Characteristics Analysis Of Network Non-Optimum Based On Self-Organization Theory

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Abstract- **This paper introduces some known non-optimum to the networks security, categorizes the non-optimum, and analyses protection mechanisms and techniques for countering the non-optimum. The non-optimum have been classified more so as definitions and then followed by the classifications of these non-optimum. Also mentioned are the protection mechanisms. The paper establishes the syndrome and empirical analysis based on the non-optimum category of the network system. At the same time, it also puts forward the non-optimum measurement of the networks system along with non-optimum tracing and self-learning of the networks systems.Besides, the various characteristics and functions of the network security can be measured from the non-optimum attributes. By summing the practice, this paper has also come at non-optimum analysis principle of the networks, established the conception of non-optimum thresholds and put forward three theorems about non-optimum parameters. Through the concept of extensionality networks function, it analyzes the actual significance of networks security based on non-optimum analysis. Based on the analysis from non-optimum to sub-optimum, it puts out the academic idea of extension networks optimal. Meanwhile, it discusses about the general framework of extension optimum. Finally, according to the previous practice of optimization, kind of method has been developed to learning approach the sub-optimum from non-optimum network.**

Keywords- non-optimum category; network security; non-optimum and security; extensionality networks function; self-learning approach.

I. INTRODUCTION

The future security of societies that depend increasingly on networks is contingent upon how our complex human and technical systems evolve. New network technologies including the Internet favor fragmentation into many loosely connected open and closed communities governed by many different principles. As the reach of today‘s networks has become global, they have become the focus of arguments over the values that should govern their development [1].

However due to the complexity of network‘s practice, there are numbers of unknown and uncertain factors, longitudinal and transverse relationship of things, people‘s networks behavior. Especially as the network systems heads to the orderly dynamic condition, some of the hidden troubles are not exposed, the achieved most optical modes are in unstable states. This implies that the recognition and practice of mankind is featured by the exploration and pursuit not only in an optimum category, but also, under many conditions, in a non-optimum category. That is to say when people are faced with urgent problems, they need not only to find out the most optimum mode or realize the most optimum aim, but also, more importantly, to get rid of the vicious influences of non-optimum accidents effectively as well as control the non-optimum factors of the network system [2].

The concept of non-optimum was introduced by He Ping in his classic paper [1]. Using the concept of non-optimum Literature [2] introduced the non-optimum analysis. Literature [3] introduced the notion of sub-optimum sets; Literature [4, 5, 6, and 7] studies the sub-optimum learning system. This approach provided a wide field for investigation in the area of system optimization and its applications. Continuing the work in [1-7], as an extension of concept presented in [6, 7], we will introduce network security based on the characteristics of non-optimum. And, we will establish their properties and relationships with other classes of early defined forms of non-optimum to sub-optimum.

This paper is structured as follows: The second section introduces the non-optimum concepts of network system, and related research reviews theoretical principles relevant to network system like characteristics of non-optimum, analysis on technology acceptance model (TAM). The third section network security architecture studies based on non-optimum analysis, at the same time, the conversion mechanism of non-optimum to sub-optimum mode. The fourth puts out the approach of extension networks optimal. Meanwhile, it discusses learning model the optimum from non-optimum network Finally the fifth section conclusion puts forward the discoveries of this research and future research direction.

II. NON-OPTIMUM ANALYSIS OF NETWORK SYSTEM

A. Basic Concept

The theory of non-optimum analysis on systems and the tracing of optimum modes are interrelated and inter-perforated, and stand reciprocally contradictory. The former expresses the escape from non-optimum category and the latter displays the exploration of the most optimal mode and its procedure. Based on the interrelationship of the two

