A Multi-Agent Probabilistic Method for Route Optimization against Cooperative Blackhole Attack

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ABSTRACT

A Mobile network enables the users to communicate in public domain. Different kind of data including voice, messages etc is communicated over the global environment. This global involvement of users in the network also increases various kinds of security threats. This research has proposed a multi-agent based analysis approach to detect the cooperative black hole nodes and to generate the preventive path for safe communication over the network. The proposed model has performed the region based analysis to detect and prevent the blackhole attack. The results show the method has improved the packet communication and reduced the packet loss in the network.

Keywords: Mobile Network, Blackhole, routing, safe communication

1. INTRODUCTION

A Mobile network is the adhoc network defined without specification of any specialized controller or infrastructure. The dynamism is the main feature of this network form available in different forms. As the network is dynamic which provides cooperative communication over the network. The route formation for the network is done by selecting the intermediate nodes. The mobile network support different data forms including data files, audio file and video file. As the security is the main criteria, such kind of network requires the high speed communication with higher reliability. The dynamic communication between two end nodes is also generated using the intermediate node selection. Mobile network exist in different forms including indoor architecture, outdoor communication architecture and hybrid architecture.

Mobile network provides the safe and reliable communication by setting up the dynamic link over two end nodes. The content level communication analysis is defined by this network to observe the node level and network level communication. The long distance communication is also the basic requirement of this network form. The communication or the transition in the network is also controlled using different constraints specified. In biometric application, big data processing, video communication. The core diameter specific communication can be drawn through the communication links. The parmater driven analysis with cooperative connecitivty is applied and observed. The communication distance, communication media and technology are the other parameter which can control the communication so that the effective communication will be drawn.

In this paper, the agent based method is presented for blackhole attack detection. In this section, the basic features and communication for mobile network is defined. In section II, the earlier work defined by the researchers is provided. In section III, the proposed research method is defined. In section IV, the results obtained from the work are provided in the form of graphs. In section V, the conclusion of work is presented.

2. LITERATURE SURVEY

In this section, the work defined by the earlier researcher is defined. Mukhopadhyay et. al.[1] has provided a work on switched wireless network under congested conditions. Author has improved the capabilities of the network by providing the mobile handling and provided the method for capacity driven estimation. Author provided the work to identify the expanding of the network under congestion avoidance algorithm so that the distributed component driven architecture can be applied over it. Mora et. al.[2] provided the optimization of switched network by improving the queue access at cost effective method under congestion control. Author defined the method for improving the switch

design so that the effective detection of congestion in the network will be done. Author defined the work using memory requirement analysis method for queue management. Khoo et. al.[3] provided the work on rerouting method for optical network using disjoint analysis approach. Author defined a traffic driven analysis on optical network to identify the traffic situation in the network. Author applied the traffic request on different network parts with cross switch estimation under different parameters. Cheung et. al.[4] has provided a work on data offloading method for congestion aware communication in switched network. Author provided the communication observation under cellular congestion situation. The work also identified the problems relative to mobility, location dependency and the time and user availability. Yuanni Li et. al.[5] has identified the switched network under congestion to identify the associated causes. The resource driven analysis is provided to optimize the effective allocation of these network resources. The congestion control methods are here applied to identify the problem and later on traffic analysis based routing is provided. Girry et. al.[6] provided a work on circuit switching to observe the congestion problem in the network. Author applied the performance problem identification for high and low traffic analysis.

Lekcharoen et.al.[7] provided a work on different backoff schemes to control the contention window to control the network speed and the traffic shape. A point driven analysis is provided under time computation to improve the network performance under load vector. Author avoided the deadlock situation with each scheme and tried to provide the maximum utilization of resources. A backoff time computation method is here defined to provide effective communication. Najah et. al.[8] provided a work on shared connectivity lines under the performance vector. A contention control method is been suggested to provide the wavelength driven communication optimization in a switched network. Author provided the capacity analysis based communication method for behavior control in global environment. Zhao et. al.[9] has provided a work on probabilistic model for observing the network statistics and the traffic to generate the effective priority driven communication path. A performance driven situation is identified where the network is degraded and based on it a preemptive priority method is provided. the link topology based network estimation is provided to generate the connected route so that the optimized communication will be formed. Xu et. al.[10] has provided a work on fiber optics network under wavelength driven estimation. A conversion communication based method is provided in decomposed switched network so that the wavelength will be converted based on the primary requirement. The contention window control method is also defined with block probability to reduce the collision situation. Anna et. al.[11] has provided a work on topology and traffic aware communication in communication network. The work includes the network estimation under routing algorithm, load processing method and cost metric derivation sothat the performance driven communication will be formed. The metric driven estimation is here provided with phase transit method so that the effective communication characterization will be achieved.

