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Node Energy Based Virus Propagation Model for Bluetooth

[1]T. Nallusamy and [2]R. Ravi
[1]Sathyabama University, Chennai, India
[2]FX Engineering College, Tirunelveli, India

Abstract: With the continuous development of mobile based Wireless technologies, Bluetooth plays a vital role in smart-phone era. In such scenario, the security measures are needed to be enhanced for Bluetooth. We propose a Node energy Based Virus propagation model (NBV) for Bluetooth. The algorithm works with key features of node capacity and node energy in Bluetooth network. This proposed NBV Model works along with e-mail worm propagation model. Finally, this research simulates and compares the virus propagation with respect to node energy and network traffic.

Key words: Bluetooth, virus propagation, node energy based virus propagation, scenario, traffic, capacity

INTRODUCTION

In the field of information security, computer viruses are comparatively considered as a old one. The first form of developed virus is "self-replicating code" which was discussed by various researchers. Viruses play a paramount role in financial losses of more immensely colossal firms due to various security breach and susceptibilities. Various researchers have discussed and deal with engenderment and detection of viruses, worms and viral vectors. Some of them were deal with the modeling viral code replication and model deportmen (Serazzi and Zanero, 2004).

Currently, mobile virus spreading is facile in present networks in which each mobile connected to network is connected to other computers directly or indirectly. Local or national spread cannot be eschewed once a pandemic virus appears, for example, chamelon virus 2012 (Gong *et al*., 2013). Currently, Bluetooth and Gregarious networks such as propagates, as propagates, the users that utilize this accommodation turn into the targets of virus writers. Users can converse and apportion files with their friends on these networks. Bulwarking against mobile virus is a long term mission. How to model and control the spread of virus have magnetized great international attention since understanding and modeling the spread mechanism make it possible to find the fundamental method against virus. Sundry models have been discussed in the earlier works (Jang and Ly, 2015; Wang *et al*., 2013; Gao and Liu, 2013). They are modeling traditional viruses, modeling e-mail predicated worms.

However, the models of virus propagation in email or IM networks are not much opportune for that in Bluetooth networks. These are auxiliary for virus propagation. As the deportment of Bluetooth users can be more involute than that in other networks, it is compulsory to construct an incipient model for virus propagation in Bluetooth network (Nallusamy *et al*., 2016; Yan *et al*., 2007). In this study, we scull Bluetooth to analyze its characteristics to model the virus propagation in it.

Problem statement: Virus propagation models proposed for Bluetooth are largely worm based models. However, the virus propagation models are not concerned with node energy based models. Bluetooth is a capacity based limited range communication. In order to provide the capacity based propagation model, the NBV Model is proposed and simulated in this study.

MATERIALS AND METHODS

Node energy Based Virus propagation model (NBV): The proposed NBV propagation model coupled with several Propagation schemes such as Epidemical Model deal with the dynamic node energy. The NBV Model estimates the propagation in terms of network size, node mobility, density and energy. In addition, it divides the node energy into two conditions based on the node energy measurement in terms of minimum energy requirement.

As we have just visually perceived, the deterministic approximation is utilizable for estimating

Corresponding Author: T. Nallusamy, Sathyabama University, Chennai, India

some consequential characteristics of epidemics the conditions under which they occur, the rate at which they grow and the expected number of infections until they reach saturation. However, since, it ignores the stochastic nature of an epidemic, it provides no information about other paramount features of the dynamics including the size of fluctuations in the number of infected individuals and the possibility that fluctuations will result in extinction of the infection. Consider for a moment the issue of the survival of the virus in a population.

Steps to perform NBV propagation model

Step 1: The node energy based virus propagation computes the network capacity in terms of network size, node mobility and density.

