Proceedings - 2016 9th International Conference on Developments in eSystems Engineering, DeSE 2016, 2017, pages 98-104

# Cyber Security Risk Evaluation Research Based on Entropy Weight Method

Hamid T., Al-Jumeily D., Hussain A., Mustafina J.

*Kazan Federal University, 420008, Kremlevskaya 18, Kazan, Russia*

## Abstract

© 2016 IEEE. The risk assessment of any Network or Security systems has a high level of uncertainties because usually probability and statistics were used to evaluate the security of different cyber security systems. In this paper we will use Shannon entropy to represent the uncertainty of information used to calculate systems risk and entropy weight method since the weight of the object index is normally used and point to the significant components of the index. We evaluate the risk of security systems in terms of different security layers and protections. The information system is analysed by perimeter, network, host, application and data layers' protections. The capability of protections is measured by introducing the concept of protection effectiveness. We write the security evaluations algorithm to normalized the protection matrix and calculate the entropy and the entropy weight, then we will use the weight and paths to evaluate and calculate the total risk in the system and give the systems administrator a clear guidance on the vulnerable security entities. We try to develop a novel approach to evaluate the cyber security suitable for the majority of cyber systems by introducing the term of security entities.

http://dx.doi.org/10.1109/DeSE.2016.18

## Keywords

Cyber security, Network Security

## References

[1] Buchley J J, Chanas S. A fast method of ranking alternatives using fuzzy numbers(short communications) [J]. Fuzzy Sets and Systems, 1989,30(3):337-339.

[2] C.L. Smith. The development of a Security Systems Research and Test Laboratory at University. Proceedings of 2004 IEEE International Carnahan Conference on Security Technology, pp. 111-115, 2004

[3] Ii Xiaohu-A Stochastic Model for Quantitative Security Analyses of Networked Systems, 2011.

[4] ISEGCOM, SCARE 0.1-The Source Code Analysis Risk Evaluation 15. November 2007, www.isecom.org.

[5] Meng FC. Comparing the importance of system components by some structural characteristics. IEEE Trans. on Reliability 1996; 45(1): Pages 59-65.

[6] Hamid, Thaier KA. "Attack graph approach to dynamic network vulnerability analysis and countermeasures." (2014).

[7] S. Mauw, M. Oostdijk,: Foundations of Attack Trees. In Won, D., Kim, S., eds.: ICISC. Volume 3935 of LNCS., Springer (2005) Pages186-198.

[8] Gregory Howard Graves. Analytical Foundations of Physical Security System Assessment. doctoral Dissertation United States Military Academy. August 2006.

[9] Tang Dan, Yin Xiandong, Fang Ni, Guo Cao. Physical Protection System and Vulnerability Analysis Program in China. Science and arms control verification technology(English in Edition). 2001(3).

[10] Hicks, C., McGovern, T., Earl, C.F., 2000. Supply chain management: A strategic issue in engineer to order manufacturing. International Journal of Production Economics 65, 179-190.

[11] James D. Williams .Physical Protection System Design and Evaluation Sandia National Laboratories .DE-AC0--94AI85000.

[12] Tang Dan, Yin Xiandong, Fang Ni, Guo Cao. Physical Protection System and Vulnerability Analysis Program in China. Science and arms control verification technology(English in Edition). 2001(3). pp.16-26.

[13] Balocco, A, Capone, P. Construction Site Risk Analysis Based on Shannon Entropy: a Case Study Application. The First international conference on safety and security engineering pp171-181.

[14] Mitchell Ashley, LAYERED NETWORK SECURITY:A best-practices approach, White paper, January 2003.

[15] https://www.gov.uk/government/news/more-smallbusinesses-hit-by-cyber-attacks, last visit 22/05/13.

[16] Dai, Jing Jing, Hui Min Hu, and Qing Cai. "Effectiveness Evaluation of Security System Based on Entropy Theory." Applied Mechanics and Materials 40 (2011): 806-811.