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Optimizing Research to the MMS Virus Spread Model

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Abstract: The MMS is currently using the mobile phone network, dissemination of multimedia information is an effective way in the mobile phone virus spread parameters that affect the basis of careful analysis, the establishment of a mobile phone virus spread model, through simulation experiments, the model can correctly simulate the kind of environmental parameters under the influence of the use of MMS mobile phone virus spread process, inhibiting the spread of mobile phone virus research with a reference value.

Key words: SMS/MMS, mobile phone network, mobile phone virus, environmental parameters

INTRODUCTION

In recent years, major mobile phone operating system platforms have found traces of viruses and mobile phone viruses have become a major issue that affect people's daily life. With the rapid popularity of smart phones and the continuous increase in network download information, SMS and MMS, more and more mobile phones have been infected with viruses (Neal, 2005). Viruses can damage normal functions of mobile phones, causing mobile phone users' alarm and attention. The so-called mobile phone viruses are new viruses that are caught by smart phones, spread through mobile phone networks and attack mobile phones or mobile phone networks in forms of Bluetooth, SMS, MMS, mail and program so as to cause abnormity of mobile phones or mobile phone networks. Their basic principles and manifestation are similar to those of computer viruses (Luo, 2006). Mobile phone virus attacks may cause crash and shutdown of mobile phones, delete information, send junk mails, or make calls. It may even destroy SIM card, ship and other hardware.

ANALYSIS OF DEVELOPMENT AND CHARACTERISTICS OF SMS NETWORK

As SMS/MMS transmission is mainly based on the format of textual or multimedia file, its mode of transmission is similar to that of PC emails. Due to the SMS character restrictions (160 English characters and 70 Chinese characters), there are large-scale virus attacks like email viruses. For MMS-based viruses, most mobile communications companies allow the transmission of multimedia data up to 300 KB. The attachments can be various multimedia materials, such as text files, sound files, FLA, Flash and audio and video files. For example, the size of the recently found Commwarrior virus is only 27 KB, which spread via MMS attachment (Wang, 2004).

Watts and Strogatz (1998) pointed out that many complex networks in real world are not networks or random networks, but small-world networks, namely a kind of network structure with small and shortest route and high clustering coefficient. Thus, the study on complex networks has been started (Wang *et al*., 2006). Mobile communications network is a typical small-world network and connections between nodes are of strong concentration effects. Communications relationships of mobile phones form the communications network, further developing into phone and SMS networks. They reflect a kind of social relationship. The SMS network has hundreds of millions of nodes, namely mobile phone users and edge is the sending relation of messages. The spatial structure of its network is shown in Fig. 1. (Zhang *et al*., 2012).

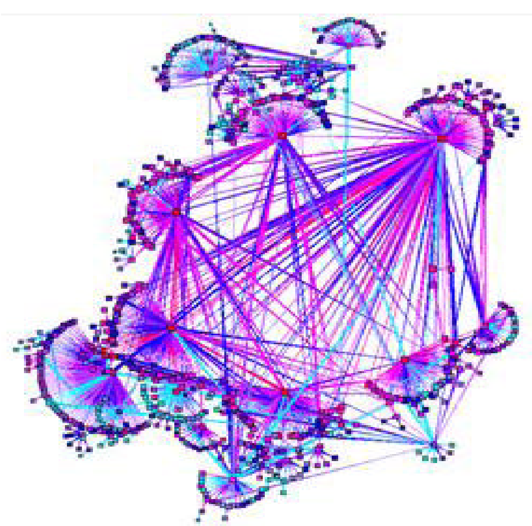

Fig. 1: Diagram of SMS network

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In a mobile communications network, each node has different effects in the network. In other words, their positions in the network are different, so mobile communications network is a weighted network. With the in-depth study of physical significance and mathematics characteristics of network nature, people have found that many real networks have a common nature, namely community structure. Relevant study of literature (Wu *et al*., 2007) shows that SMS network also has such a feature. In other words, the whole SMS network consists of several 'groups' or 'communities'. In these communities, connections between nodes are very close, while connections between communities are sparse.

