ISSN : 0974 - 7435 Volume 10 Issue 11

2014

BioTechnology

An Indian Journal

FULL PAPER

BTAIJ, 10(11), 2014 [5215-5224]

Research on the stability and control about propagation patterns of computer virus based on the computer network

Xianhao Miao

School of Computer, Hubei Polytechnic University, Huangshi, Hubei, (CHINA)

ABSTRACT

With the increasingly frequent of the informatation and digitization of today, the computer becomes a new means of transport and has spread to every household, but the resulting computer virus has become the key problem to computer users. This paper makes a deep research on network computer virus propagation model. We study from the classification of computer viruses, computer viruses network transmission way, network computer virus propagation model these three aspects, adopts the overall progressive hierarchical structure, interlocking each process, and combined with statistical theory, the circular hierarchy, the concept of tree in graph theory and the thought of clustering analysis, then establishing a new network computer virus propagation model based on hierarchy analysis, finally we put forward that: the variety of the computer virus, the diversification of its transmission way, the specialization of its propagation characteristics, Email invasion, system repair invasion, web browsing invasion are the main network transmission way, although all kinds of computer virus are different, and they are not easy to be antivirus and cleaned, but it is possible to classify the computer virus which has the same characteristics transmission way, so as to further develop defense system and the immune system, which helps to control the spread of computer viruses timely.

KEYWORDS

Computer virus; Network transmission; Circular hierarchy; Immune system.

INTRODUCTION

The computer is an increasingly frequent new type of communication tools with the development of digitization and information technology in modern society, its emergence is the Gospel of the 21st century. Although the computer brings great convenience to our life, at the same time, the creation of computer viruses are constantly bothering us.

Computer virus likes all kinds of influenza viruses, and it has various forms, different types of viruses have different characteristics, therefore we must fully consider it in the process of doing computer virus research. In Yang Maobin's book< the three kinds of new type of computer virus propagation model>, this paper introduces the basic types of computer virus, and based on this, he studies the propagation characteristics, and puts forward three kinds of new type of computer virus propagation model, through concrete elaboration and analysis, finally he illustrates the spread of computer viruses are greatly influenced by its own attributes and transmission characteristics.

In addition, the study of network computer virus propagation models, has change from the initial infection to the two state of immunity, latent, further to blending in the spread of the virus and clear concept, its propagation models have been relatively perfected. For this, GaiShaoTing carried on a thorough discussion on the establishment process of computer virus propagation model, on the basis of the stability and controlling; she not only analyzed the advantages and disadvantages of each model, but also put forward her own opinions in view of the shortcomings and disadvantages. Cao Junyi, for another example, researched on the mechanism of computer virus, on the basis of, network transmission and combined with the feature of its mechanism and the transmission characteristic, he put forward a spread of the computer virus defense strategy.

On the basis of previous studies and combining with the properties of the computer virus, this paper analyzes the classification, propagation characteristics, and set up a new network computer virus propagation model based on hierarchy analysis from the perspective of network transmission,, it also makes the theoretical contribution for controlling and resisting of the computer virus.

RESEARCH FOUNDATIONS

With the advent of the computer and the network popularization, the computer virus also arise, it spreads randomly attaching to the network, which destroyed a large number of computer system, moreover, it helps to steal important confidential documents leading to the property damage of country and people. Computer virus is a kind of computer instructions or the program code which will damage computer functions or destroy data and have bad impact on the computer, it can replicate, reproduce, and has the characteristics of strong infectious, good concealment, high latent, destructive, and sensitive to stimulate. With the popularity of computer and network, computer virus spreads in the form of a variety ways to erode our computer system from different levels. In many route of transmission, the network is the main mode of computer virus, on studying the computer virus of the network transmission, we can:

(1) Understand the characteristics of computer virus, so as to develop more advanced computer virus defense system;

(2) Control the generation and transmission of computer viruses, protect the privacy of the computer system and safeguard the interests of the individual, collective and country from illegal molecules;

(3) In-depth analysis of the computer virus propagation characteristics is conducive to curb its occurrence and spread, and make different control scheme according to the different propagation characteristics;

(4) Strike against the confidential criminal behavior of invading our computer systems, stealing privacy by using a computer virus and reduce the occurrence of criminal imagination.

