A Web-based Installation Manual Management System for Open Source Software

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Abstract

Recently, Open Source Software (OSS) has become commonly used at many places. Unfortunately, although the use of OSS is often hard for novice users, many OSSes have few good manuals. To solve this problem, we have proposed a method of automatically generating a Web-based installation manual for an OSS by editing the log information recorded during the installation process by a skilled user. However, this method has another problem of requiring several manuals even for the same OSS, because installation commands may be different depending on the installation environment such as Linux distributions and versions. In addition, novice users sometimes make input mistakes during installation process that cannot be detected by themselves. In this paper, we propose a Web-based system to manage the created manuals so that users can easily use them. By incorporating the analogous manual search algorithm after investigating command changes under different environments, our system is able to show similar manuals if no existing manual matches to the search condition. Besides, we propose the installation guidance function to avoid mistakes by users. It monitors the input commands by a user, and displays the correct commands with the error message if a mistake is found. The experimental results in installing OSS packages by novice users confirm the effectiveness our proposal.

1. Introduction

An open source software (OSS) has been developed to allow users to alter and republish its source code that can be freely downloaded from the Internet. At present, OSS has been frequently used for researches, developments of application systems, and educations in a lot of companies, public agencies, and universities, in respect of merits of the simple design release, the low introduction cost, and the high quality of source codes.

However, OSS is inherently different from commercial software, because any organization such as software companies does not supply the whole piece of an OSS with a sense of responsibility. As a result, the lack of its documentation including the operation manual can happen, which may become the serious problem at its use. This undesirable situation may come from the fact that the OSS developer must prepare its documents in addition to the development task as a volunteer. Thus, it becomes difficult to complete the documentation works together due to the heavy burden. Besides, an important OSS sometimes requires the integration of multiple OSSes. Then, it becomes hard for OSS beginners even to install it if the installation manual is incomplete.

To solve this problem, we have proposed a method of automatically generating a Web manual for installing an OSS by editing the log information recorded during the installation process by a skilled user [1][2]. Unfortunately, this method has another problem of requiring several manuals even for the same OSS, because installation commands may be different depending on the installation environment such as the Linux distribution for the computer and the Linux distribution/OSS versions. Actually, it is impossible to create all the manuals to cover any difference by our method. In addition, novice users often make simple input mistakes in installation process.

In this paper, we propose a Web-based installation manual management system. This system uses a Web database to manage the created installation manuals, so that novice users can easily access manuals matching to their installation environments, and skilled OSS users can easily upload new manuals for OSSes with new versions. Besides, after investigating differences of installation commands un-

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der different installation environments, we present the analogous manual search algorithm so that our system is able to show similar manuals if no existing manual matches to the search condition. Furthermore, we propose the installation guidance function to avoid mistakes by users. It monitors the input commands by a user, and displays the correct commands with the error message if a mistake is found. The experimental results in installing OSS packages by novice users confirm the effectiveness of our proposal.

This paper is organized as follows: Section 2 introduces our installation manual generation method. Section 3 presents the Web-based installation manual management system. Section 4 presents the analogous manual search function. Section 5 presents the installation guidance function. Section 6 concludes this paper.

2. Installation Manual Generation Method

In this method, a skilled OSS user is first requested to install the OSS on a personal computer (PC) in order to record the operation logs in files, so that they can be used for generating the installation manual. This method actually consists of four sets of functions: input functions, edit functions, display functions, and combined manual generation functions.

2.1 Input functions

The input functions include the text log function to store the text data that is displayed as input/output information on the PC terminal, and the image log function to store operations as moving images on the PC screen by using a screencasting software. The text logs are stored as the text files, and the image logs are as Flash and HTML files, respectively.

2.2 Edit functions

The edit functions include the text manual generating function of converting the stored text log into the HTML file for the Web system, and the image manual generating function of dividing the image log into a set of individual image files such that each file corresponds to one input command for installation, and then, associating them with the text manual. Finally, the edit functions output the standard HTML document with embedded shockwave movies.