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research areas, the formation of non-optimum category and the constraint of non-optimum are the foundation to establish the optimum category. It means that only when man does the research out of the non-optimum category, can they be on their way to trace the most optimal modes. The concept of non-optimum is quite comprehensive in network system. From the viewpoint of network systems‘ software, non-optimum means unfeasible and unreasonable [2]; from the viewpoint of human‘ network behavior, it means non-trusted [3]; from the viewpoint of network systems‘ capacity, it means ineffective and abnormal [4]; from the viewpoint of network systems‘ change, it means obstacles, disturbance and influence [5]. There exists a serious of non-optimum problem from the entity of the network system to the change of the network system, which causes non-optimum category. As to every kind of networks security problems, there is the individual non-optimum category as well as the common non-optimum category. The so-called individual non-optimum category is decided by the characters of the networks relationship system, while the common non-optimum category is an objective entity of networks behavior. At present, most security analysis is designed manually based on past experience of their networks behavior. Since the number of possible optimization model very large for realistic applications of reasonable complexity, security analysis modeling designed manually may not work well when applied in new problem instances. Further, there is no systematic method to evaluate the effectiveness of security designed manually. For these reasons, a ―cooperative" method for discovering the proper security decision for a particular application is very desirable. This leads to the development of our method for extensionality security model (ESM) of non-optimum category.The security of the network system emerges and develops in non-optimum category. Every security attributes exists in a non-optimum category, and the real actions of the non-optimum tell its risk phenomena of networks systems. Generally speaking, these risk phenomena are included in the non-optimum category of network system, but since the network system is rather complex, it takes on certain unclear attributes under any condition. The unclear attributes are unknown things possessed by the risk system of network security, which are decided by the complexity of the risk system in numerical value. For example, the risk analysis of the network system is much more complicated than the physical system. Therefore the unknown things of an network system are much more than a physical system. These unclear attributes cause the risk factors of the system. Figure 1 shows the relationship between the non-optimum and the network security.

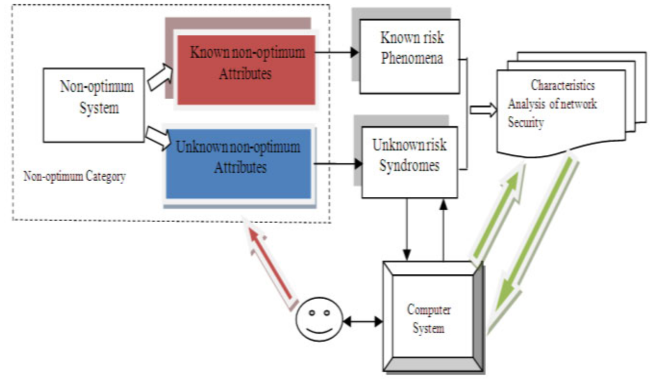

Fig.1. Characteristics analysis of networks security based on non-optimum

B. Experience analysis

Network‘s experience provides non-optimum syndrome for the network system. When the recognitions are different, the non-optimum syndromes are different as well. The tracing to the network‘s behavior and conditions of the past can propose a non-optimum syndrome. In an artificial network system, different people have different be saviors and stories, thus different experiences. Sometimes experiences are called a kind of recognitions; but as the level of recognition is different, the experience of the network is also different. The syndrome of the system is selected and decided by the experience of the network, and the reasonability of the experience‘s selection is also a meaningful question for discussion. For example, the increase of the function of the network can reduce the non-optimum category, and the changes of the network‘s behavior can cause new non-optimum factors, which change with the network‘s behavior. Thus the non-optimum category of the actual system is composed of non-optimum syndrome, the amount of non-optimum changes and the potential non-optimum factors. Under the prerequisites of the formation of the network‘s experience, there is a process of recognition to the non-optimum behavior, which is a self-learning and self-accustomed process. Natural non-optimum is an objective entity, which does not change with people‘s will. However, when people get hold of the basic characteristics of the non-optimum, they can set up certain functions to avoid the non-optimum, which is not the main subject of the non-optimum analysis theory of the system [3]. From the creation to the death of the network system, there is an overall running procedure. In fact, a whole, standard running condition does not exist, and also breaches the development regulation of things. From the viewpoint of the dialectic from recognition to entity, this also accords with the entity and recognition to the non-optimum. For example, as a decision-maker of a concern, one first needs to do a series of work related to the management of the concern and the strategic development objectives. That is to say, to find out what methods to take, what problems to solve and what difficulties to conquer. The key to finish this series of work is to correctly find out the non-optimum problem that exists meanwhile with the objectives. Of course, these non-optimum problems are formed by direct experience, indirect experience and partial hypotheses. Mentioning hypotheses, people might ask: Can hypotheses be hypotheses? Can they be replaced? These doubts are unnecessary. The actual research shows that if there is no hypothesis, there is no affirmation; to accept a hypothesis is to confirm; the acceptable effect is in the direct ratio of the affirmation. Most of the chemical systems are set up on hypotheses, which importance is obvious. Mathematics is also the conclusions made by logistic reasoning inference discursiveness discussions based on hypotheses.