Thus, we can see that a computer virus research has very important significance for the personal, social, collective, and even the whole country.

Computer virus has the characteristics of diversity and complexity, it can be divided into different kinds according to the properties of computer disease, and the common computer viruses are system virus, worm virus, Trojans viruses, Hack, and script virus and so on. Now based on the theory of circular hierarchy, we can classify them, as shown in Figure 1.

First annular layer : C_1 Virus in the media, C_2 Virus infection, C_3 Attacking ability of the virus, C_4 The algorithm of the virus;

Secondary annular layer : C_{11} Network virus, C_{12} File virus, C_{13} Boot virus; C_{21} Resident viruses, C_{22} Non resident viruses; C_{31} Harmless type, C_{32} Non- dangerous type, C_{33} dangerous type, C_{34} Very dangerous type; C_{41} companion virus, C_{42} "Worm virus, C_{43} Parasitic virus, C_{44} Variant virus.

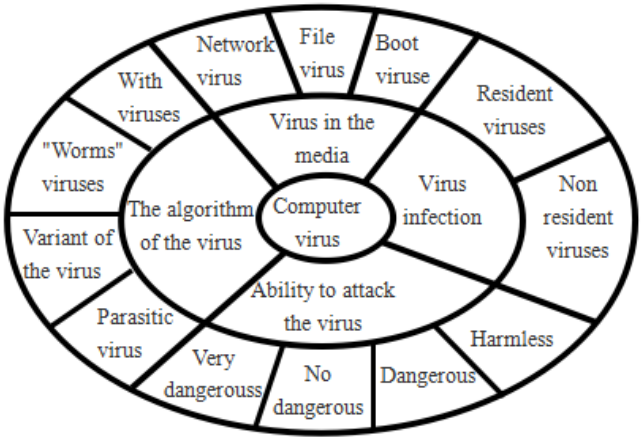

Figure 1 : The classification of computer virus

Through the circular hierarchy, we can analyze the following conclusions:

(1)The types of computer virus is very rich, because of its properties can be divided into different categories, therefore, we must take fully consideration in the study of computer virus differences of its properties;

(2) The spread of computer virus need attaching to the media, and the computer virus has strong destructive and highly infectious due to its special transmission way;

(3) A computer virus can reside within the computer subject, and some will not reside. So according to the harmful degree of the size, it can be divided into non-dangerous type, slightly dangerous type, very dangerous type, and so on, in these viruses, worm viruses is one of the most common one, and also is of higher attack.

NETWORK TRANSMISSION ANALYSIS MODEL OF THE COMPUTER VIRUS BASED ON THE TREE DIAGRAM

Network transmission is the most common and most fast way for the spreading of computer virus. Through the network, computer virus can spread quickly to everywhere, its infectivity is strong, and it has good concealment, high latent, huge destructive, and sensitive to stimulate, which not only can replicate itself, but also can reproduce itself.

Usually, the main spreading ways of the computer virus is mainly through the e-mail, system repair, and browsing the web. In these processes, the computer virus makes full use of its characteristics

of infectivity, concealment, latent, destructive, motivational, which makes the seeds of the virus spread to everywhere.

Tree diagram is the simplest structure in the graphs, but it is very important figure, and is widely applied in the field of nature and society, the acyclic connected graph is the tree diagram, and it has the properties of the Table 1 below:

TABLE 1 : The nature of tree diagram

No.	Nature
1	Any tree should exist the point of 1
2	The number n of the vertices should have the number $n-1$ legs
3	Every two points of the tree should have only one leg
4	The tree is connected, but remove any side, it will become a disconnected tree
5	There is no circle of a tree, but if we add a leg in the nonadjacent point, it can make a circle.

