

Benefits of Web Applications Security Testing for on Sri Lankan SMEs

M.D.A. Kavindya¹, O.M.B. Jayasundera², T.L.Guruge³, D.W. Senevirathne⁴ and C.D. Manawadu⁵

^{1,2,3,4}Faculty of computing, Sri Lanka Institute of Information Technology, Metro Campus, Colombo 03, Sri Lanka

⁵Zone24x7 Private Limited, Colombo, Sri Lanka

Abstract—Owing to the advancement and complexity of web systems increases day by day, with the development of information and communication technology, it has been an enormous task to maintain them with a greater care. A secured web application is an essential requisite of every business organization which they could be benefited in achieving their short term and long term business objectives and supportive day to day business functions as well. Reasoning those benefits, such applications should be facilitated quite often, providing with testing and maintenance in order to sustainably survive in the business environment. In that case, security testing has become an indispensable activity of web application development life cycle. It aims to maintain the privacy of data and check whether the security requirements are satisfied by the web applications when they are subjected to malicious data inputs as well. This paper reviews the benefits that can be enjoyed by undertaking an effective security testing for web applications and emphasizes those benefits with regard to small and medium scale of business enterprises in Sri Lanka. An attempt has been made to tie various existing researches and provide a direction for further researches in future.

Keywords— Web applications, Maintenance, Information and Communication Technology (ICT), Small and Medium scale enterprises (SME), Security Testing

I. INTRODUCTION

In Recent years with the prompt of economic growth and evolution of new technology, many business organizations tend to adopt web based business processes increasingly. It can be witnessed that rapid distribution of internet which produces significant demand of web applications requires strict security supplies for companies. When it defines the web applications or most commonly used term; web app, it can be considered as any application software that runs in a web browser and is created in a browser-supported programming language which relies on a web browser to render the application. In other words, any website component that performs some function for the user, qualifies as a web app [1].

Web domain is worldwide and dynamic in nature which makes it more disposed to malicious activities like security breaches and virus attacks. Due to this, there is an increase in the number of vulnerabilities in web applications which can be misused by attackers so as to gain unauthorized access to the web applications. Since modern web systems are really complex and diverse, responsiveness of web applications quite high ever evolving and should be effective.

In view of expansion of the web applications, security becomes a critical concern and is related to the quality of the

web application as well. Hence it can be said as security becomes an elusive goal when dealing with web applications. Security testing as a process of disclosing defects in the information system, protects data and maintain functionality as planned. Because of the logical limitations of security testing, passing such a security test is not an easy task since the system sufficiently satisfies the security requirements only if that security testing is well organized. Accordingly, security testing phase can be combined with the development phase for increasing the trustworthiness of the web applications. Goal of security testing is to detect those defects that could be exploited to conduct attacks [2]. In brief, security testing in deed validating controls, removing unauthorized controls, understanding how newer threats affects application environment and denies access for malicious people and codes as well.

In the point of business perspective, web application attacks could vary with regards to nature of the business process they engaged in, types of data used and extent of business activities involved with web. There can be seen that organizations have to experience a wide range of web application attacks like authentication, configuration management, session management, parameter manipulation, auditing and logging, exception management and input

validation [3]. Therefore when referring a business organization which needs to protect their web applications, the main focus must be to protect their critical organizational data such as financial data, credit card information, user personal and customer information, healthcare data and other organizational sensitive information. The following figure shows that when a business increasingly depend upon web applications, all elements of application including the whole system in between user and database needs to be concerned. [4]