Jahromi et. al.[12] provided the work on congestion control method in a congested network with relevant parameter specification. The method includes the communication behaviour observation for ATM network under bit rate and the communication time parameters. A proportional estimation with derivative controller is provided in this work to generate the difference order analysis. Jesus et. al.[13] provided a work on congested interconnection network to reduce the communication cost. Author applied the cost and power analysis method with capacity derivation and congestion control so that the isolation of the communication traffic can be optimized with different isolation techniques. Nakayama et. al. [14] provided a work on rate specific path estimation method for improving the communication access and effort. Author provided the preventive communication solution for generating the effective network path. The method derived the path based on the link and traffic rate observation in the network. An average communication based comparison is suggested to provide the effective network switching so that the TCP controlled communication will be performed at higher communication rate. Lawniczak et. al.[15] has provided a spectral analysis based packet filte method to observe the phase transition in a switched network. The network decomposition in a wavelet driven network is provided for providing the communication control respective to critical point observation. Roberto et. al.[16] provided a routing scheme based recovery method to improve the end to end delivery of packets. Author defined the estimation of path loss and restoration to provide effective recovery against network failure. An overload analysis is suggested along with interrupted communication observation to generate the alternate paths. Lawniczak et. al.[17] has defined a phase transition based communication method to provide the communication against congested network. An algorithmic communication modeling is provided for topology robust communication. The additional link estimation and network derivation is provided in this work to gain the effective network throughput.

3. RESEARCH METHODOLOGY

This work is focused to identify a preventive route against the multiple blackhole attacks exist in the mobile network. The multi agent based probabilistic approach is divided in two main phases. In first phase, the placement of agents over the network is done. In this phase, the position of the agents is identified based on the coverage, connectivity and load. After locating the agent position, each agent observes the neighbour nodes in a probabilistic way. In this phase, the communication parameters are observed on each coverage region. The analysis is done under communication delay, communication loss parameters. Based on the high communication delay and heavy data loss, the black hole node is identified over the network. Each of the black hole node is also analyzed with neighbor nodes to locate the other black hole nodes in the network which are acting as active node with blackhole node. After identifying each blackhole, the preventive route is generated over the network. The flow of the work is shown in figure 1.

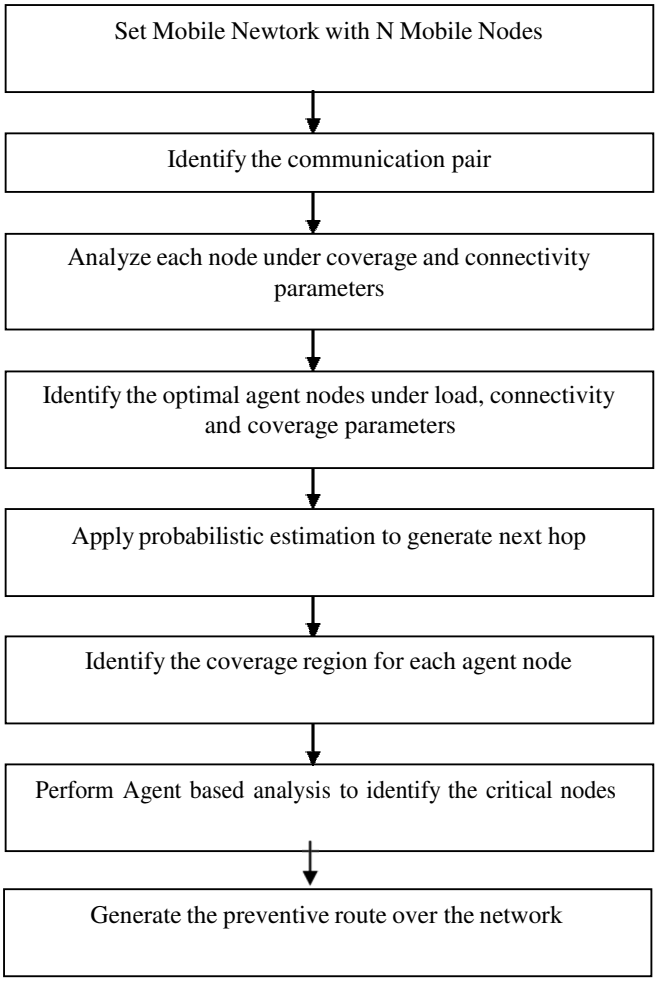

Figure 1: Flow of Work

In this section, the blackhole preventive route formulation method using multi-agent analysis scheme is provided. Figure 1, shows that the model has performed the analysis in two phases. In the first phase, the evaluation at zone level is done to identify the zone areas and the identification of agents. Once the agents are identified, the coverage node analysis within the agent scope is done to recognize the critical and the safe nodes. The preventive communication path is generated based on communication constraint analysis within the region.