2.3 Display functions

The display functions display the text manual and the image manual to users on a Web browser. The *frame* system of the Web browser is used to display the text manual on the upper half of the browser screen and the image manual on the lower half of the same screen. For the OSS requiring the integration of multiple OSSes, their corresponding manuals can be displayed using a *tag* browser at the same time.

2.4 Combined Manual Generation Function

A lot of OSSes are used with multiple OSS packages together, such as the LAMP[3] structure for Web applications. For an OSS package requiring installations of multiple OSS packages at the same time, the combined manual generation function combines the individual manuals for these OSSes. First, the individual manual is generated for each of the OSS packages. Then, the combined manual is generated by linking the individual manuals by hand. Actually, the combined manual can be composed freely by using our Web system.

3 Proposal of Installation Manual Management System

3.1 Outline

In this section, we present a Web-based installation manual management system, by expanding the combined manual generation function. This system is implemented using MySQL, PHP, and Apache. The flow for using this system is as follows:

1) An *manual creator* generates OSS installation manuals by using the method in Section 2, and upload them to the Web server.

2) The manual creator registers the *integration information* among OSS packages for the combined manual if necessary.

3) A *manual user* selects the OSS core package for installation, using the form at the Web browser. The core package indicates the OSS package for the main purpose of use.

4) The *Web system* selects the set of installation manuals required to install the core package, and shows them at the Web browser.

5) The *system manager* can remove or change manuals and integration information, if necessary.

3.2 Design of Three User Functions

From the usage flow, the following three user functions are designed for this system.

3.2.1 Functions for Manual User

A manual user can access an OSS installation manual at the Web browser, by selecting it from their categorized list directly, or by specifying the search condition.

3.2.2 Functions for Manual Creator

A manual creator can upload an OSS installation manual to the Web database system after specifying the OSS name and the integration information for the combined manual at the form of the Web browser. The creator can also modify the integration information, if necessary.

3.2.3 Functions for System Manager

A system manager can manage the user account information for manual users and manual creators, and can remove or modify manuals or integration information, if necessary.

3.3 Implementations

3.3.1 Functions for Manual User

(1) Manual Selection Function

The accurate input of an OSS name can be hard for novice users, because they are not familiar with OSSes. Thus, at the left side of the screen, our system displays the menu listing six categories of OSSes, namely, *Web server*, *Web application*, *file server*, *management and development software*, and *office suit*, so that the user can easily select the intended OSS from this list by referencing the category. At the right side, it displays the link to the selected manual, and the information about the OSS in the manual such as the OSS name, the OSS version, the outline, and the Linux distribution and its version used for this manual. As the default Linux distribution and version, *Ubuntu 8.10* is used for any OSS in this implementation, because it is popular among novice Linux users[4]. Besides, at the lower side, the shell script for the partial automatic installation of the OSS can be downloaded.

(2) Manual Search Function

The manual search function allows the manual user to access the installation manual for the OSS whose version is not the latest among its manuals in the Web database system. At the upper side, it contains the forms to input the search keys such as the OSS name, the OSS version, the Linux distribution name, and its version. At the lower side, it displays the search result including the OSS name with the link to the manual, its version, the outline, the Linux distribution, and its version. The shell script for the partial automatic installation can also be downloaded there. If there is no matching manual to the search condition, the most analogous manual is displayed. The details will be discussed in the next section.

3.3.2 Functions for Manual Creator

(1) Manual Upload Function

Using this function, the manual creator can upload the OSS installation manual after specifying the OSS name and the integration information for the combined manual. When it is necessary to upload multiple files at the same time, they can be combined together into one file using the ZIP format before uploading. In this case, our system automatically decompresses them into separated original files.

(2) Modification Function for Integration Information

A manual creator can modify it using the form.

3.3.3 Functions for System Manager

(1) Manual Removal Function

A system manager can remove any manual from the database system using simple check boxes.

