An Analytical Approach to Assess and Compare the Vulnerability Risk of Operating Systems

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Abstract : Operating system (OS) security is a key component of computer security. Assessing and improving OSs strength to resist against vulnerabilities and attacks is a mandatory requirement given the rate of new vulnerabilities discovered and attacks occurring. Frequency and the number of different kinds of vulnerabilities found in an OS can be considered an index of its information security level. In the present study five mostly used OSs, Microsoft Windows (windows 7, windows 8 and windows 10), Apple's Mac and Linux are assessed for their discovered vulnerabilities and the risk associated with each. Each discovered and reported vulnerability has an exploitability score assigned in CVSS score of the national vulnerability database. In this study the risk from vulnerabilities in each of the five Operating Systems is compared. Risk Indexes used are developed based on the Markov model to evaluate the risk of each vulnerability. Statistical methodology and underlying mathematical approach is described. Initially, parametric procedures are conducted and measured. There were, however, violations of some statistical assumptions observed. Therefore the need for non-parametric approaches was recognized. 6838 vulnerabilities recorded were considered in the analysis. According to the risk associated with all the vulnerabilities considered, it was found that there is a statistically significant difference among average risk levels for some operating systems, indicating that according to our method some operating systems have been more risk vulnerable than others given the assumptions and limitations. Relevant test results revealing a statistically significant difference in the Risk levels of different OSs are presented.

Keywords : cybersecurity, Markov chain, non-parametric analysis, vulnerability, operating system