4. RESULTS

The proposed research work is simulated in NS2 environment on a random network scenario. The network scenario and parameters considered in this research are provided in table 1.

Table 1: Communication Scenario

Parameters	Values
Network Area	100x100
Number of Nodes	36
Protocol	AODV
Simulation Time	100 Sec
Packet Size	512
MAC protocol	802.11
Topology	Random

Initial Energy	20J
Transmission Loss	.3J
Receive Power Loss	.3J

Here figure 1 is showing the communication parameters based on the random scenario taken in this work. The scenario is defined with specification of network parameters, communication parameters and the protocol specification. The table shows that the network nodes are defined with energy restriction. The communication control is provided in this work using AODV protocol.

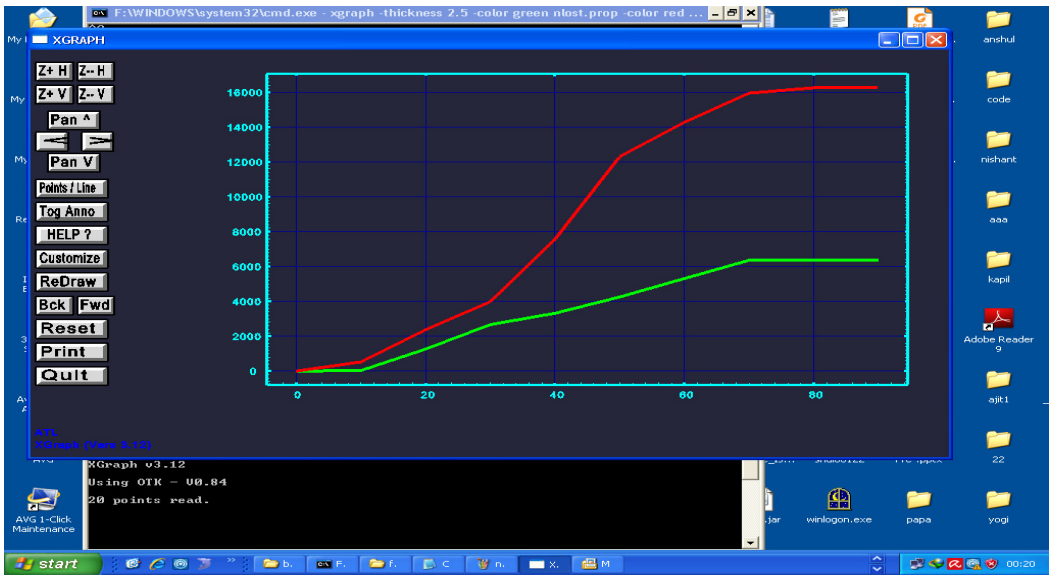

Figure 2: Packet Transmission Analysis

Figure 2 depict that the packet communication is been increased continuously in proposed approach. As the nodes are dead no more communication is performed over the network. Here straight line represents the dead network situation. In this figure, x axis represents the simulation time and y axis shows the packet communication. Here the figure is showing the packet communication specifically for proposed work. The figure shows that initially the packet communication in case of proposed work is higher.

Figure 3: Packet Loss Analysis

Here figure 3 is showing the packet loss analysis over the network in case of existing and proposed work. Figure shows that the packet loss in case of proposed work is much lesser then existing work. In this figure, x axis represents the simulation time and y axis shows the packet communication loss.

Figure 4: Packet Delay Analysis

Here figure 4 shows the comparative analysis of provided work under communication delay parameter. Figure shows that the packet delay in case of proposed work is much lesser then existing work. In this figure, x axis represents the simulation time and y axis shows the communication delay. The green line is showing the communication delay for the proposed work and red line is showing the communication delay obtained from existing work. The figure shows that initially the delay in case of proposed work is higher.

CONCLUSION

A mobile network is dynamic network, which suffers from various internal and external attacks. Blackhole attack is one such critical attack in which the infected node captures the flowing communication and does not forward it. In this paper, a multi-agent based probabilistic method is provided to identify the cooperative blackhole attack and generate the preventive path. The comparative results show that the method has reduced the communication loss and communication delay.