So, we make tree diagram Figure 2 for the various ways of virus transmission

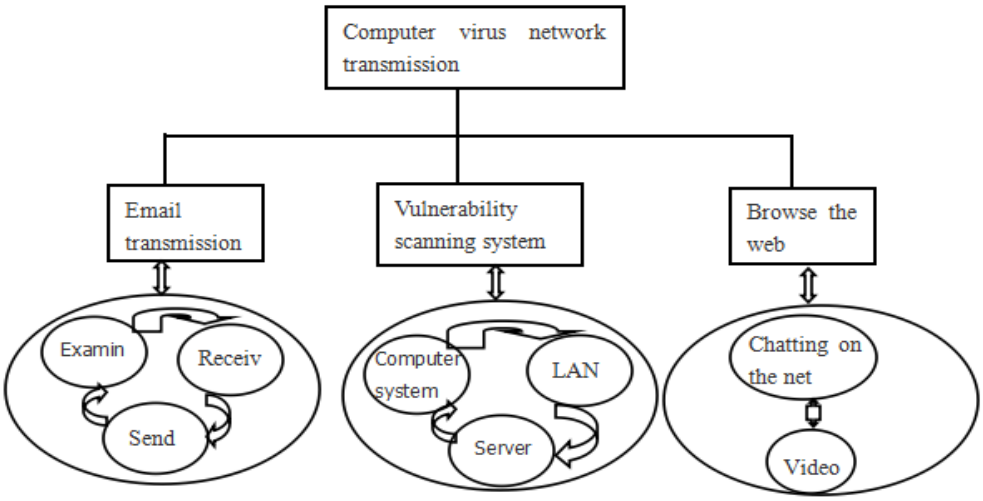

Figure 2 : Tree diagram

Through the analysis of Figure 2, we can get the following conclusion:

(1)The network route of transmission of computer viruses is mainly through the mail, vulnerability scanning system, and browsing the web, they are independent of each other.

(2)The email transmission is one of the more common computer virus network transmission way, the process of receiving, checking and sending of the email will lead to the spread of the virus;

(3)In addition, in the process of the system repair scanning loopholes, the computer virus will use its characteristics of concealment, with the scan progresses, the virus will invade our computer motherboards through computer systems, local area network, which can lead to paralysis;

(4) Browsing the web is the most direct; the most rapid way of the computer virus transmission, in the process of browsing the web, computer virus will invade our computer systems through the malicious URL. In addition, in the process of network chat, video will also have all kinds of computer virus propagation.

In tree diagram, each first and secondary branches forms a fulcrum of the tree, each of the fulcrum interacts between each directions, such as the receiving, viewing, and sending of the E-mail, it is a series of process, and each process are independent of each other and influence each other too, so the tree fulcrum forms the second-level network computer virus propagation.

Email invasion model of computer virus network transmission

In Email invasion model of computer virus network transmission, the receiving , viewing and delivering of messages is the most common way for the computer virus to spread, in this process, the main computer virus invasion way is finding the target address at first, then copies itself and send out again, finally it will activate the virus code.

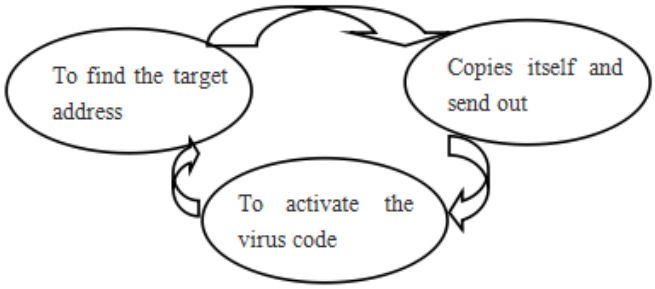

Figure 3 : Email invasion process

The Email invasion of computer virus in Figure 3 shows that network transmission is based upon a certain process of computer virus and steps, the main explanation is as follows:

Step 1: Computer itself has Email address books and historical records, and available Email address, the virus has the characteristics of the hidden, virus can invade the host and theft of private information through searching the Email information. Email software has been installed in computer users, such as *Outlook* software, the virus will get the email address from invasion software of the installed software.

Step 2:When the virus find email address of the computer subject, it will play its replication features, reproducing itself and make reproduction, and through the available main body of email addresses, the replication virus will be automatically sent to the main email address. In addition, in this process, the virus will develop its characteristics of strong concealment, so that the send and copy process is hidden, it will not be noticed.

Step 3: After the copied computer viruses being sent out through the available email address, it will mislead the users through various channels to activate the virus code, so that to let the virus alive, usually, the significant marked email title and content will cause the curiosity of the users, so that the computer virus can achieve the purpose of activation.