(2) User Account Management Function

The system manager can add, delete, and modify the account information of any user for the system including the manual user and the manual creator.

4 Analogous Manual Search Function

In this section, we present the analogous manual search function for the case that the manual matching to the search condition does not exist in the Web database system.

4.1 Command Changes under Different Installation Environments

OSSes usually have several major and minor versions, because they are currently under developments around the world. Besides, several Linux distributions exist, such as Fedora, Ubuntu, and Vine, where our proposed installation manuals assume that the users use Linux as the OS at their PCs. Furthermore, Linux has several different versions. As a result, a variety of installation environments can exist for OSSes, and the installation commands may be different depending on the environment. Therefore, we investigate the changes of installation commands to install *WordPress* as the typical OSS on Ubuntu/Fedora/Vine distributions, when either of the Linux distribution/OSS version, and the Linux distribution is changed. *WordPress* has often been used to edit Blogs.

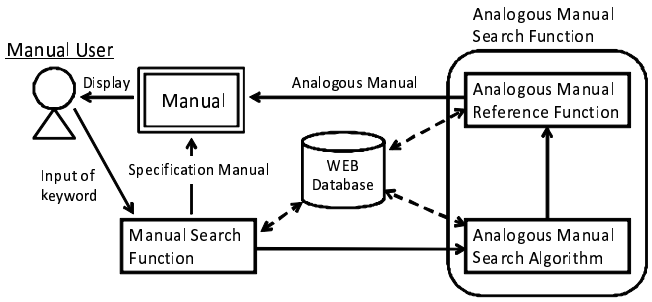

Figure 1. Outline of analogous manual search function.

4.1.1 Changes by Different Linux distribution Versions

First, we investigate the command changes when only the Linux version is different. Here, we use Fedora with versions 8, 9, 10 and Ubuntu with 7.10, 8.04, 8.10. The installation commands are the same among them, which suggests that the Linux distribution version does not affect the installation commands of OSSes.

4.1.2 Changes by Different OSS Versions

Then, we investigate them when only the OSS version is different. Table 1 shows that only the command specifying the OSS version must be changed.

4.1.3 Changes by Different Distributions

Finally, we investigate them when only the Linux distribution is different. Table 2 shows that the package management commands and the repository names for package distributions are different depending on the Linux distribution. Thus, major changes of the installation commands are necessary in the case of different distributions.

4.2 Analogous Manual Search Function

4.2.1 Analogous Manual Search Algorithm

From the investigation results in Table 1, 2, we conclude that the similarity of the installation commands decreases in the order of 1) the Linux distribution version difference, 2) the OSS version difference, and 3) the Linux distribution difference. Thus, we present the analogous manual search algorithm to find the best-fit manual to the search condition specified by the user when the manual satisfying the same condition does not exist. This algorithm evaluates the similarity of each existing manual in the order of $1) \rightarrow 3)$, and outputs the manual with the highest similarity. We implemented this algorithm at the Web server using PHP.

4.2.2 Analogous Manual Reference Function

Our current implementation of the analogous manual display function does not apply the necessary command changes in the manual automatically. Thus, users need to change the commands if necessary by themselves. For the better reference, our analogous manual display function shows the links to the second and third analogous manuals in addition to the most analogous one. By referencing several related manuals, users may be able to apply the proper changes of installation commands.

5 Proposal for Installation Guidance Function

5.1 Outline

In the installation guidance function, each input command by the user during the installation process of an OSS is always monitored using the Linux command, and is compared successively with its pre-registered correct one. The correct input commands have been stored in the log information file with the corresponding responses from the system when a skilled user has actually installed the OSS. The log information file has been used to generate the installation manual automatically. When an incorrect input command is found, the corresponding error message and the corrected command are displayed. Thus, using this system, the user can detect operation mistakes at the early stage, and carry out the smooth OSS installation.

