# A Comparison of Open-Source CMS and Analysis of Security Vulnerability

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*Abstract*—Following development of the Internet, interest in open software based Content Management Systems has been increasing. Many websites were bom, provoking software development that helps developers easily build websites. Using these Open-Source CMSs, web pages can be  developed and managed more easily and quickly. In this study, the performances, technologies, and usability of popular CMSs were compared centering on the Open-Source CMS in Republic of Korea. In addition, vulnerabilities in contents security was examined and what are necessary for users to prevent security problems was investigated.

*Keywords*—CMS, OpenSource CMS, CMS market, Wordpress, Plug-in Software

## I. INTRODUCTION

F OLLOWING the spread of computer and activation of the Internet in the 20th century, numerous homepages were born, provoking development of software that helps developers easily build homepage.

The number of people other than professional developers that open homepages has also increased and the market size of the Internet shopping mall recorded 19 trillion KRW in 2010 [1]. CMS for building homepage makes it possible to manage contents in any location as it supports web-based management and the utilization of open-source CMS is especially increasing these days [2]. As services provided through the Web have become diverse, the kinds of cyber attacks targeting the Web became diverse and accident incidence rate have been increasing day by day.

In order to examine the current situation of open-source CMS that is becoming widely used, the characteristics, strengths, and weaknesses of Open-Source CMSs including shares and usability were comparatively analyzed separately for South Korea and foreign countries and the frequency of occurrence of vulnerabilities was analyzed to examine the security of Open-Source CMSs.

## II. RELATED RESEARCH

### A. Mobile Development and Mobile  Accessibility

In 2014, whereas the number of wire telephone subscribers in South Korea was 16,939,000 with a decrease by 3.9%, the number of mobile phone subscribers was recorded as 57,208,000 with an increase by 4.6% compared to the previous year[3]. Out of the amount of Internet usage, the amount of access through mobiles is increasing more than that through PCs. Whereas Internet usage through PCs utilizes web browsers such as Internet Explorer, Chrome, and Safari, in the case of mobiles such as tablet PCs and smartphones, users access the Internet based on apps(Mobile Application). Recently, mobile apps are provided so that they can be used only on mobiles but also on PCs simultaneously through web browsers or apps dedicated to PCs. As mobiles have been popularized as such, existing web services are also developed considering mobile devices. Therefore, demand for not only web accessibility but also mobile accessibility that enables access from diverse mobile device is increasing. Since Open-Source CMSs that have been released recently satisfy such demand from users, web service constructions using them have been increasing.

### B. Open-Source CMS

XE (XpressEngine) is a CMS that was once widely used in Korea, but the CMS that has largest market share worldwide is

#### 1) XpressEngine

Among homepage building tools that are provided in CMS type to developers in Korea, XE (XpressEngine) is best known. Although XE was originally a web program that generates and manages BBS (bulletin board system) made in PHP language, it currently provides diverse homepage templates other than bulletin board and enables simple development of homepage using tool kit. That is, it supports easy fabrication of homepage without directly implementing diverse functions through web programming.

#### 2) Wordpress

Wordpress, which is the largest open-source CMS in the world, was founded by Matt Mullenweg in 2003. It is one of the installation-type blogs that is intuitively constituted so that users can easily understand it after using for a while. It has an advantage of excellent flexibility in building homepage and utilization of relatively more themes and open-sources compared to other tool. As of July 2014, there are as many as 2,570 themes and 31,435 plug-ins registered in Wordpress official homepage [4]. However, it has disadvantages of limited design option, vulnerable security such as weak management of large-scale contents, etc[5].

### 3) Plug-in

In open-source CMS, diverse plug-ins exist for each tool. Plug-in is a core component that enables users to change shapes or functions as they wish without altering the core code of homepage building tool. Most CMS supports plug-in, but manual differs in each plug-in and a series of installation, activation, setting and using are required in most cases[6].