The system repair invasion model of the network spread of computer virus

In the process of using computer, there will be regular and irregular system vulnerabilities usually, and it is the best time for the virus to invade in the process of scanning to fix a computer system. In the process of scanning, virus will spread with the help of computer system vulnerabilities, LAN and server hole.

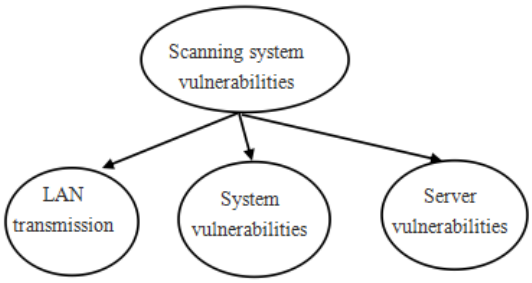

Figure 4 : Scanning system vulnerability propagation steps

The system repair invasion of computer virus in Figure 4, shows that there are three main ways for the computer virus to spread in process of the system repair of network transmission, the main explanation is as follows:

The first: Send system vulnerabilities notification to the user, and invade software of user's computer in the process of system repair vulnerabilities, which leads to the spread of computer viruses.

Second: LAN is one of the most common networks, but owing to the negligence of management in some local network area and lack of security and protection consciousness, it leads to easier invasion for the computer virus to spread into the computer system, and carry on the next step of copy, reproduce and spread.

Third: The computer user's server is one of the computer virus transmissions, the worm virus can use the holes that appeared on the server to control the user, and carry on remote control, once the computer is controlled by the virus, a lot of malicious code will ensue, which leads to the server paralysis.

THE RESEARCH OF NETWORK COMPUTER VIRUS PROPAGATION MODEL BASED ON THE THEORY OF THE STATISTICAL ANALYSIS

In the process of studying the network transmission of computer virus, many scholars have made a summary, and according to the properties and propagation characteristics of computer virus, a lot of network propagation model is made, these models are summed up in the following categories in order to facilitate further analysis, such as in Table 2.

TABLE 2 : Network propagation model of computer virus

Model name	Classification gist	Model features
Model SIS	There are susceptible state S and susceptible state I	Use the biological epidemics mathematical model
Model SIR	immune state	Add the immune state in model SIS
Model $SEIR$	Use to describe the received virus code	Add latent state E into the model SIS
Model $SIDR$	Virus prevention, immunization	Join the spread of the virus and clean condition
Model $e-SEIR$	One	Consider the spread of group and point

The above model SIS, model SIS, model $SEIR$, model $SIDR$, model $e-SEIR$ are the classical analysis model of network spreading computer virus, each model are progressive transformation between each other, further they all take fully consideration based on the study of the above model and they have joined the new elements to consider comprehensively, so that the network of computer virus propagation research will be enriched.

SIS model of network computer virus spreading research

According to Table 2 network computer virus propagation model, we can see that SIS model is defined according to the state of computer nodes. Usually, there are two kinds of state of the computer on the network, susceptible state S and susceptible state I.

In a state of susceptible if the computer is invaded by a computer virus, it becomes the computer nodes of infection status, if computer users carry on the antivirus treatment, this part of the computer nodes are in a susceptible state, although its own is not taking with a computer virus, but still susceptible, so this part still has the potential to become infectious virus. The process, which computer virus infected computer users will continuously reciprocate angina and again.

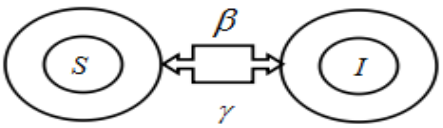

Figure 5 : SIS Model steps

Through the above *SIS* model Figure 5, we can be obtain:

(1) The network spreading computer virus is a vicious cycle of reciprocating process, computer subject once invade by the computer virus, the impact can not be completely removed by antivirus;

(2) In the process of network spreading computer virus, computer users are facing the viral infection and the risk of invasion at any moments; this is due to the infectivity characteristics of computer virus.

Therefore, in the process of cleaning up and curing the computer virus, only one time antivirus is useless, we should carry on the multiple antivirus, and clean up the computer virus deeply, so that the computer virus from computer subject will be entirely cleaned out, and to ensure that the computer is clean.