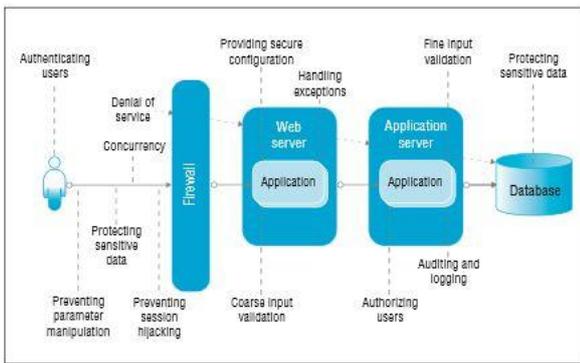


Fig.1. Web application security concerns

Here, the main focus is intended to give upon small aspect of business organizations namely small and medium scale of enterprises (SMEs) in Sri Lanka, which can be discussed in detailed by emphasizing the importance and benefits they get from security testing for their web applications. The term SME is defined with regard to different aspects in different countries. The benefits will also differ accordingly from security tests for different web apps as their business processes could vary. However, when concentrating on Sri Lankan SMEs, web based business environment is quite improved during last decade as the level of penetration of the web based selling is very much limited. Very few companies surveyed by USA had used the services of a web portal for selling. The point to be highlighted is the portals were local establishments and none had used a strong dot com company for business service [5]. Since there were no improved web based applications for SMEs back then, indeed the applications were out of secure. With the development of information and communication technology throughout recent period, the advancement and complexity of web systems had increased with days. Therefore it has been a gigantic task to maintain them with a greater care in order to achieve their short term and long term business objectives.

This research paper provides a clear thought for Sri Lankan SMEs about the valuable benefits which can be achieved by conducting effective security testing for their web based business applications and what is the gap should be refilled by comparing the current issues with security testing. It was needed to observe specific answers for some research questions listed as follows.

- Do Sri Lankan SMEs really in need of testing their web applications?
- Do those SMEs willing to strengthen their security barriers when particularly it is needed in web applications?
- What are the security testing processes that SMEs need?
- Will those security testing be benefitted the SMEs in business perspective?

The second section delivers the existing researches and surveys that conducted upon the topic and what were the roots for conducting this particular research. Third section of the paper describes the procedure that has been followed to conduct the research with the steps. Fourth section explains the observation which leads to assist the research component and concluded with the importance to targeted parties.

II. LITERATURE REVIEWS

In order to gather information about the particular topic, numerous existing researches, surveys, journals and web sites had to be referred. Thus an attempt has been made to tie various existing researches to present all extracted data in an integrated manner. When creating the base that underlies the whole concept of the research, defining the correct terminology for web application and why exactly it connects with security testing was a critical factor to be mentioned.

Once the base of the concept is formed, it is necessary to build the facts that fits together in order to make the concept complete. It was needed to find about the security testing and what does it exactly mean by security for web applications. Issues and challenges of security testing of web applications were significantly supported to understand the existing issues involved with current testing. As Arunima Jaiswal et.al discussed about security testing of web applications, issues and challenges were discussed by giving specific answers for questions that current security testing process faces in web applications [2].

According to Jon Oltsik et.al, the testing tools and services which needed for web application security testing were explained on behalf of Enterprise Strategy Group (ESG). Through the research report; Web Application Security Testing Tools and Services, the types of web application attacks, web application security testing challenges, Static application security testing (SAST) and Dynamic application security testing (DAST) have been analysed and explained [3].

The importance of safeguarding web applications and providing the right testing approaches were underscored in the article which written on behalf of IBM. An understanding of why makes web applications vulnerable,

few strategically best practices for protecting web applications and elaboration for security measures were given in the article [4].

A survey on e-commerce implementation in SME sector for Sri Lanka conducted by Sri Lanka Business Development Centre (SLBDC) in order to analyse the importance of converting the traditional methods of business processes into effectively emerged web based supply networks. The capacity that can be achieved by maintaining good web system within the SMEs in Sri Lanka has been emphasized in the paper. [5]

According to Dr. ShefaliNandan, the paper reviews the studies that emphasize the need to adopt ICT in SMEs, benefits of ICT in SMEs, identifies problems in adoption and offers suggestions for overcoming barriers to adoption. In order to get an overall understanding about small and medium enterprises area was crucial task in conducting the research and the web applications which supports to SME capacity were important to be familiar with [6].

III. METHODOLOGY

Reasoning the high precision, real time and effective way to gather responses by conducting limited modest steps, the research team has decided to collect necessary information by using questionnaires. Assuming the quality of the criteria contained in questionnaire can be measured through a quantitative approach, direct and important questions were asked to determine how well proper security testing can be adopted in web applications used by SMEs in Sri Lanka.

As the first step of conducting the research, the research problem was defined clearly and literature reviews were collected related to the problem. Using quantitative and qualitative researches, research design was conceptualized and data collection was formed by using two approaches; questionnaire and observation. Questionnaire was targeted to a particular audience who are currently working in the business industry particularly in SMEs. The purpose of conducting questionnaire is to get truthful opinions on benefits of security testing when SMEs using the web applications. Selected personnel who are associated with IT related tasks were questioned in order to gain knowledge about ongoing security testing practices that have been adopted in their business web applications. Number of ten questions was asked from the audience and as another method, observation was done by referring the related literature reviews. The total population was taken as the selected samples because of questionnaires were distributed only among most relevant targeted group of personnel who are subject to the research problem. The collections of data were analyzed in order to analyze the benefits of web application security testing for on Sri Lankan SMEs.

