



SECURITY EVALUATION OF COMPUTER NETWORK BASED ON HIERARCHY

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Abstract

Network security is an important issue that the develop- ment of computers faces. Based on hierarchy, the network security evaluation is researched by using the analytic hierarchy process in this study. The network security was the target hierarchy, and the environment, hardware, soft- ware and data security were used as the indicator hier- archy. The weights were calculated and sorted to under- stand the network security situation. An instance analysis was carried out by taking a campus network as an exam- ple. It was found that the campus network had some shortcomings in anti-virus software, vulnerability scan- ning and access control, and the security needed to be strengthened. Moreover the reliability of the method was proved. The network security evaluation method based on hierarchy designed in this study is feasible, which pro- vides some theoretical bases for its further development in the field of network security.

Keywords: Data Security; Hierarchy; Network Security

1 Introduction

With the development of society, the popularity of com- puters has gradually increased, and the network has continuously penetrated into people's daily lives, occupying an indispensable

important position [12]. However, with the rapid development of computer networks, more and more information sharing has made the network attack methods more diversified, and the network security prob- lem has become more and more serious [2]. The network security problem mainly refers to ensuring the security of information and data in the network. The threat of network security not only affects people's private infor- mation, but also causes certain economic losses [7].

In order to establish a secure network environment, network security technologies are constantly being up- dated and developed. However, in the face of ever- changing network threats and attacks, traditional net- work security methods have become more and more inadequate [1]. Thus, pre- understanding of the network se- curity situation becomes more and more important. The network security evaluation refers to understanding the problem of the network through the overall analysis of the network security situation, and timely adopting re- pair measures to improve network security and ensure the good operation of the network. Due to the significance of of the network security, research on its evaluation meth- ods is also deepening.

Zhou et al. [14] proposed an evaluation method com- bined with fuzzy logic modeling and entropy weight method. The entropy was used to verify the

objectivity of the model, and then quantitative analysis was carried out by fuzzy method. Sun et al. [10] combined the genetic algorithm and neural network to study the financial network security evaluation of the power industry. The weighted algorithm was used to calculate the comprehensive security score of the network, and corresponding suggestions were put forward. Jiang et al. [5] proposed a model based on body temperature safety evaluation, through the imbalance of immune system to carry out network risk assessment, and proved the validity of the model through simulation experiments. Based on the gray relational clustering analysis, Shi [9] analyzed and evaluated the influencing factors of network security to determine the level of network security. The effectiveness of the method was proved by the analysis of actual cases. Based on hierarchy, this study analyzed network security from environment, hardware and software security, and then used analytic hierarchy process to evaluate network security, so as to discover the inadequacies of the network and take timely measures to improve network security. The example analysis proved the effectiveness of the method and provided some theoretical support for network security evaluation.

2 Computer Network Security

The rapid development of computers has brought a series of network threats and risks which have a great impact on network security. Network security means that hardware, data, etc. in a computer network are not damaged and leaked and can be safely and continuously operated. The following points should be achieved to realize network security:

Availability: Information in the network can be accessed and used to provide effective services.

Confidentiality: Information and data in the network are not illegally stolen by

unauthorized users, and users can operate in an absolutely confidential environment. **Integrity:** the information and data in the network will not always be tampering, deleting, etc. during the transmission process.

Non-repudiation: The network ensures the authenticity of the identity of the recipients of the information, and the recipients of the information cannot deny the transmitted information.

The current network security problem comes from the network attack in the process of information transmission. On the one hand, it comes from the threat to network devices. These insecure factors may be caused by unintentional operations, or may be due to hackers and other lawless elements. In order to ensure network security, methods such as identity authentication, access control, digital signature, and digital encryption have emerged. Based on hierarchy, this study evaluated network security to have a better understanding of network security

3 Hierarchical Evaluation Indicator System

In order to evaluate network security, it is first necessary to establish an evaluation indicator system. The following principles need to be followed in the selection of indicators:

Scientificity: The selected indicators should be able to scientifically reflect the cyber security situation.

Feasibility: If the selected indicators can collect the required data conveniently, the evaluation process is as simple as possible and easy to operate.

Comprehensiveness: The selected indicators should be able to comprehensively reflect the network security

This study considered the security factors of environment, hardware, software and

data. These four aspects were used as the first-hierarchy indicators of network security evaluation. Then, each first-hierarchy indicator was subdivided and the hierarchical evaluation indicator system is established, as shown in Figure 1



Figure 1: Hierarchical evaluation indicator system

In Figure 1, network security is the target hierarchy, A, B, C, and D represent the indicator hierarchy, and A1, B1, etc. represent the sub-indicator hierarchy, and the project hierarchy is the method that achieves the goal.

4 Hierarchical Analytical Method

Establishment of Judgment Matrix

According to the expert and the 1-9 proportional scale [4] (see Table 1), the significance of each index is analyzed by the method of pairwise comparison to form the judgment matrix A:

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