Arabian Journal for Science and Engineering
https://doi.org/10.1007/s13369-019-04319-2

RESEARCH ARTICLE - COMPUTER ENGINEERING AND COMPUTER SCIENCE

Cyber Security Threats and Vulnerabilities: A Systematic Mapping Study

Mamoona Humayun[1] · Mahmood Niazi[2] · NZ Jhanjhi[3] · Mohammad Alshayeb[2] · Sajjad Mahmood[2]

Received: 9 May 2019 / Accepted: 26 December 2019

Abstract
There has been a tremendous increase in research in the area of cyber security to support cyber applications and to avoid key security threats faced by these applications. The goal of this study is to identify and analyze the common cyber security vulnerabilities. To achieve this goal, a systematic mapping study was conducted, and in total, 78 primary studies were identified and analyzed. After a detailed analysis of the selected studies, we identified the important security vulnerabilities and their frequency of occurrence. Data were also synthesized and analyzed to present the venue of publication, country of publication, key targeted infrastructures and applications. The results show that the security approaches mentioned so far only target security in general, and the solutions provided in these studies need more empirical validation and real implementation. In addition, our results show that most of the selected studies in this review targeted only a few common security vulnerabilities such as phishing, denial-of-service and malware. However, there is a need, in future research, to identify the key cyber security vulnerabilities, targeted/victimized applications, mitigation techniques and infrastructures, so that researchers and practitioners could get a better insight into it.

Keywords Cyber security · Threats · Vulnerabilities · Attack

1 Introduction

In today's world, cyber civilization has become a popular and inevitable source of information sharing and other professional activities including business, shopping, bank transactions, advertisements, services, etc. This exponential increase in the use of cyberspace has resulted in an exponential increase in cybercriminal activities. The basic reason for this increase is the excessive usage of Web applications in almost every field of life. These Web applications are not free from design faults, and cyber criminals exploit these faults to gain illegal access to systems [1, 2]. Therefore, cyber security has become an important concern for researchers and practitioners [2]. Cyber security can be defined as the collection of tools, techniques, policies, security measures, security guidelines, risk mitigation strategies, actions, training, good practices, security reassurance and latest technologies that may be used to protect cyber space and the assets of users [3]. Cyber security nowadays has become a matter of global interest and importance, and it involves securing information by detecting, preventing and responding to cyber attacks [3–5].

The defensive mechanisms used by various organizations to protect their cyber space are not sufficient to protect these cyber environments from the ever-increasing security vulnerabilities. Therefore, it is one of the important scientific challenges that has been attracting the attention of researchers and practitioners for the last decade. A number of research efforts have been made in different cyber domains, each having specific features and peculiarities to address various security breaches [1]. In the literature, various approaches and tools have been suggested for the detection and the mitigation of cyber security threats [6, 7]. However, before proceeding with further research in this area, there is a need to compile the existing work. To fill this gap, this research study aims to provide a broad

✉ NZ Jhanjhi
noorzaman.jhanjhi@taylors.edu.my

[1] Department of Information systems, College of Computer and Information Sciences, Jouf University, Al-Jouf, Saudi Arabia

[2] Information and Computer Science Department, King Fahd University of Petroleum and Minerals (KFUPM), Dhahran, Saudi Arabia

[3] SoCIT, Taylor's University, Subang Jaya, Malaysia

Published online: 06 January 2020