5.2 Implementation

The proposed function consists of the *installation monitoring subfunction* and the *message generation subfunction* as shown in Figure 2. Both subfunctions have been implemented using the shell scripting method in Linux. The installation monitoring function always compares the input commands with the corresponding correct commands in the log information file. When an incorrect command is detected, the message generation function displays the error/warning message screen containing the correct commands and the error message. Here, the correct commands are emphasized by red color so that the user can easily sense them. This screen is repeatedly displayed until the user inputs the correct commands. Only after the correct commands are input, the next input command is compared.

The installation guidance function is coded using the shell script. We added the code to the Linux configuration file *.bashrc* so that the above-mentioned function can run

Table 1. Comparison of installation commands (Different OSS Versions).

wordpress 1.0 (Used Ubuntu8.10)	wordpress 2.5.1 (Used Ubuntu8.10)	wordpress 2.7 (Used Ubuntu8.10)
sudo apt-get update	sudo apt-get update	sudo apt-get update
sudo apt-get install httpd	sudo apt-get install httpd	sudo apt-get install httpd
sudo apt-get install apache2	sudo apt-get install apache2	sudo apt-get install apache2
sudo apt-get php5 php5-mysql	sudo apt-get php5 php5-mysql	sudo apt-get php5 php5-mysql
sudo apt-get install mysql-server mysql-client	sudo apt-get install mysql-server mysql-client	sudo apt-get install mysql-server mysql-client
/etc/rc.d/init.d/mysqld start	/etc/rc.d/init.d/mysqld start	/etc/rc.d/init.d/mysqld start
sudo mysql	sudo mysql	sudo mysql
grant all privileges on wordpress. * wordpressuser@localhost identified by 'wordpress';	grant all privileges on wordpress. * wordpressuser@localhost identified by 'wordpress';	grant all privileges on wordpress. * wordpressuser@localhost identified by 'wordpress';
create database wordpress;	create database wordpress;	create database wordpress;
exit	exit	exit
tar xvfz **wordpress-1.0.tar.gz**	tar xvfz **wordpress-2.5.1.tar.gz**	tar xvfz **wordpress-2.7.tar.gz**
chown -R andy wordpress	chown -R andy wordpress	chown -R andy wordpress
mv wordpress /var/www/html	mv wordpress /var/www/html	mv wordpress /var/www/html

Table 2. Comparison of installation commands (Different Linux Distributions).

Ubuntu 8.10	Fedora 9	Vine 4.2
sudo apt-get update	**yum update**	**apt-get update**
sudo apt-get install httpd	**yum installd httpd**	**sudo apt-get install apache**
sudo apt-get install apache2	—	—
sudo apt-get php5 php5-mysql	**yum install php php-apache php-mysql**	**apt-get php php-mysql**
sudo apt-get install mysql-server mysql-client	**yum install mysql-server mysql-client**	**apt-get install mysql-server mysql-client**
/etc/rc.d/init.d/mysqld start	/etc/rc.d/init.d/mysqld start	/etc/rc.d/init.d/mysqld start
sudo mysql	mysql	mysql
grant all privileges on wordpress. * wordpressuser@localhost identified by 'wordpress';	grant all privileges on wordpress. * wordpressuser@localhost identified by 'wordpress';	grant all privileges on wordpress. * wordpressuser@localhost identified by 'wordpress';
create database wordpress;	create database wordpress;	create database wordpress;
exit	exit	exit
tar xvfz wordpress-2.5.1.tar.gz	tar xvfz wordpress-2.5.1.tar.gz	tar xvfz wordpress-2.5.1.tar.gz
chown -R andy wordpress	—	—
mv wordpress /var/www/html	mv wordpress /var/www/html	mv wordpress /home/httpd/html

automatically at every command input. The code is downloaded to the users PC with the log information file, when he accesses to the Web site for our OSS installation manual.

