wikipedia, n.d.)
- **iTunes:** iTunes is one multimedia management program by Apple. The users can first for example buy the music and then they can organize and play it. They are then also able to burn and convert the music. On the new macOS Catalina iTunes is separated into three categories: Music, Podcasts and TV. (Wikipedia, n.d.)

- **Skype:** Skype is a communication program with which you can make voice and video calls, as well as use the chat function alongside. The special feature of Skype is that you can talk to up to 50 people at once. (Skype, n.d.)
- **Google Earth:** Google Earth allows the user to travel around the world from home only by entering addresses or coordinates. It is a program developed by Google, which shows the earth in 3D. As well as this, user can also explore the Moon and the planet Mars with Google Moon and Google Mars. (Wikipedia, n.d.)
- **WinRAR:** With WinRAR users have the possibility to create ZIP and RAR archives but also to unpack archives in all formats. (Wikipedia, n.d.)
- **MacOS:** MacOS is an operating system which was developed by Apple for their products. When it comes to operating systems, macOS is right behind Windows. The latest version is macOS Catalina, which is available in 39 language. (Wikipedia, n.d.)
- **Adobe Flash Player:** Adobe Flash Player is a software which is used in the browser to enable streaming audio and video. (Adobe, n.d.)
- **Adobe Photoshop:** Adobe Photoshop is an image editing and graphic design software. The good thing is that you don't have to use Photoshop only on your PC, you can also edit your picture on to go on your tablet. Creativity never ends with Photoshop, as the software is regularly expanded with new features. (Adobe, n.d.)
- **Adobe Acrobat Reader DC:** With Adobe Acrobat, the users can view, edit, fill out and print the PDF documents. The new version of the software is also connected to the cloud. (Adobe, n.d.)
- **Adobe Lightroom:** In Lightroom, you can take photos, then edit them and finally share them This program also offers tutorials created by professionals.

The special thing about Lightroom is that it can be used on any device. (Adobe, n.d.)

- **Shopify:** Shopify is an e-commerce platform where the users can build their own online shop. (Wikipedia, n.d.)
- **Wix:** With Wix users can create their own websites. The users have two options, either to design the website themselves from the beginning or to have the website designed by Wix. Therefore, users have to answer a few questions about themselves, and from these answers Wix creates the website for them. (Wix, n.d.)
- **Squarespace:** Squarespace is a platform where the users can create websites, and the hosting of a website is here included. (Squarespace, n.d.)

3.5 Advantages and Disadvantages of Proprietary Software

This paragraph shows some advantages and disadvantages of Proprietary Software.

Advantages:

- **Ownership:** By purchasing a proprietary software, users acquire full ownership rights to the software. This entitles them to receive ongoing updates, bug fixes and new product versions as soon as they are released. (Kulthe, 2018)
- **Usability:** Proprietary Software are developed professionally and tested many times. Usability is here very important because they want to reach large crowds of end users with this software. The end users must be able to use the software after installation without any problems. (Gaille, 2019)
- **Support:** Proprietary Softwares provide more support for their users, than the Open Source Software. The users can get in touch with support team any time they have problems or questions. (Gaille, 2019)

Disadvantages:

- **Costs:** Proprietary Software are usually subject to charges. To be able to use the software, users must pay a license fee. Usually there are monthly subscription costs. (Kulthe, 2018)
- **Customization:** Here, the source code is here proprietary, and that's why the users don't have the right to modify the source code. (Kulthe, 2018)
- **Security:** All the security depends on software developer. If there is something wrong with the source code, or there are some security issues, it can take a while until they fix it. This is due to the fact that they only work with a small group of people, unlike an open source software where anyone has access to fixing the code. (Kulthe, 2018)

4 Cost Comparison: Open Source Software vs. Proprietary Software

In this chapter the individual cost elements are described in more detail and a study is presented as an example.