The evaluated benefits can be realized and some strategic security testing practices can be implemented by Sri Lankan SMEs in actual scenario and it will rest as the future work to be carried out. Founded the feedback for the assessment, it states the importance of security testing for web applications in business functionalities and courage to develop more secure web based applications with greater care.

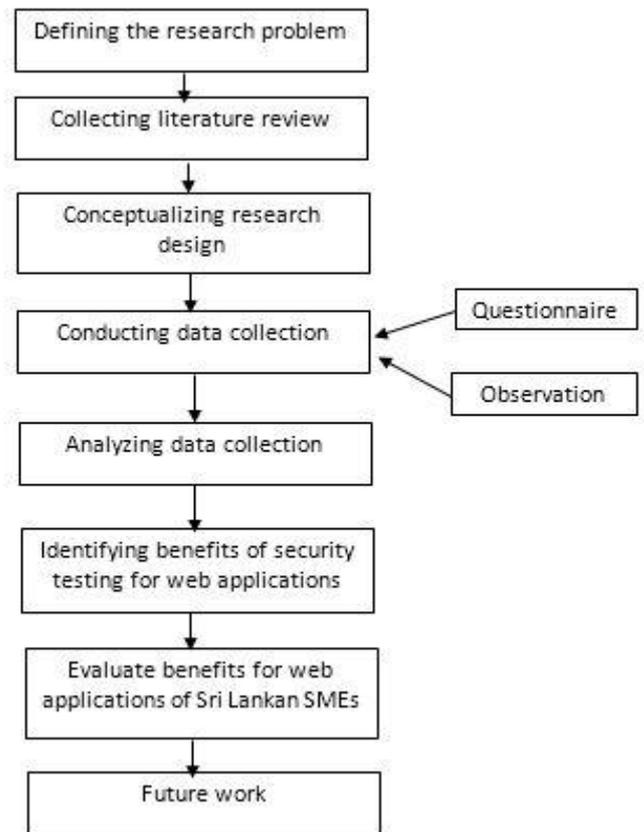


Fig.2. Flow chart of the methodology of research

IV. RESULTS AND DISCUSSION

This section of the paper analyses the consequences of 40 responses to the questionnaires distributed among the targeted group. Observation obtained from the literature review and comparisons of the results attained from questionnaire are highlighted here in order to assist the research component.

First question was based on the sector of the SME that the respondent is involved in his career. It was needed to identify the field that majority of the personnel working on, in order to recognize what are the particular benefits each sector is associated with. Out of 40 respondents, majority engaged in service sector which can further classified as provide banking, insurance, ICT and communication services.

1. What is the sector that SME involved?



Fig.3. Sector of SME of the participants

2. What is the level of experience using web application?

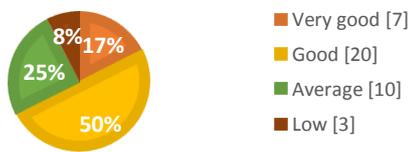


Fig.4. Level of experience using web applications

Second question was focused on the level of experience of the participants in web applications. It was crucial to get to know the experience level of using the web applications by each of the personnel, in order to analyse the benefits they could enjoy from proper security testing. Most of the participants have good and average experience level using the web application and few of them have very good experience and low experience of using web application of their company.

3. Do you have a knowledge about security testing processes related to company web applications?



Fig.5. Knowledge about security testing processes related to company web applications

Third question was evaluated on the knowledge that participants have in security testing processes related to web applications of their business organizations. Out of the sample population, 70% have marked as Yes as per they do have knowledge about security testing processes and rest 30% marked as No and they are lack in knowledge.

Fourth question was charged to know that are there any certain advantages of using security testing for web applications according to the knowledge of the selected sample of personnel. Out of all, 36 participants marked as Yes and it can be seen the majority of them agreed with the statement.

4. Are there any certain advantages of using security testing for web applications?



Fig.6. Certain advantages of using security testing for web applications

Fifth question was asked to identify why security testing is needed for a web application. From the answers of participants, it could be able to recognize some of the motives that shows why security testing is necessary for a web application in a business organization. Participants have provided the answers by stating the importance of security testing as proper validation of control, removing the uncontrollability of web application functions, understanding dynamic threats properly, get to know malicious codes and hackers.