5.3 Evaluation

5.3.1 Experimental condition

The effectiveness of our function is verified through an experiment of installing OSS packages by fourth grade students in Takamatsu National College of Technology. Before this experiment, they have taken a lecture on the computer

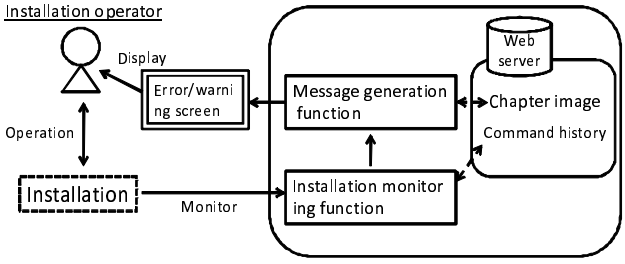

Figure 2. Outline of installation guidance function.

Table 3. Comparison of number of completed students.

	proposal	compare1	compare2
Completed	12	7	2
Uncompleted	3	8	12

Table 4. Comparison of number of misoperations.

	proposal	compare1	compare2
Average number	12.2	8.7	6.1

literacy education of 30 hours. In addition, we have confirmed by the questionnaire that they do not have any operation experience of the command line interface in Linux and of an OSS.

To compare the installation performance, the 44 students are divided into three groups such that their average ability of using a computer in our questionnaire results is almost equal. The first group of 15 persons is assigned our automatically generated Web manual with the installation guidance function ($proposal$). The second group of 15 students is assigned our Web manual without the installation guidance function ($compare1$). The last group of 14 students is assigned a conventional manual in [5]($compare2$).

In this experiment, PCs with Celeron-D 2.8GHz CPU and 1G memory were used. To prepare the same OS environment for all the PCs, the Vine Linux 4.2 is used as the platform OS of our system, after the VMware Player was installed onto the Windows XP Professional. The tasks in this experiment were performed on this virtual OS environment.

The installation of XOOPS is selected as the assignment for this experiment. XOOPS is an OSS to produce a content management system. For the successful installation of XOOPS, the four OSS packages of Apache, PHP, MySQL, and XOOPS must be installed correctly in this order, and the links between these OSS packages must be established. They can usually be completed in about 20 minutes if the user has the knowledge of constructing a Web server. Thus, the time to complete the tasks was limited in 40 minutes in our experiment.

5.3.2 Results

(1) Number of Completed Students

Table 3 compares the numbers of completed and uncompleted students among three groups. $proposal$ provides the largest number of completed students among them. Actually, the exact probability test indicates that there is the statistical and substantial difference between $proposal$ and $compare2$ with $p < 0.01$, and there is no statistical and substantial difference between $proposal$ and $compare1$ with $p > 0.5$. However, the reason may come from the fact that the number of students in this experiment is too small. In futures, we need to expand this experiment to more students.

(2) Behavior analysis of subjects

Table 5 compares numbers of incorrect input commands among three groups. $proposal$ reduces the number of them to about the half of the case by $compare2$, and to about 70% of the case by $compare1$.

6 Conclusion

This paper has proposed the Web-based manual management system for Open Source Software installations with the analogous manual search function and the installation guidance function. The experimental results confirm the effectiveness of our proposal. Our future studies include the usability refinement of the system and the application of this system to various OSS packages.

References

[1] Y. Murakami, N. Funabiki, H. Tokunaga, K. Shigeta, and T. Nakanishi. A proposal of an installation manual generation method for open source softwares using operation logs. *The 4th international conference on signal-image technology & internet-based systems.*, pages 547–554, November 2008.

[2] Y. Murakami, N. Funabiki, H. Tokunaga, K. Shigeta, and T. Nakanishi. A proposal of an automatic installation manual generation method using operation logs for open source software. *IPSJ*, 50(3):926–939, March 2009.

[3] LAMP
http://ja.wikipedia.org/wiki/LAMP.

[4] K. Fukuda, The latest information on Linux distribution. *Software Design*, Vol.283 pages 108–115, November 2008.

[5] Installation of XOOPS(Linux)
http://kisa.homeip.net/wiki.