### 4) Naver Syndication

Naver syndication is an API service developed by Naver Inc. in Korea in April 2010. This API service is an API that defines synchronization rule between the website that contains contents and searching service that searches for contents. By addressing the disadvantage of previous method used in searching contents collection, burden on independent sites can be decreased while enhancing the quality of searching service. Moreover, in case of using Naver syndication, searching accuracy increases as the independent site's contents are updated in real time and formalized web documents are collected [7].

### C. Web Accessibility of CMS

ActiveX is a technology made by Microsoft in the USA that is provided for connection between geberal application programs and the Web. Currently, in South Korea, ActiveX is still used in many sites such as financial transaction sites or online shopping malls. As shown in Figure 1 below, Chrome developed by Google is widely used as a web browser throughout the world[8]. However, since Chrome web browser does not support ActiveX, 87.64% of South Koreans still use Internet Explorer of MS[7]. However, most Open-Source CMSs are optimized in Chrome browser and many pieces of content are not executed or do not appear on Explorer.
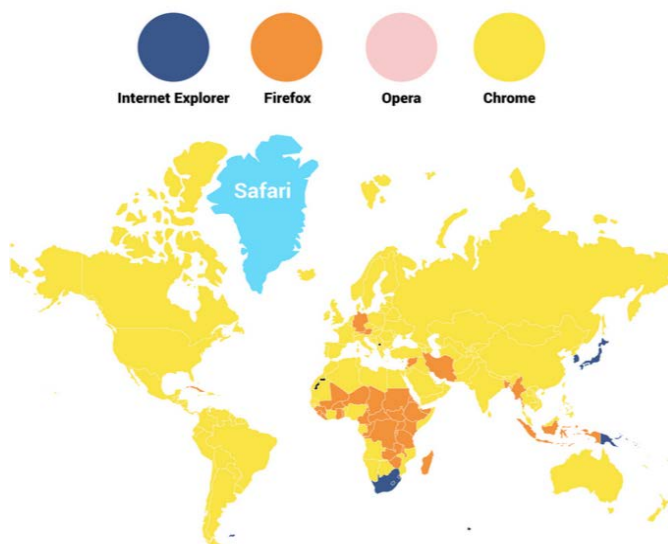


Fig 1  Usage of Internet Explore

### III. MARKET SHARE ATTRACTION OF OPEN-SOURCE CMS

Figure 2 below shows CMS market share in Korea. As of

October 2013, Wordpress has the largest CMS market share in Korea with its proportion 41.0%. Considering that CMS market share of XE (eXpress Engine) exceeded 60% in 2011, it is clear that the market is very rapidly changing. This indicates the fact that the Korean market is transforming from a local market to a global market.



Percentages of websites using various content management systems among the sites that use .kr
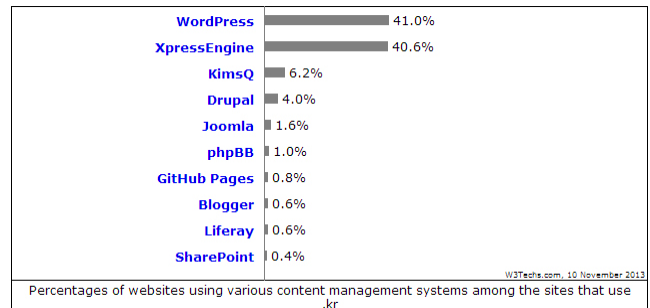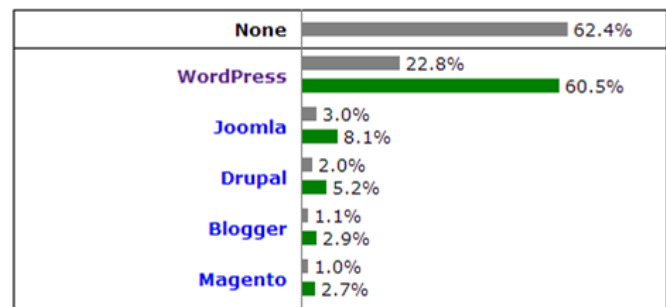
Fig.2 CMS Market Share in Korea

Fig.3 CMS Market Share



Looking at the international CMS market share, Wordpress has the number one CMS market share with 59.6%, which is far from Joomla that has second-largest market share (9.2%). Moreover, as is shown in grey bar graph in Figure 3 that indicates absolute usage percentage, one out of five global websites are made using Wordpress [4].