5. Why security testing is needed for a web application?

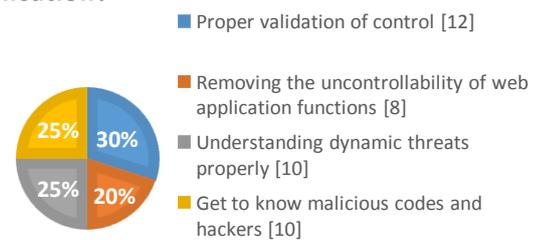


Fig.7. Need of security testing for web applications

Sixth question states about various kinds of web application attacks or failures which participants have been gone through out their working time period. While majority of SME organizations happened to faced user authentication errors, attack on sensitive information, authorization problems and failures in session management such as session hijacking, other types of failures like errors in exceptional handling and failures in input validation were taken less amount.

6. What are the various kind of web application attacks or failures that organization usually facing?



Fig.8. Web application attacks or failures

7. Do the developers sufficiently test the security of web applications?

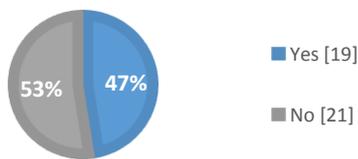


Fig.9. Testing the web applications sufficiently

Seventh question analyses whether the developers in the SME business organizations are sufficiently test the security of web applications. Out of the selected sample of participants, 19 of them marked as Yes and 21 of them marked as No. Therefore it can be said that considerable amount of organizations are not engaged in working with high secure and proper tested web applications.

8. What are the challenges that the SMEs are facing in web application security testing?

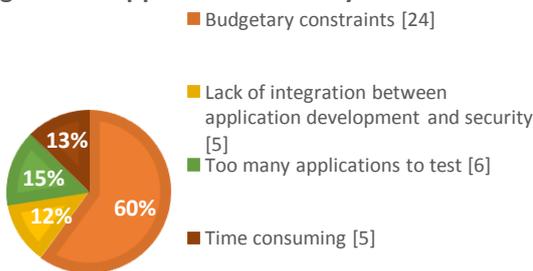


Fig.10. Challenges SMEs face in web application security testing

Eighth question defines in terms of challenges that the web application security has to overcome. According to the perspective of selected group of participants, there can be seen few limitations that challenge to a web application in business organization. Budget constraints took the highest number here and lack of integration between application development and security, too many applications to test and

time consuming has been taken quite same amount respectively.

9. What are the Reasons involved in web application security challenges ?



Fig.11. Reasons involved in web application security challenges

Ninth question was focused on the reasons could be involved in web application security challenges of the selected SMEs. Collective reasons were provided by the participants which elaborates the root causes to the above mentioned limitations. Among those answers, poor management involvement in web security and unawareness of developers about web security issues were taken high number of responses and non-secure coding practices and poor quality of security testing were taken average number of responses respectively.

Final question was concentrated on security testing practices that are advantageous to be used for web applications when it particularly related to performance of business activities in SME. According to the responses, the best practices that can take in action are; provide annual security training for all application team members, develop security best practices across all employee and non-employee application users, monitor the security status of every application regularly

and develop an automated tool that helps for application security.

10. What are the best security practices that protects web applications in organization?

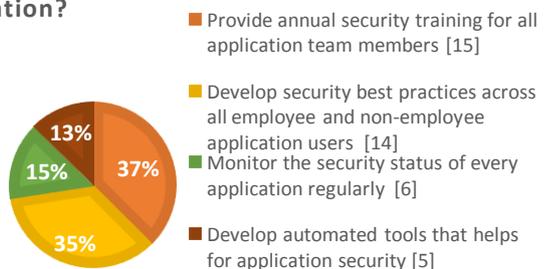


Fig.12. Best practices to protect web applications

According to the pattern of responses, it can be argued even though the SMEs in Sri Lanka currently use web applications in their day to day business activities, most of the organizations are unaware about the security testing that

should be done for the web applications. With the responses attained from the participants, it can be summarize that those web applications used in SMEs are not sufficiently tested in security wise and there can be seen some challenges those SMEs are facing. According to the question 09, there are some reasons to weakening the security testing in web applications and as per the question 05, the importance of security testing is emphasized well. Therefore it is important to overcome those limitations and attain appropriate security testing which strengthen the web application and supports to achieve business objectives easily.