The research of the model of network computer virus spreading

On the basis of the *SIR* propagation model, scholars put forward the *SIR* model which is increased the immune status of propagation. This shows that when the computer is in the susceptible state, if it is invade by virus, it becomes a state of infection, and after antivirus it has the ability to offence the disease, then the virus is not reciprocating in the computer subject again and again, because it will produce an antibody like our human beings.

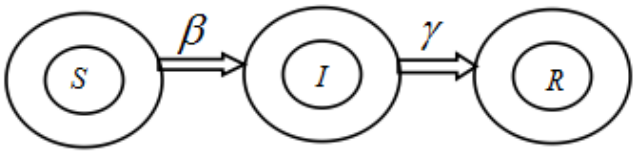

Figure 6 : SIR Model steps

By analyzing the above Figure 6, we can obtain:

(1) The computer virus does not infinitely survive, after cleaning up the main body of the computer, it can generate antibody of the virus in the computer, so that it can prevent the computer subject from another virus invasion attack in the next time;

(2) The spread of computer virus among network is the same as the spread of the medical flu virus, once it form the antibody, the subject of computer and the user will have certain immune ability, which can resist a computer virus invasion, keeping themselves in a safe state.

The research of network computer virus based on hierarchical analysis model

By analyzing the propagation model *SIS* and transmission model *SIR* , we can see that computer viruses cannot be eradicated, we can establish corresponding firewall as long as making clear of the dangers of various viruses, and antivirus the properties of the virus , it can produce the immune system to some kind of virus in the computer subject, the immune system is similar to the flu virus antibody, which can let the subject itself no longer be encroached against by the virus.

Therefore, on the basis of the analysis, we establish the hierarchical analysis model based on the network spreading computer virus, and classify the harm of various viruses, so as to set up different levels of defense system, which laid a strong foundation for the controlling of computer disease

TABLE 3 : Classification of computer virus

Type of virus	Hazard level	Description
Backdoor, Mail, PSW	1	Hazard level represents the dangers of this kind of computer virus, level 1 means the highest harm, and the more upward of the level, the smaller the harm is.
Worm, DL, IM	2	
MSN, Spy, IMMSG, Trojan	3	
QQ, MSNMSG, Virus, Harm	4	
ICQ, QQMSG, Dropper	5	
P2P, ICQMSG	6	
IRC, UCMSG	7	
Proxy	8	
Clicker	9	
Dialer	10	

Through the above the level of computer virus classification in Table 3, the network computer virus propagation can be further analyzed and the level of network computer virus propagation analysis model is established, as is shown in Figure 7.

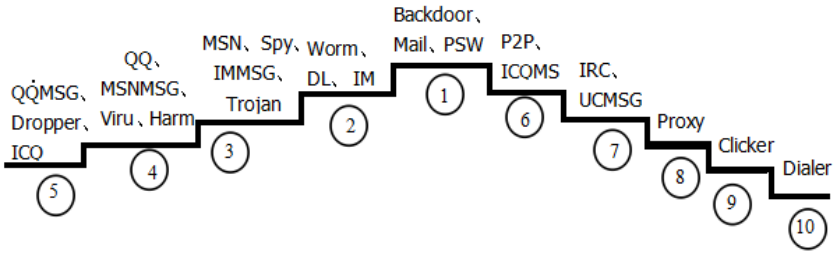

Figure 7 : Level analysis model

In the process of the construction of the above model, we can get the related conclusion:

(1)The harmfulness size of a computer virus can be divided into ten levels, each level contains different virus;

(2)The most threaten one of all kinds of computer virus is also in the gradient of the highest category in the hierarchical analysis model.

In a hierarchical analysis model, different levels of the main network computer virus have different ways of transmission; therefore, we carry on the further analysis, as shown in the Figure 8.