Step 2: The protocol ensures whether the capacity is sufficient to meet the network requirements. The Bluetooth user network has user N nodes and each node is assigned a number i = 1, 2, 3, ..., M. We presume number of available clients is client N and each one is donated by C k, k = 1, 2, ..., M. A general model for a network is represented as a graph G (N, C). In that, N represents the set of nodes N = {1, 2, ..., n} and C represents the set of direct connections C = {i, j}. Every node can make the direct connection with others which are placed within the radio range ($\Re$). The direct connection (i, j)∈C denotes that the node j is located within $\Re$ of node i called Neighboring node (NH_I).

Let, p(I, t) will be the probability of infection at time T. The time limit will be (0, t) to (I, t) 0 will be the starting node and I will be the infected node. Propagation of virus relies on the node energy factors such as network Size (S_{NW}), density (ρ), node mobility (γ) and Node Energy (E_N) as it is delay sensitive.

Assume that every node (i∈N) initially h as M joules and T ($\Re$) km. For every data transmission the node obtains (K-b) reduction due to the increment of T as shown in Eq. 2. In addition, the node energy reduction for every data packet transmission (D_T) is represented as K-E (D_T). Moreover, the data transmission exists among the N_I and N_J, if and only if, the N_J has K-E (D_T)>E_M where K-E (D_T)→ data packet receiving power at node N_J and E_M→ minimum energy to receive the packet successfully as shown in equation. Thus, the proposed system relies on the node energy factors to determine the spreading rate (Fig. 1 and 2). The distribution and arrival rate of virus spread will be monitored using poisson process. The initial time will be 0 and the propagation Time T. The probability measure for the model will be:

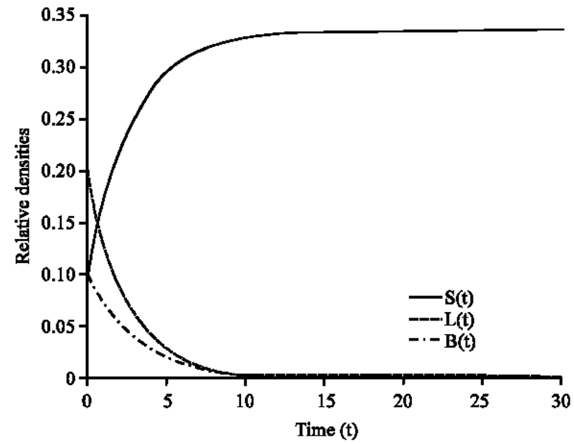

Fig. 1: The energy level of N nodes at starting level which describes S(t), L(t), B(t)

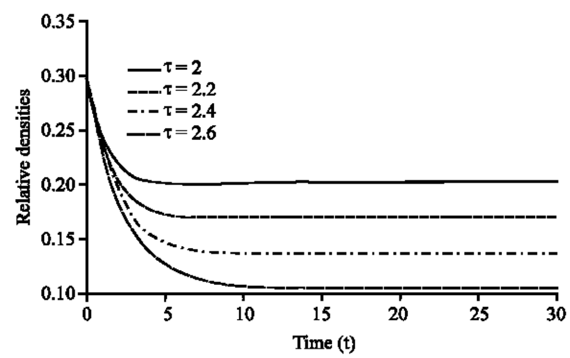

Fig. 2: Describes the evolution of L(t)+B(T)

$$\mu_{K,T}(dx) = \frac{I^{I}}{T(T)} x^{T-1} e^{-Kx} dx \tag{1}$$

Concentrated on (0, K) and T(K, T) distribution. Note that when we have T = 1, this is the exponential distribution. We have:

$$\int_{0}^{K} e^{iox} \mu_{K,T}(dx) = \frac{1}{(1-\frac{i\theta}{K})^{T}} \tag{2}$$

For the probability of spreading of virus propagation.