V. CONCLUSION

This paper focused on the encouragement and guidance that can be gained by analysing the benefits of web applications security testing for on Sri Lankan SMEs. Currently, most of Sri Lankan SMEs face couple of challenges in protecting their web based applications since crucial data and daily business information are warehoused in these apps. Therefore it is important that keeping the web applications of the organizations safe and secure updated. Both challenges and benefits in web application security testing discussed based on the questionnaire results and the observation obtained from the related research papers. Hence it is significant that overcome the challenges and reasons for security threats such as user authentication errors, attack on sensitive information, authorization problems and failures in input validation and understands the importance of security testing for web applications especially when it comes to business organizations. Proper validation of control, removing the uncontrollability of web application functions, understanding dynamic threats properly and get to know about malicious codes and hackers can be highlighted as benefits.

According to the responses from industrial participants, by doing a good security testing for business web applications, it can get a better decision making in overall organization since web application of the organization involved with all inner departments and outside suppliers, customers and other stakeholders of the SMEs. Because of the research was done only as an academic level, questionnaires and observations were analysed and results were obtained but as an implementation in real world, Sri Lankan SMEs can evaluate the benefits according to their business context and can strengthen their web based application security testing related to organization.

REFERENCES

- [1] M. Cobb, "techTarget," [Online]. Available: <http://searchsecurity.techtarget.com>. [Accessed 10 August 2014]. J. Breckling, Ed., *The Analysis of Directional Time Series: Applications to Wind Speed and Direction*, ser. Lecture Notes in Statistics. Berlin, Germany: Springer, 1989, vol. 61.
- [2] G. D. A.Jaiswal, "Security Testing of Web Applications: Issues and Challenges," *International Journal of Computer Applications*, vol. 88, no. No.3, p. 32, 2014. M. Wegmuller, J. P. von der Weid, P. Oberson, and N. Gisin, "Highresolution fiber distributed measurements with coherent OFDR," in *Proc. ECOC'00*, 2000, paper 11.3.4, p. 109.
- [3] J.gahm,J.oltsik,"Web Application Security Testing Tools and Services Infographic".May 7, 2013,[online].Available:<http://www.esg-global.com/infographics/web-application-security-testing-tools-and-services-infographic/>[Accessed:Aug.14,2014].
- [4] "Understanding Web application security challenges." Jan,2008.[Online].Available:ftp://ftp.software.ibm.com/software/rational/web/whitepapers/r_wp_webappsecurity.pdf[Accessed:Aug.13,2014].
- [5] G. D. A.Jaiswal, "Security Testing of Web Applications: Issues and Challenges," *International Journal of Computer Applications*, vol. 88, no. No.3, p. 32, 2014.
- [6] "Small and Medium Enterprises(SME)",Mon.11,2011.[Online].Available: http://www.nhrep.gov.lk/index.php?option=com_content&view=article&id=81&Itemid=59&lang=en. [Accessed:Aug. 13, 2014]*FLEXChip Signal Processor (MC68175/D)*, Motorola, 1996.
- [7] Why Web Vulnerability Testing Needs to be Automated.Wed, 03 Jul 2013, [Online].Available:<https://www.netsparker.com/blog/web-security/automatic-web-application-vulnerability-testing-detection/>[Accessed:Aug.13,2014]A. Karnik, "Performance of TCP congestion control with rate feedback:TCP/ABR and rate adaptive TCP/IP," M. Eng. thesis, Indian Institute ofScience, Bangalore, India, Jan. 1999.
- [8] Ruby on Rails Security Basics. Wed, 06 Aug 2014 [online].Available:<https://www.netsparker.com/blog/web-security/ruby-on-rails-security-basics/>[Accessed:Aug.13,2014].
- [9] DOM Based Cross-site Scripting Vulnerability.Tue, 15 Jul 2014,[Online].Available:<https://www.netsparker.com/blog/web-security/dom-based-cross-site-scripting-vulnerability/> [Accessed:Aug.14,2014].
- [10] Why QA Pros Should Be More Involved in Web Security.Wed, 18 Jun 2014,[Online].Available:<https://www.netsparker.com/blog/web-security/quality-assurance-professionals-web-application-security/>[Accessed:Aug.14,2014].