III. SELF-ORGANIZATION OF NETWORK SYSTEM SECURITY

A. *Self-Organization Of Network System*

In the research of the self-organization theory of systems, the transmission of order and non-order is a core question. The theory of dissipation structure, the theory of hyper circulation, synergetic theory and chaos theory contribute a great deal to it. In fact, their individual theories include non-optimum theory of the system. Because the major character of the self-organization of the system is to perfect the running of the system, develop its goals, they have to experience from non-optimum to optimum, and from optimum to non-optimum. If the system is not featured with this attribute, it doesn‘t need self-organization either. Analysis shows that systems always stay on the border of optimum and non-optimum, and the aim of self-organization is to bring the system from the border to the optical category. There is a time limitation on the system‘s stay in the optimal category. Within a certain time, because the system is stable, it stays in the optimal category. However, if the system is not stable, it will soon move from the optimal category to the new border and cause a sustained situation of the system. The sustained situation is neither a developing situation, nor an ideal situation. Of course, the actual angle of the system doesn‘t have the most optimal criteria, and it is also not necessary to make sure what is most optimal. As long as the system can shorten the time of moving from the non-optimum category to the border and from the border to the optimum category, the system is satisfactory.

If the system is able to realize the transit, it has a good self-organizing capacity. As is known from the self-organization theory, profound changes will not influence the system, and only the huge changes composed of profound changes might cause the evolution of the system. This conclusion can make the non-optimum control of the system effective, and they system will stay naturally in the optimum category, or on the border. People can achieve the self-organization function on the border, e.g. the organization is open, exchanges energies with the outside. Thus the function and behavior of the system change and new non-optimum control comes into being. Then, the system goes back to the optimal category. The self-organization through coordination and super-circulation can let the system replicate and consummate itself and reach the optimum category. (It still needs be emphasized that the optimum category shows the category that can be controlled by the system‘s non-optimum).

Researchers found out that non-optimum system should be set up at the same time with the optimum system. The non-optimum here refers to the one against the optimum. Non-optimum system is decided by all the incompatible problems and limits inside and out side the system, which influences directly or indirectly the system‘s executive process and final goal. Whether a system falls in the optimum category is also decided by the incompatibility and degree of limitation, which in turn decide the non-optimum degree of the system (non-optimum degree).

Only when the system has the full control and adjustment capacity on its incompatibility and degree of limitation, is the system on the tracing of the most optimum, and this is the new research for the self-organization theory. The bases of the non-optimum analysis theory are obtained from the hyper-circulation theory. The hyper-circulation theory can feed a lot of random effects back to its jumping-off point, which represents the start of the system‘s circulation, and make themselves a reason of the maximum. A highly orderly macroscopically functional organization can evolve through self-replicating and self-selecting. This kind of self-replication and self-selection is realized in the non-optimum and optimum hyper-circulation. The entity of non-optimum calls for the optimum category under certain demanding conditions. The measurement of optimum and non-optimum category is the core of system optimization.

There are two sides to everything, and the final direction of the network can be only achieved through practice and the transition of the two sides. The state of the network behavior decides its goal by choosing between optimum and non-optimum. Hence the non-optimum problem is illustrated through the following method:

Suppose N_o represents an optimal system of network behavior, N_{no} a non-optimal system of network behavior. No matter it is an optimal system or a non-optimal system, they are all composed of network system objective O, and G is the function subsets of the network system, E is the environment of the network system. As to the optimal system, if the structure *Л* (*O*, *G*, *E*) of the sub-optimum (cannot make sure of the condition of optimum and non-optimum) of the network system *S* composed of objective *O,* function *G* and environment *E* meets the following conditions:

I. The objective of the network system can be attained;
II. The function of the network system can be achieved;
III. The environment of the network system can be controlled.