RESULTS AND DISCUSSION

Simulation study and modelling: In this study, some numerical solutions are given to the impression of our experiments. To demonstrate the stability of unaffected nodes. Let, K1 = 0.004, K2 = 0.009, T = 0.1 which runs on Bluetooth. In this case, we have R_0 = 0.6489. To demonstrate the system, we taken publicly available worm

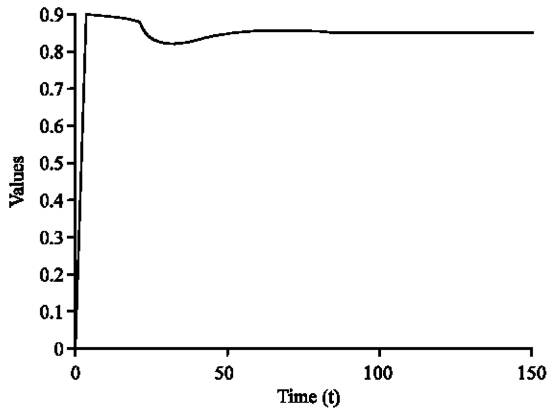

Fig. 3: Describes how L(t)+B(t) evolve with time. It can be seen that optimal control can control the diffusion of computer viruses effectively

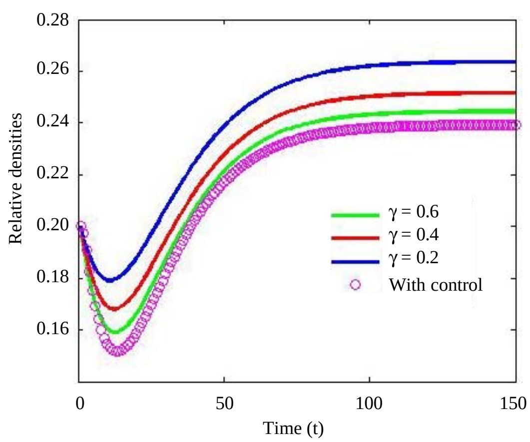

Fig. 4: The control variable Yk and optimal control for virus spreadings

sources for evaluating model. Consider system (4) with $K_1 = 0.4$, $K_2 = 0.3$, O = 0.2, T = 0.2, $\delta = 0.3$, $\mu = 0.3$ and $\Lambda = 500$ for $\tau \in \{2.0, 2.2, 2.4, 2.6\}$.

To demonstrate optimal control of system (11), we take the following set of parameter values $\beta1 = 0.4$, $\beta2 = 0.4$, $\alpha = 0.2$, $\delta = 0.4$, $\mu = 0.3$, ck = 0.02, $\Delta = 0.9$ and $\Lambda = 1000$ for γ {0.2, 0.4, 0.6}. Describes how L(t)+B(t) evolve with time. It can be seen that optimal control can control the diffusion of computer viruses effectively.

To demonstrate the effect of parameter *c*k on optimal control of system (11), we take the following set of parameter values $\beta1 = 0.4$, $\beta2 = 0.4$, $\alpha = 0.2$, $\delta = 0.4$, $\mu = 0.3$, $\Delta = 0.9$ and $\Lambda = 1000$. Figure 3 illustrates how L(t)+B(t) evolve with time and ck. Figure 4 shows the control variable uk for different ck values.

CONCLUSION

In this study, we discussed about virus propagation models and how the virus spread rapidly. A new scale-free networks are efficiently. The spreading threshold for the model has been determined. The global asymptotic stability of the virus-free equilibrium has been shown when the threshold is below one whereas the permanence of the virose equilibrium has been proved if the threshold is above one. The effect of some system parameters on the virus spreading has been examined. In particular, it is found that: lower scaling exponent benefits the diffusion of viruses; a lower rate of installing system could restrain virus spreading; a lower rate of uninstalling system could benefit virus spreading. Then, we apply optimal control strategies to minimize the latent and the breaking out computers. We also pointed out that for certain values of the control rate there exists its corresponding optimal control. The analysis and simulation, distinctly, show that using the optimal control theory can control the computer virus diffuse effectively. Therefore, the proposed method provides some interesting insight into the dynamics of computer virus and could be a powerful tool in controlling the propagation of computer virus.

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