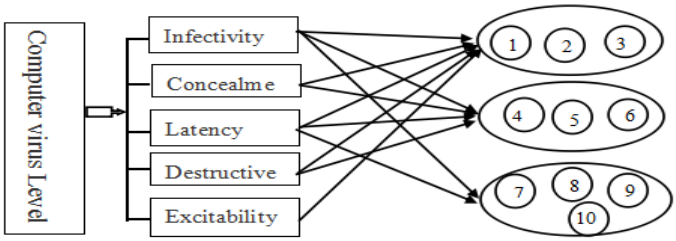

Figure 8 : The propagation characteristics of computer virus classification

By combining the five characteristics of computer virus: strong infectivity, good concealment, high latent, huge destructive, stimulate of sensitive. In view of the Figure 7, it shows the level of network computer virus propagation model and gives us more detailed analysis, which conforms to the clustering analysis.

The main basic idea of cluster analysis is: we set there has the n samples $X_1, X_2, \ X_n$ in set. First, each sample is alone, to calculate the distance between classes within the sample, the calculation of two nearest type of category. And then calculate the distance between the new types, and we will gather the recent class of two types of variables again and repeat this cycle.

Combing the concept of clustering analysis with the basis of above analysis, we can get the following point of view, such as Table 4.

TABLE 4 : The point of view of grade analysis model

No.	Concept
Point 1	Different levels of the computer virus has different characteristics, the higher the level is, the greater the harmfulness of the computer virus will be, the more obvious the characteristic and the more complex the virus will be. It also will be not easy antivirus and clean;
Point 2	First three levels of a computer virus is the most common type of virus, and is also a set features of the most comprehensive categories, its spread strictly comply with the basic characteristics of the spread of the virus;
Point 3	Although all kinds of computer virus has the properties of the different, but from the perspective of the characteristics of computer virus, some kind of virus can be summed up in a class, this also provides a strong theoretical support for the research of computer virus and antibody immune system;

The above Table 4 describes the clustering analysis thought, based on hierarchical analysis model of the basic characteristics of network computer virus propagation as well as the analysis point.

CONCLUSIONS

Through the analysis of network computer virus propagation model, we can study the basic feature of computer virus and several kinds of traditional network computer virus propagation model, then we has carried on some innovations on the basis of this, which helps to establish the level of network computer virus propagation analysis model, so as to get the following conclusion:

(1) In the study of the classification of computer virus, we use the application of circular hierarchy to make a more intuitive observation of the virus, so we can get the classification: the types of computer virus are very rich, the transmission way is of great diversification, specialization, strong destructive, and of high infectious, even more it can reside within the computer subject.

(2) In the study of computer virus network transmission way, we use the application of the thought of the tree in graph theory, and drawing a tree diagram of the spread of computer virus network, then we can obtain that: Email invasion, system repair invasion, web browsing invasion are the main modes of transmissions.

(3) In the study of network computer virus propagation model, we use the application of statistics and the thought of clustering analysis, through statistical analysis and classification research and on the basis of the traditional network transmission model, we innovate a new network computer virus propagation model based on hierarchy analysis, thus we can obtain that: in different levels, the higher the computer virus level is, the harmfulness the destroy will be, the more obvious the characteristics will be, and the more complex the virus will be. It is not easy to antivirus and clean, although all kinds of computer virus has different properties, we can still considerate all kinds of computer viruses in an unified way through the classification.

REFERENCE

[1] Gai Shao Ting; Network Computer Virus Propagation Model Stability and Control Research [M], China Ocean University, **(2013)**.

[2] Yang Maobin; Three Kinds of New Type of Computer Virus Propagation Models: Theory of Strategy Research and Application [M], Chongqing University, **(2012)**.

[3] Qing-Hua Deng; Computer Virus Propagation Model and Defense Strategy Research [D], Central China Normal University, **(2009)**.
[4] Wang Xy; Computer Virus Propagation Model and Testing Research [D], Central China Normal University, **(2011)**.
[5] Ren; Network Transmission Mechanism of Computer Virus: Three New Model of Dynamical System [M], Chongqing University, **(2012)**.
[6] Hua Yong; The Computer Virus Propagation Model Based on Game Theory [D], Central China Normal University, **(2011)**.
[7] Cao Jun; Based on the Network Transmission Mechanism of Computer Virus and Defense Strategy Research [D], Central South University, **(2004)**.
[8] Zhang Chunming; Computer Virus and HIV Optimal Control Model [M], Chongqing University, **(2011)**.