If you would be confronted with a choice between Open Source Software or rather or Proprietary Software, it is not enough to simply choose based on the currently popularity of the software or the fact that it may be commonly used by many companies. Instead, you have to ask yourself different questions. Do I already have the right hardware for the software, or do I have to buy new one? What hardware does the software require? Am I able to install the software by myself, in other words do I have the require know how for this procedure, or do I have to pay someone to install the software for me? Can I and my employees operate the software without any problems, or is training necessary? Is the modification of the software allowed, or do I not have a chance to customize the software to my needs? Does the software come with support options, to be able to contact a support team in case of any issues with the software? What are the maintenance costs which will be due in the course of use? And in the case, that you are replacing an existing software with a new one, you will have to think of how you can migrate, extract and import your data. From these questions, it becomes clear that there is much more to consider when choosing a suitable software. (nibusinessinfo., n.d.)

The question of how much does Open Source Software cost or how much does Proprietary Software cost cannot be answered so easily. Because too many factors and conditions determine the pricing of a software.

4.1 Software Costs

We already know that Open Source Software can be downloaded for free from the web. Proprietary Software, on the other hand, requires a license fee. However, by comparing prices, you can't tell which one is better as there are other factors which are much more important than the price. (Dölle, 2013)

For a better overview we will divide the costs into categories. Those categories include software, hardware, hosting and support costs. With these categories, the total cost of ownership (TCO) can be calculated. In practice, the Company would usually calculate TCO for three to five years. You need to calculate TCO for every software solution, and then you are able to accurately compare them. (Digital Principles, n.d.)

- **Management and staffing:** Is my team equipped with all technical knowledge or do I have to hire an external person?
- **Development and setup:** Is it Open Source Software or Proprietary Software? In other words, do I have to pay a license fee. You have to research if there are individual charges per user or if there a flat-rate for a certain number of users. It is also necessary to clarify whether the software is compatible with other existing systems. You also have to ask if it is possible to customize the software according to your needs. Furthermore, you have to consider how much time is needed to install the software. You also have to find out if you already have the necessary infrastructure and hardware, whether you would need to buy one.
- **Deployment:** If there are many differences between the old and the new software, and the employees do not know how to use the software, they would have to be sent for training. This raises question of how long must the training be and do all employees have to participate and how frequently?
- **Operations:** Besides that, you have to know if the support is included or not. If not, then to whom should you contact if a bug needs to be fixed. Then there is

also the question of whether the training needs to be refreshed or not. (Digital Principles, n.d.)

4.2 Example: Cybersource Study

This example refers to the TCO study “Linux vs. Windows – Total Cost of Ownership Comparison” by Cybersource, which was published in 2002. The costs are calculated for a company with 250 employees for over a three-year period. Two different scenarios are tested. The first scenario assumes that the new hardware will be purchased. In the second scenario, hardware which is already existing in the company is used. The costs are divided into following categories:

- **Hardware costs:** This includes costs for workstations, servers and network infrastructure)
- **Software costs:** This includes costs for platform software, office applications and specific technical applications.
- **Operating costs:** This includes costs for staff salaries, internet connection, consultancy fees and miscellaneous.

In both scenarios, Microsoft Windows Server 2000 and Windows XP Professional is compared with standard Linux distribution SuSE 7.3 and Open Office. (Goelaan, 2002)

Scenario 1:

	Windows	Linux
HARDWARE		
Workstation	\$232,300.00	\$232,300.00
Server	\$25,837.00	\$25,837.00
Network Infrastructure	\$25,900.00	\$25,900.00
TOTAL Hardware Costs	\$284,037.00	\$284,037.00
SOFTWARE		
Platform Software	\$56,121.00	\$79.95
Office Productivity Applicati	\$222,397.50	\$0.00
Specific Technical Applicati	\$4,455.00	\$0.00
Total Software Costs	\$282,973.50	\$79.95
OPERATING COSTS		
Staff Salaries	\$345,000.00	\$376,500.00
Internet Connectivity	\$36,000.00	\$36,000.00
Consultancy Fees	\$45,000.00	\$45,000.00
Miscellaneous	\$25,000.00	\$25,000.00
TOTAL Operating Costs	\$451,000.00	\$482,500.00
TOTAL COSTS	\$1,018,010.50	\$766,616.95
LINUX SAVINGS		\$251,393.55
% Total Cost		24.69%

Figure 6: Scenario 1 All New Hardware

Source: http://www.goelaan.ch/documents/linux_vs_windows_tco_comparison.pdf

Scenario 2:

	Windows	Linux
SOFTWARE		
Platform Software	\$56,121.00	\$79.95
Office Productivity Applications	\$222,397.50	\$0.00
Specific Technical Applications	\$4,455.00	\$0.00
TOTAL Software Costs	\$282,973.50	\$79.95
OPERATING COSTS		
Staff Salaries	\$345,000.00	\$376,500.00
Internet Connectivity	\$36,000.00	\$36,000.00
Consultancy Fees	\$45,000.00	\$45,000.00
Miscellaneous	\$25,000.00	\$25,000.00
TOTAL Operating Costs	\$451,000.00	\$482,500.00
TOTAL COSTS	\$733,973.50	\$482,579.95
LINUX SAVINGS		\$251,393.55
%Total Cost		34.25%

Figure 7: Pre-Existing Hardware

Source: http://www.goelaan.ch/documents/linux_vs_windows_tco_comparison.pdf

By using Linux with existing hardware, the company can save up to around 25% of the total cost. So, it is clear that the Linux is the winner in the scenario 1. If a new hardware is purchased, the company can save up around 34% of the total cost. In conclusion the Linux is still the better choice. On the next pages it can be seen how the software costs and hardware costs are composed. Interesting to mention is that programs such as Apache, Gimp, OpenOffice and more, are included with Linux distribution. (Goelaan, 2002)

Microsoft Solution Software Cost

Norton Antivirus 2002	250 copies	\$12,487.50
MS Internet Information Server	2 copies	\$0.00
MS Windows 2000 Advanced Server	9 copies	\$35,991.00
MS Commerce Server	1 copy	\$12,333.00
MS ISA Standard Server 2000	1 copy	\$1,499.00
MS SQL Server 2000	1 copy	\$4,999.00
MS Exchange Standard Server 2000	1 copy	\$1,299.00
Windows XP Professional	250 copies	\$74,750.00
MS Visual Studio 6.0	3 copies	\$3,237.00
MS Office Standard	250 copies	\$119,750.00
Adobe Photoshop 6	2 copies	\$1218.00
Additional Client Access Licenses	230 licenses	\$15,410.00
Total		\$282,973.50

Linux Solution Software Cost

Linux Distribution (eg SuSE 7.3)	only 1 copy necessary	\$79.95
Apache (Web server)	provided with distribution	\$0.00
Squid (Proxy server)	provided with distribution	\$0.00
PostgreSQL (Database)	provided with distribution	\$0.00
iptables (Firewall)	provided with distribution	\$0.00
Sendmail / Postfix (Mail servers)	provided with distribution	\$0.00
KDevelop (IDE)	provided with distribution	\$0.00
GIMP (Graphics)	provided with distribution	\$0.00
OpenOffice (Productivity suite)	provided with distribution	\$0.00
The Exchange Project (e-Commerce system)	only 1 copy necessary (free download)	\$0.00
Total		\$79.95

All prices are in US\$ for ease of conversion to your currency, and correct as of 2002-04-19

Figure 8: Software Licence Costs

Source: http://www.goelaan.ch/documents/linux_vs_windows_tco_comparison.pdf

1 x Mail Server

IBM xSeries 220, Part Number: 86464AX

- Processor: Pentium III 1.26 Ghz w/ 512KB Processor cache
- Memory: 256 MB PC133 ECC SDRAM RDIMM
- Maximum memory: 4096 MB
- Storage: IBM 36.4 GB 10K-rpm Ultra160 SCSI Hot-Swap SL HDD (Part Number 06P5755) driven by Integrated Dual-Channel Ultra160 SCSI Controller.
- Maximum storage: 660 GB (Hot-swappable)
- Optical Drive: 48X-20X CD-ROM
- Ethernet: Integrated Ethernet 10/100 Mbps
- Power: 385W Power Supply and Smart-UPS 1000.
- Peripherals: IBM Keyboard and Mouse.
- Operating System: Costs removed from published price to provide a OS-neutral figure

Total cost: \$2,373.00

1 x Proxy / Firewall Server

As above, with 10/100 EtherLink Server Adapter by 3Com (with CD) (part number 09N9901)

Total cost : \$2,458.00

5 x File / Print Servers:

As mail server, with

- an extra 256MB RAM (bringing total to 512MB),
- second 36.4GB Harddrive and
- 10/100 EtherLink Server Adapter by 3Com (with CD) (part number 09N9901).