### IV. A COMPARISON OF OPEN-SOURCE CMS

### A. Comparative Analysis of the Open-Source CMS

Table 1 below shows the comparison results between domestically and internationally used CMS that were chosen according to their market share. Following the exponential growth of Smartphone since 2010, the trend has changed such that CMS can support response web. As of now, every CMS turned out to be able to support the response web and search engine optimization program of SEO[11]. Except for the domestic CMS of XE and Gnuboard, all the CMS tools are capable of building shopping malls by installing separate plug-in. Especially, open-source based Magento is independently supporting building of shopping mall site and it supports all languages and currencies worldwide as well as major global payment methods. As of now, it is used in 1.5 million shopping malls, which constitutes 35% of the current online shopping mall solution market [10,11,12].

As for the multilingual support(MNLS:Multi-National

| | CMS | MNLS | SEO | Market share (%) | | Shopping mall | Plug-In | Security | Dev Language | Database | Responsible Web |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Korea | World wide | | | | | | |
| World wide | wordpress | ○ | ○ | 41.0 | 59.6 | ○ | ○ | X | PHP | MySQL | ○ |
| | Joomla | ○ | ○ | 1.6 | 9.2 | ○ | ○ | X | PHP | MySQL | ○ |
| | Magento | △ | ○ | 0.1 | 2.6 | ○ | △ | X | PHP | MySQL | ○ |
| | Drupal | ○ | ○ | 4.0 | 5.6 | ○ | ○ | ○ | PHP | MySQL, SQLite, Oracle | ○ |
| Korea | XE | △ | ○ | 40.6 | 0.1 | △ | ○ | ○ | PHP | MySQL | ○ |
| | KimsQ | △ | ○ | 6.2 | 0.1 | ○ | ○ | X | PHP | MySQL | ○ |
| | GNUboard | △ | ○ | 0.4 | 0.1 | △ | ○ | X | PHP | MySQL | ○ |

Language Supplyment), Wordpress, Joomla, Drupal, etc. supported all the languages worldwide, while other tools had multilingual supports with limited languages. Wordpress turned out to have considerably larger number of plug-in supports compared to other tools and Magento had fewest. Naver syndication is supported by the Korean CMS KimsQ, Gnuboard, and XE. As Korean Naver is not well known in international CMS market, it was not supported. However, it can be used in Wordpress and Drupal by making use of separate plug-in and module. As for the program language and database, all the seven tools were using PHP and MySQL, while XE and Drupal turned out to be capable of using OracleDB, MS-SQL, etc., in addition to MySQL.

### B. Comparative Analysis of the Open-Source CMS

Plan-on planner Kim Beom-soo once mentioned that "when strong member management function is required, the domestic CMS XE based on bulletin board is more proper than Wordpress" [3]. Internationally developed CMS is quite exotic in its structure or services. Although this can become an advantage in creating global service, it can put limits in case of building service for Koreans on the other hand.

Korean communities are mostly based on bulletin board. Large communities such as 'DCinside' and 'Today's humor' are also based on bulletin board. When managing members in community, the members are classified or divided into sub groups according to their activities on bulletin boards, which are converted to scores. However, in case of using oversees CMS, although bulletin board can be made, there is no function that delicately manages members as in Korean community websites.