Smart phones are essentially computers with communication function. With the rapid development of smart phones, MMS based on mobile phone operating system has become an effective method of people's communication(Wang and Li, 2007). Therefore, similar to viruses in computer networks, the viruses that spread through SMS will be exponentially grown and viruses in computers will rapidly spread to smart phone terminals. Therefore, the study and exploration of the mobile phone virus spread model in SMS network are of great significance and it is of great value in control and prevention of mobile phone virus spread.

STUDY OF MOBILE PHONE VIRUS MODEL

Zheng Hui, etc established a mobile phone virus model for the study of mobile phone viruses (Zheng *et al*., 2006). It mainly uses three important parameters (distribution density of mobile phone, coverage radius of Bluetooth signal, moving velocity of mobile phone) to build the spread model of mobile phone viruses. The model is shown in Eq. 1 and its parameters are shown in Table 1.

$$\frac{dI}{dt} = I((\pi r^2 + 2rv)\rho - 1)\frac{\Omega\sigma - I}{\Omega\sigma}\beta - \delta I \tag{1}$$

This model conducts the simulation for infection of the Bluetooth system. As the operating system of smart phones and weaknesses of Bluetooth transmission are not taken into account, there is no relevant study of MMS-based model and current SMS traffic takes a large proportion of the mobile phone traffic, the above study is defective for the study of mobile phone virus spread model. We believe that the MMS-based mobile phone virus spread model should be the following model:

$$\frac{dN_{mms}}{dt} = L.P.\beta_{mms}.N_{mms} - \delta.N_{mms} \tag{2}$$

Table 1: Meanings of parameters

I	The no. of mobile phone viruses at time t
Ω	Moving space of mobile phones (2D)
ρ	Distribution density of mobile phones
β	Infection rate of mobile phone viruses
δ	Recovery rate after infection
r	Coverage radius of Bluetooth signal
v	Moving speed of mobile phones

Table 2: Meanings of parameters

N	The no. of mobile phone viruses at time t
L	No. of contact persons for mobile phone communication
P	Occupancy of operating system
β_{mms}	Infection rate of mobile phone viruses
δ	Recovery rate after infection

Table 3: Simulated experiment's parameter meanings and experimental values

Parameter	Meaning	Value
L	No. of contact persons for mobile phone communication	1-20
P	Occupancy of operating system	0.6
ρ_{mms}	MMS infection rate of mobile phone	0.4
δ	Recovery rate after infection	0.025
z	Initial number of mobile phones infected with viruses	1

Based on Eq. 2,assume:

$$a = LP\beta_{mms} - \delta$$

MMS virus infection model (2) can be simplified as:

$$\frac{dN_{mms}}{dt} = aN_{mms}$$

$$\Rightarrow \frac{1}{a}\int \frac{1}{N_{mms}} dN_{mms} = \int 1dt$$

$$\Rightarrow \int \frac{1}{N_{mms}} dN_{mms} = \int adt$$

$$\Rightarrow (\ln|N_{mms}|) = at + z$$

Z is a primary constant:

$$\Rightarrow |N_{mms}| = e^{at+z}$$

$$\Rightarrow N_{mms} = \pm e^{at+z} = e^{t(LP\beta_{mms} - \delta)+z}$$

SIMULATED EXPERIMENT

In order to verify the validity of MMS-based mobile phone virus model, it is necessary to conduct relevant simulated experiment. The meanings of experiment parameters are shown in Table 3.

P is occupancy rate of Symbian operating system. According to reference's data analysis (Wu *et al*., 2007), the current occupancy rate can be 0.6. β_{mms} is the infection

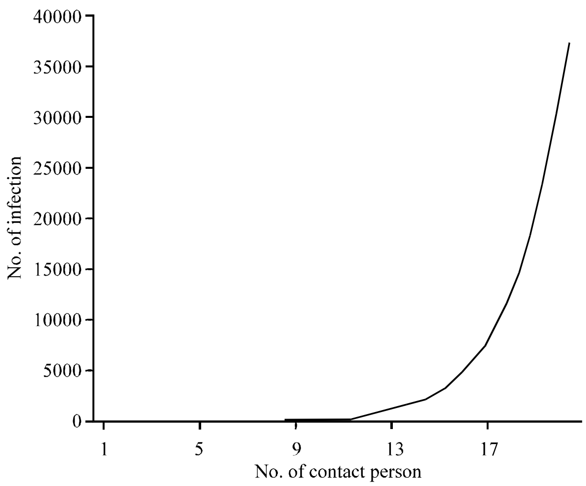

Fig. 2: Relationship between contact person no. and infection no.