Total Cost: \$3,252.00 x 5 = \$16,260.00

1 x Intranet and SQL Server

Specification as per mail server.

\$2,370.00

E-business server

Specification as per mail server.

\$2,373.00

Therefore, total cost of server hardware = \$25,837

245 x Standard Workstations

IBM NetVista A22p 2292

- Processor type: Pentium 4 1600 Mhz w/ 256 KB
- Memory: 128 MB PC133 SDRAM
- Monitor: G78 17inch (16 inch Viewable) Monitor (Part Number 66274AN)
- Hard drive: 40GB Ultra ATA/100 Hard Drive
- Floppy Disk Drive.
- Optical device: 48X-20X CD-ROM Drive
- Graphics: NVIDIA AGP 4X with 16 MB SDRAM Video Memory
- Audio: SoundMAX with SPX and IBM Speakers.
- Ethernet: Intel PRO/100 Ethernet w/Wake on LAN
- Modem: IBM PCI V.90 Modem, 56K
- IBM Mouse & Keyboard.

Total cost = \$928.00.00 x 245 = \$227,360

Developer Workstations

As above, with 256MB of RAM.

Total cost = \$988.00 x 3 = \$2,964

Graphic Designer Workstations

As per developer workstations.

Total cost = \$988.00 x 2 = \$1,976

Therefore, total cost of workstations = \$232,300

Figure 9: Hardware Specification and Costs

Salaries and Services Costs

Network Infrastructure Specification and Costs

Network Infrastructure is calculated as the cost of equipping one computer, whether it be a workstation or a server, with a connection point on a port or a switch, appropriate cabling and a wall socket, as per current industry best-practice. Research has shown this turns out to be approximately \$100 per computer.

Therefore, network infrastructure is calculated as the number of computers multiplied by \$100.

Total Cost of Network Infrastructure $259 \times \$100 = : 25,900$

Staff Salary Specifications and Costs

Staff for both our Windows platform model and our Linux/Open Source environment were sourced from online placement agency firms (such as Dice.com and Mojolin.com) . We performed a search using some of the core technologies required for both platforms, and itemised three core staff members for our example organisation. We require a Senior systems administrator and co-ordinator, reporting to our example firm's executive management. We also require a mid-level generalist, and a junior help-desk support staffer. Ancillary or specialist technical services will be provided by external consultants

Windows Platform Permanent Staff

Salary for Senior Systems Admin	@ \$55,000 per-annum for 3 years = \$165,000
Salary for Mid-level Systems Admin	@ \$35,000 per-annum for 3 years = \$105,000
Salary for Junior Support Officer	@ \$25,000 per-annum for 3 years = \$75,000
Total Cost of Windows Platform Permanent Staff = \$345,000	

Linux Platform Permanent Staff

Salary for Senior Systems Admin	@ \$60,000 per-annum for 3 years = \$180,000
Salary for Mid-level Systems Admin	@ \$38,500 per-annum for 3 years = \$115,500
Salary for Junior Support Officer	@ \$27,000 per-annum for 3 years = \$81,000
Total Cost of Linux Platform Permanent Staff = \$376,000	

Specialist Consultancy Services

Most organisations need specialist IT consultancy services and for our example organisation, we will allocate the same set cost to both the Windows and Linux models to cover this service provision.

Total Cost of Specialist Consultancy Services = \$25,000

Figure 10: Salaries and Service Costs

Source: http://www.goelaan.ch/documents/linux_vs_windows_tco_comparison.pdf

5 Conclusion

After all this given information the question arises, according to what criteria can one choose the right software? There is no wrong or right way. It is only important that you know your needs. And when it comes to software you need to prioritize your needs. Therefore, you should consider before buying software, which features are important to you, and which not so. It is helpful to make a list with features, and to rank them according to the necessity.

- **Essential Features:** These features must be included with software, otherwise it cannot be selected.
- **Conditional Features:** These features are not as important as the essential ones, but if they are missing in one software version, another version which has these features will be selected.
- **Nice to have Features:** These features don't have to be included in software, but it is nice if the software has them.

When the list is ready, it can be compared with all software options. And here we go, that's one of the ways you can choose your software. (Bimlearningcenter, n.d.)

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