Another reason is font and graphical factors. Koreans actually put much emphasis on 'cute' fonts of homepage and they tend to concentrate on its graphical factors. Comparing the products displayed on three mostly used international shopping malls and top three Korean shopping malls, the difference is apparent. While international shopping malls have more text factors than graphics, Korean shopping malls have fewer texts. In the latter, the texts are either altered in images or more focus is put on the products' appearance and visual effects. Figure 4 below shows product description pages on one of the famous Korean shopping malls and on eBay. In case of many text factors, broken text phenomenon does not occur even if the page is zoomed in. However, the focus on the product description can be dispersed. On the other hand, in case of many graphical factors, jagging can occur in graphic-type text when the page is zoomed, but focus can be concentrated on important product description.
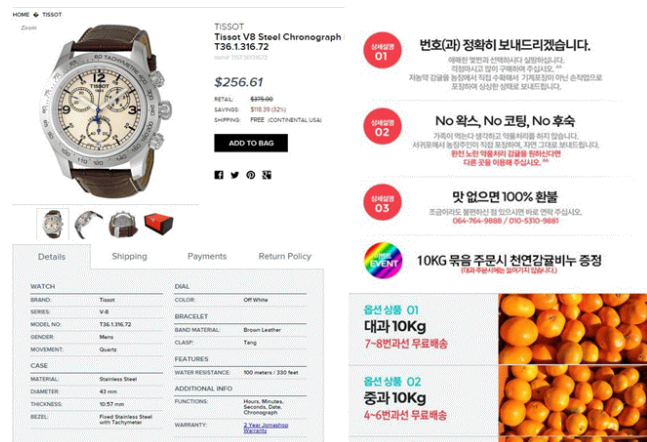


Fig.4 Comparison of ebay.com and auction.co.kr

Therefore, Korea's Web service market requires membership management functions to mange communities, and the open source CMS is required to develop and support plug-ins to compensate for those functions. However, product information on shopping sites operated in Korea tend to process even text information as graphics. Therefore, if the open source CMS, which basically supports the recent responsive Web, is implemented, it might not be able to respond to various mobile devices. For this reason, contents should be produced and improved by dividing them into text information and graphical elements.

## V. WEAKNESS OF OPEN-SOURCE CMS

As services provided through the Web have become diverse, the kinds of cyber attacks targeting the Web became diverse and accident incidence rate have been increasing day by day. Most of vulnerabilities recently found in web services are XSS and DDoS attacks.

- XSS(Cross Site Scripting)

XSS refers to the vulnerability with which scripts prepared by attackers are delivered to other users and executed on other users web browsers without any proper verification. Malicious scripts are executed on the user's side and immediately outputted on web browsers[13].

- DDos(Distributed Denial os Service)

DDoS refers to service denial attacks that are malignantly attacking systems to make the resources of the relevant systems run out so that they cannot be used for originally intended purposes[14].

### A. Analysis of Web Weakness of Open-Source CMS

The annual amount of damage caused by cyber crimes is approximately 120 trillion won and at least one million people on average per day, 12 persons per second encounter criminal damage[15]. In addition, it is said that 63% of SNS users experienced cyber crimes. Although great convenience was obtained from the popularization of the Web, attacks through the Web were also popularized because no appropriate responding system was established. Figure 5 is a summary of the present situation of occurrence of vulnerabilities in Open-Source CMSs that have been popular recently.
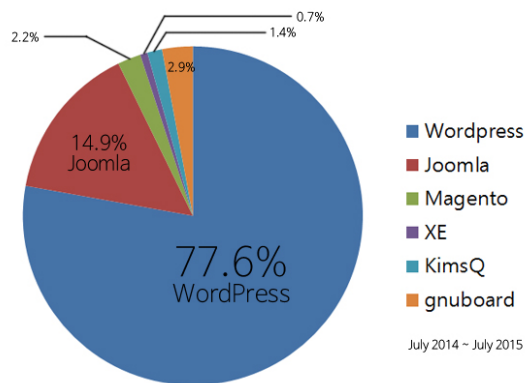