REFERENCES

[1]. A. Mukhopadhyay and Z. J. Zhao (2009), "Additional switching nodes: Not a panacea for congested wireless networks," 2009 18th Annual Wireless and Optical Communications Conference, Newark, NJ, 2009, pp. 1-6.

[2]. G. Mora, P. J. Garcia, J. Flich and J. Duato(2007), "RECN-IQ: A Cost-Effective Input-Queued Switch Architecture with Congestion Management," 2007 International Conference on Parallel Processing (ICPP 2007), Xi'an, 2007, pp. 74-74.

[3]. K. L. Khoo and R. Parthiban(2010), "Disjoint path re-routing in optical networks," International Conference On Photonics 2010, Langkawi, 2010, pp. 1-5.

[4]. M. H. Cheung, R. Southwell and J. Huang(2014), "Congestion-aware network selection and data offloading," Information Sciences and Systems (CISS), 2014 48th Annual Conference on, Princeton, NJ, 2014, pp. 1-6.

[5]. Y. Liu, X. Li, S. Chen and Z. Qin(2010), "Link Congestion Control Mechanism Based on Multi-Topology," 2010 6th International Conference on Wireless Communications Networking and Mobile Computing (WiCOM), Chengdu, 2010, pp. 1-4.

[6]. K. T. Girry, S. Ohzahata, C. Wu and T. Kato(2014), "A Circuit Switching Method for Improving Congestion of Tor Network," Broadband and Wireless Computing, Communication and Applications (BWCCA), 2014 Ninth International Conference on, Guangdong, 2014, pp. 416-421.

[7]. Somchai Lekcharoen(2007), "Performance and evaluation of adaptive backoff schemes in traffic shaping over high speed network," 2007 Asia-Pacific Conference on Communications, Bangkok, 2007, pp. 241-245.

[8]. O. Najah, K. Seman and K. Abdulrahim(2014), "The performance of OCDM/WDM with buffering based on shared fiber delay line," Information, Communication Technology and System (ICTS), 2014 International Conference on, Surabaya, 2014, pp. 269-274.

[9]. Z. Zhao, B. Willman, S. Weber and J. C. De Oliveira(2006), "Performance analysis of a parallel link network with preemption," 2006 40th Annual Conference on Information Sciences and Systems, Princeton, NJ, 2006, pp. 271-276.

[10]. Y. Xu and G. Fan(2009), "Reservation signalling mechanism for reducing blocking probability in optical burst switching networks with limited wavelength conversion capabilities," in IET Communications, vol. 3, no. 3, pp. 402-417, March 2009.

[11]. A. T. Lawniczak and Shengkun Xie(2008), "Study of number of packets in transit in a data network model near onset of congestion using functional fixed effect models," Electrical and Computer Engineering, 2008. CCECE 2008. Canadian Conference on, Niagara Falls, ON, 2008, pp. 001779-001784.

[12]. K. Keramat Jahromi, H. S. Anvar and R. Barzamini(2008), "Adaptive congestion control in networks with multiple congested nodes," Communications, Control and Signal Processing, 2008. ISCCSP 2008. 3rd International Symposium on, St Julians, 2008, pp. 273-281.

[13]. J. Escudero-Sahuquillo et al. (2015), "Efficient and Cost-Effective Hybrid Congestion Control for HPC Interconnection Networks," in IEEE Transactions on Parallel and Distributed Systems, vol. 26, no. 1, pp. 107-119, Jan. 2015.

[14]. Y. Nakayama(2014), "Rate-based path selection for shortest path bridging in access networks," 2014 IEEE International Conference on Communications (ICC), Sydney, NSW, 2014, pp. 1266-1271.

[15]. A. T. Lawniczak, P. Lio`, S. Xie and J. Xu(2007), "Wavelet Spectral Analysis of Packet Traffic Near Phase Transition Point from Free Flow to Congestion in Data Network Model," 2007 Canadian Conference on Electrical and Computer Engineering, Vancouver, BC, 2007, pp. 364-367.

[16]. R. Rojas-Cessa and Z. Qin(2009), "Proactive Routing for Congestion Avoidance in Network Recovery under Single-Link Failures," 2009 21st IEEE International Conference on Tools with Artificial Intelligence, Newark, NJ, 2009, pp. 822-825.

[17]. A. T. Lawniczak, K. P. Maxie and A. Gerisch (2004), "Effects of network connection topology and routing algorithm on phase transition and throughput in packet-switching network model," Electrical and Computer Engineering, 2004. Canadian Conference on, 2004, pp. 2429-2432 Vol.4.