Then S is called an optimal network system. The attainability of the objective of the system shows that the distance between the recognized goal of the system and the actual goal of the system is acceptable. The achievability of the function of the system refers that the actual functional resources is near to the objective-required resources. The controllability of the environment of the system refers to the self-organizing capacity or the order parameters achieving the permitted value. Suppose O_r is recognition goal of the network system, O_s acts as the actual goal of network system, α represents the difference of the value between O_r and O_s, which shows the degree of acceptance of the goal of the system. G_s acts as the system's actual functional resources, G_r acts as the resources demanded by the system's objective, and β expresses the functional measurement value between G_r and G_s; The entropy of the actual system $e \leq \gamma$, and γ expresses the system's standard entropy. Thereby for the system's sub-optimum structure $Л$ (O, G, E), if there are ε, δ, ε, (random minimal discrepancy can be accepted) causing $|\alpha - \alpha_0| \leqq \varepsilon$, $|\beta - \beta_0| \leqq \zeta$, $|\lambda - \lambda_0| \leqq \eta$ to hold at the same time, the system S is an optimal system. α_0, β_0, λ_0 is the border value of the system's optimum and non-optimum, and thereby the gathered assemble $Л(\alpha_0 \beta_0 \lambda_0)$ is the criteria of the system's non-optimum analysis. In the actual system analysis, under certain selected standards (ε, δ, ε is known), for α, β, λ, when man can't obtain α_0, β_0, λ_0, the system S is called non-optimum system.The above is the overall description of the non-optimum problem of the network system, which tells how to decide the overall frame-saw in the non-optimum system. However, different measurement and means have to be applied in different systems to solve actual problems. Proper quality and quantity determining methods are applied in the actual system analysis. Furthermore, artificial intelligence and expert system reasoning tools can play important roles in non-optimum system analysis. One of the emphases on the non-optimum analysis theory is to describe the borders of the optimum and non-optimum category quantitatively. Because the borders change with objective conditions and subjective desire of mankind and human being has different behavior parameters, they always appear as uncertain under dynamic. Meanwhile, because of the continuous progress of mankind's practice and recognition, under cooperating of the widely exchanged scientific information, the borders might become certain and describable during the dynamic changes. As to the judgment of the reasonability and accountability of the described borders, it is no a theoretical problem, but a problem of selecting the methods and checking the practice. In addition, when analyzing the problems of the network system through quantitative methods, a lot of relationship parameters need to be statistically analyzed and attributably appraised. In many aspects, the influences of the system's non-optimum are depended largely on the experience accumulated in the recognition of the system. That is to say, experiential analysis plays an important role in the non-optimum system analysis, which reflects the meaning and function of the combination of the nature and quantity evaluation.

B. *Network Risk Analysis Based On Non-Optimum*

There are two situations in risk analyzing of network system: the inherent non-optimum attribute under stable conditions of a network system is decided by the function of the system; the non-optimum attribute under unstable situations of the system is obtained through statistic analysis. That is to say, risk the process of a systems development, non-optimum factors effect on the system, which causes a relationship that does not exist when the system is stable, and it is called non-optimum-born relationship. Every system has to have a non-optimum-born relationship; otherwise, the system goes into risk when it is unstable. For instance, in a strategic decision-making of a large finance corporation, how to build up a non-optimum-born relationship is the key of the corporation's survival and development. It works as this: through the yearlong experience of the corporation, a stable non-optimum area is formed (according to certain experience-decision effect of each year), through which the reasons of unstable factors of the system can be reflected and non-optimum genes found. Of course, there is non-optimum genes everywhere in the system and what we need are the major genes, which are the major factors that cause the system risk to fluctuate to a certain extent. In the actual analysis of the system risk, some factors have direct relationship with the non-optimum genes, some indirect. More relative factors are more influenced by non-optimum genes. Therefore, the factors can be divided into the major non-optimum effect and the minor non-optimum effect. Minor non-optimum effect is influenced by other factors. The core of the tracing to the risk happened from building up non-optimum syndrome of risk and non-optimum cause of formation. The syndrome cannot really become the influence, and the actual non-optimum indeed influences the system, both of which come from non-optimum syndrome. There is a procedure of diagnosis from the syndrome to the cause of formation. The diagnosis happens when the behavior of the system finishes, and includes: the cause of foundation of non-optimum from the major syndrome; the cause of foundation of non-optimum from the minor syndrome, which is the overall framework of the tracing to non-optimum. Two types of mapping F_{I} and F_{II} can be established:

$$F_{\mathrm{I}} : S \rightarrow D, \quad F_{\mathrm{II}} : A \rightarrow K,$$

where $S=\{s_1,s_2,\ldots,s_m\}$, which is the aggregate of the major syndrome, s_m $\{m=1,2,\ldots,g\}$ is every detailed major non-optimum aggregate, $D=\{d_1,d_2,\ldots,d_n\}$ d_j $\{j=1,2,\ldots,n\}$ acts as every detailed major non-optimum syndrome, $A=\{a_1,a_2,\ldots,a_r\}$ is the minor non-optimum syndrome aggregate, a_u $\{u=1,2,\ldots,r\}$ acts as every detailed minor non-optimum syndrome, $K=\{k_1,k_2,\ldots,k_v\}$ acts as the non-optimum aggregate of the system, ,k_l $\{l=1,2,\ldots,v\}$, is every detailed non-optimum of the system.

If system's non-optimum is shown as $W=\{S, A\}=\{W_1, W_2, \ldots, W_{g+r}\}$, when given a group of non-optimum input $W_i \subseteq W$, under the above two mapping effects, the relative sorts of the non-optimum of the system $d_j \in D$ and the output of the non-optimum factors $K_j \in K$ can be gotten.