Fig 5 Weakness Occurrence of Major SW

The present situation of occurrence of vulnerabilities in major software programs is as follows; Wordpress 77.6%, Joomla 14.9%, Gnuboard 2.9%, Magento 2.2%, KimsQ 1.4%, and XE 0.7%. Therefore, the ratio of occurrences of vulnerabilities of Wordpress which is number one in the occurrence of vulnerabilities is higher by 62.7%p than that of Joomla which is number two. The ratio of attempts for hacking for Wordpress was higher by 24.1% and that for XSS vulnerability attacks was higher by 60%[16]. The attempts occurred in Wordpress are more frequent than those occurred in all other CMS platforms. The fact that many hackers aim at WordPress because of its overwhelming amount of usage and its poor security performance seems to be a major cause. On the other hand, Drupal has not experienced any occurrence of vulnerability for almost one year as it has operated a separate security team, published security white papers every month, inspected module security, and continuously provided updates

of security related data along with feedback. Although the number of times of finding vulnerabilities can be proportional to the number of users, the most important cause is users' low level of security consciousness. According to a questionnaire survey conducted with firms that use Wordpress platform, 44% of respondents answered that they did not separately employ web site and IT managers[17]. The following figure shows the results of a survey of the numbers of occurrence of vulnerabilities for one year from July 2014 to July 2015 [18].
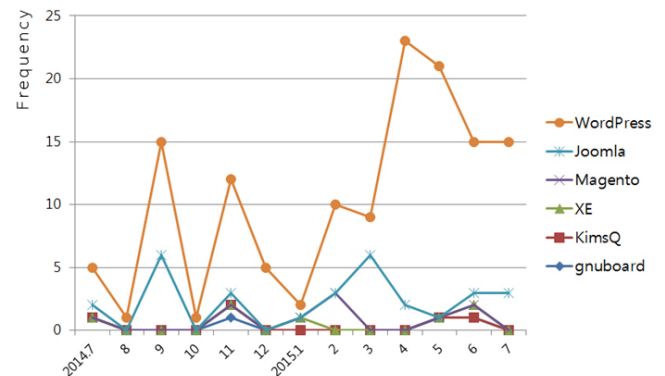


Fig 6 Number of Weakness Occurrence by Month

The monthly average numbers of occurrences of vulnerabilities were as follows; WordPress 7.3, Joomla 1.5, Magento 0.23, XE 0.15, KimsQ 0.07, and gnuboard 0.3. Therefore the numbers of occurrences of vulnerabilities of WordPress was shown to be higher by 79.4% (5.8~7) than Joomla and the number of occurences of vulnerabilities of WordPress in April 2015 was 21 which was at least 10 times larger than that of other CMSs. As such, the vulnerabilities of WordPress were shown to be overwhelmingly more frequent compared to other CMSs.

IT systems are composed of largely three layers; network, system, and application. Security should be evenly applied to all the layers without exception. Among web application attacks, application attacks using vulnerabilities account for most of entire attacks. For protection of web applications, vulnerabilities of web applications should be complemented in advance using methods such as web vulnerability scanners, web firewalls, web malicious code detection, secure coding, and data encryption.

### A. CONCLUSION

Use of Wordpress in Korea is continuously increasing with an establishment of Wordpress User Forum in 2012. In current situation in Korea where the Smartphone penetration rate surpassed PC penetration rate, development of CMS response web has become more important. More progresses are expected of Wordpress that supports 'mobile response web design' and enables easy extension by many developers as it is based on open source.

This paper conducted comparison analysis on the characteristic and performance of Wordpress, by comparing the

domestic and international cases, for the purpose of investigating the current situation of Wordpress. It turned out that CMS used in Korea possesses Korean unique characteristics. For introduction of more international CMS to Korea, it will be necessary to develop bulletin board and member management contents in a way that is commonly used in Korea, along with font or graphical factors development. Since perfect security cannot be achieved for the Web, continuous security updates should be conducted to prevent web security problems and when the numbers of plug-ins is larger as with WordPress, comparably larger number of solutions should be developed. However, the most important cause is users' low level of security consciousness. Users should enhance their security consciousness to reduce and prevent unnecessary damage in advance.

To this end, this study plans to research Korean-style plug-in development technologies and guidelines on the production of contents that will be placed into the CMS.

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