Table 4: Comparison between number of mobile phone contact persons and mobile phone infection number

No. of contact person	No. of infection
1	4
2	7
3	11
4	17
5	28
6	45
7	73
8	117
9	190
10	306
11	495
12	800
13	1293
14	2090
15	3378
16	5459
17	8822
18	14257
19	23040
20	37235

Table 5: Comparison between infection time and infection no. (L refers to number of contact persons)

Infection time	Infection no. (L = 1)	(L = 2)	(L = 3)	(L = 4)	(L = 5)
1	3.111	3.651	4.284	5.028	5.900
2	3.561	4.904	6.753	9.300	12.807
3	4.076	6.586	10.644	17.202	27.799
4	4.665	8.846	16.777	31.817	60.340
5	5.339	11.882	26.443	58.850	130.974
6	6.110	15.959	41.679	108.853	284.291
7	6.994	21.434	65.694	201.341	617.081
8	8.004	28.789	103.544	372.412	1339.431
9	9.161	38.668	163.204	688.834	2907.358
10	10.486	51.935	257.238	1274.106	6310.688

rate for MMS. As such attacks are similar to social engineering virus attacks. It will not become effective until

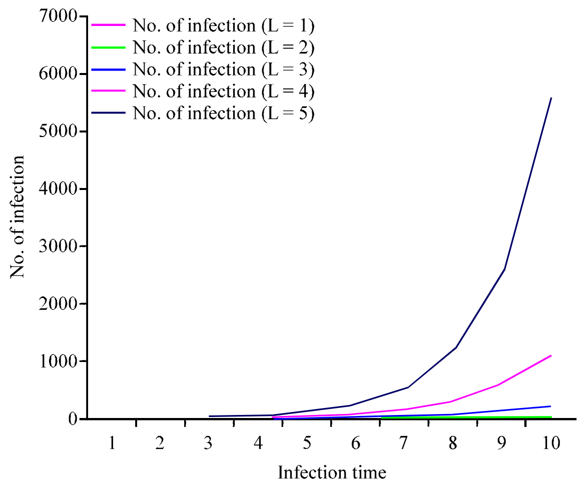

Fig. 3: Relationship between infection time and infection number under different numbers of contact persons

the user presses. According to reference, it can be seen that the infection rate for this type of attack is around 0.4 (Wang *et al*., 2006).

It is assumed that the infection time is 3 sec, the comparison between number of mobile phone contact persons and mobile phone infection number is shown in Table 4.

Relationship between contact person number and infection number is shown in Fig. 2.

The more the contact persons in a mobile phone, the more the MMS infection number.

MMS infection rate for mobile phones: During the virus attack, it will automatically send MMS virus message to the outbox. According to user's speed to send text messages, it will normally take one minute to send one text message. Thus, the real-time monitoring mechanism should be added to the outbox. If more than one text messages are sent in one minute, the alarm should be shown, so it can reduce to 1 L^{-1}. After the calculation, the infection numbers for different contact person numbers are shown in Table 5.

Relationship between infection time and infection number under different numbers of contact persons is shown in Fig. 3.

MMS is added with the SMS intercept warming message, the infection curve will become the state of L = 1 and it will significantly reduce the infection number.

CONCLUSION

In this study, MMS-based mobile phone virus spread model is studied and the new mobile phone virus spread model is established. The performance of model under different factor influences is studied through simulation experiment. Finally, it puts forward effective strategies to control the mobile phone virus spread in MMS network. Strategies have practical values, which can effectively reduce huge losses caused by MMS network-based mobile phone virus spread.

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