Before deciding the characteristics of the two mappings, the non-optimum syndrome drawn from experiential material statistics need to be divided into major syndrome and minor syndrome. The principles of deviation are decided by how much information the non-optimum syndrome can provide, concerning the recognition of the system's non-optimum. Suppose:

$$P(d_j \mid w_i) = \frac{N_{d_j}}{N_{w_j}}$$

When syndrome W_i appears, non-optimum d_j causes the conditional probability of the system, where N_{wi} acts as the number of times that syndrome W_i arises, and N_{dj} acts as the number of times that non-optimum d_j occurs as non-optimum appearance when the syndrome W_i arises. More

$$P(w_i) = \{P(w_1), P(w_2), \cdots, P(w_{m+r})\}$$

is the probability distribution of syndrome W_i, that is

$$P(w_i) = \frac{N_{w_i}}{N_w},$$

Where N_w is the overall times that all the syndromes occur, N_{wi} acts as the number of times when syndrome i occurs. The above-mentioned N_{dj}, N_{wi}, N_w can be drawn from empirical statistics of resources. Thus, the entropy function of the relative $P(D_{wj})$ is

$$H(D| w_i) = -\sum_{j=1}^{n} P(d_j|w_i) \,\mathbf{lb}\, P(d_j|w_i)$$

The correspondent mean entropy is

$$H(D| W) = \sum_{i=1}^{m+r} P(w_i) H(D|w_i)。$$

Choosing dependable level β to make the syndrome Wi of

$$\frac{H(D|w_i)}{H(D|W)} \le \beta$$

the required major syndrome , it is decided that the non-optimum of the system d_i is the long symptom, and the others short symptom are all minor syndrome. As to relative syndrome w_i, w_g,

$$H(D|w_i) = H(D|w_g)(i \ne g),$$

both W_i and W_g belong to minor syndrome. The level of selection is decided by the utilization rate of the experiences. The higher the rate is, the greater is the level of selection. [4,5]

After the analysis of non-optimum symptoms of the system, non-optimum syndrome can be set up, which provide useful information for the real-time analysis of the system. In fact, there are different non-optimum symptoms in people's minds. As an excellent decision-maker, he has to possess good recognition capacity of non-optimum symptom; otherwise, he is simply not able to control the system.

When analyzing the non-optimum symptom of the system two aspects have further to considered: one is the non-optimum symptom within the system, and the other is the non-optimum symptom outside the system (the environment). As to a secluded system, it only has the non-optimum symptom within the system. Therefore, the non-optimum symptom will most probably influence the system, which is an alternative and interrelated process with the behavior of the system. According to the definite rules of the development of things, the number of times that the non-optimum occurs provides evaluating opportunities to the behavior of the system. For example, the traders in the markets face these situations when they do the business. How the four parties of A, B, C, and D agree to a bargain depends on whether they have had the experiences of trade, except for some basic conditions of deals. If trader A has experienced some kinds of unfeasible, unsatisfactory and unfavorable non-optimum situations, his result is relatively dependable. Obviously, if B doesn't have these kind of experiences, his result of trade cannot be as good as A's. In fact, it is impossible that all of the experiences are balanced, and as for the absolute balancedness, the non-optimal experiences are not taken into account. Actual analysis shows that the traders don't have the same non-optimum recognition, which is because every dealer has different objective, behavior attribute and environment. If they do possess the same non-optimum recognition and similar entity conditions, it can be balanced under certain conditions. Except for the analysis of the system of the past, the key is to analyze the system's present and future situation, where the dynamic and opening characteristics of the system have to be taken into account.

IV. Conclusion

This paper presents a technique for analyzing network security using non-optimum analysis on systems. The inputs to the system are suitable sub-optimum sets representing linguistic values for network security goals of congeniality, integrity and availability. The non-optimum analysis was constructed using the fuzzy reasoning in order to adequately analyze the inputs. It might also be necessary to use an adaptive non-optimum analysis for security risk analysis. We have been able to design a system that can be used to evaluate the security risk associated with the production of secure network systems. This will definitely help network system organizations meet up with the standard requirements. A technique for assessing security of network system before final deployment has been presented.

The result of this study shows that if the network producing companies will incorporate security risk analysis into the production of network system, the issue of insecurity of network system will be held to the minimum if not eliminated. This study has also revealed that if each of the network security goals can be increased to the maximum, then the level security will also be increased and the risk associated will be eliminated. Finally, security risk analysis is a path towards producing secure network and should be considered a sub-optimum activity by network systems self-organizations.

V. References

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