

Cluster Enabled Performance Evaluation of MANET Routing Protocols Using Mobility Patterns

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Abstract: Mobile Adhoc Networks are basically infrastructure less networks that operates in a energy constrained setup. The constant movement of nodes in this type of network environment, enforces implementation constraint, to depute any responsibility on a node, like routing decisions, security enforcement etc. This paper focus on designing a modified clustering scheme to track the node mobility using eccentricity. The objective of bringing clusters is to preserve and monitor nodes mobility pattern using appropriate data structures deputed on the cluster head. Moreover to analyze the effect of this modified clustering scheme, the performance of three routing protocols namely, Adhoc Ondemand Distance Vector Routing(AODV), Clusterhead Gateway Switch Routing(CGSR) and Dynamic Source Routing (DSR) is measured and compared.

Keywords: MANET, Cluster, Node Mobility, Eccentricity.

I. INTRODUCTION

Basically, Adhoc Networks are infrastructure less networks, and is known as Mobile Ad-hoc Networks (MANET). Since each node acts as router, there will be no fixed router in this architecture. Since the nodes are mobile in nature, their connectivity will be in a dynamic fashion. This dynamic nature enforces the mobile nodes to organize and control their responsibilities by themselves in a distributed manner [1]. The nodes of these networks function as routers [2], which discover and maintain routes to other nodes in the networks. Due to this dynamic nature of the mobile nodes, frequent disconnections in links and change in topological structure are common scenario in MANET and it creates a big hurdle in the functioning of routing protocols that are designed for MANET [3]. To handle this challenge, it is ideal to build a hierarchy among nodes so that the topology changes can easily be tackled. This is possible when nodes are grouped on some parametrical basis to form clusters. Clustering is used to partition an adhoc network into some smaller groups [4], and all the partitioned clusters function as a whole. It can also be used for transmission management, backbone formation and routing efficiency. Hence, it is found that clustering and cluster enabled structures enable a better use of network infrastructures in a dynamically larger networks. The clustering enables certain control over the node mobility since the node among themselves are hierarchically arranged. Normally a routing protocol is used for node communication, which facilitates the sharing of information by choosing a better route between any two nodes in a network. The specific route to destination is calculated by routing algorithm. Each router has information of nodes that are directly connected to it. A routing protocol shares this knowledge amongst its first nearest neighbors, and then to the entire network. It is classified as reactive (on- demand), proactive (table-driven) and hybrid protocols [5][6].

In this paper, a modified clustering scheme is proposed to evaluate the performance of routing protocol. For that a simple data structures is incorporated into the cluster heads, CH, through which the position of the mobile nodes can be tracked. This strategy of identifying the position of mobile nodes enables the routing protocol to offer their full functionality since frequent disconnections are due to node mobility.

The rest of this paper is organized as follows. Various work related to clustering and routing is presented in section 2. The mathematical background of clustering is presented in section 3. The proposed methodology is discussed in section 4. Experimental evaluation of results of the performance the routing protocols in a simulated environment are discussed in section 5, and finally section 6 ends with conclusion.

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	10. Obasi C. C., Ikharo A. B., Balogun V. A., Udaba A., Ogbewey L. I., “Computational Analysis of Kinematics of 3 – Links Articulated Robotic Manipulator”, International Journal of Engineering and Advanced Technology, Vol. 9, No. 2, 2019. Available at: DOI: 10.35940/ijeat.F8631.129219.		
317.	Authors:	M. H. Mota, P.S. Patil	
	Paper Title:	The Effect of Alum as Filter Conditioner on the Performance of Conventional Rapid Sand Filter	
	Abstract: Filtration is a one of the most important and critical unit process followed worldwide which removes dirt particles from water. As the water quality standards are changing and becoming more stringent, the improvement in the performance of existing rapid sand filters is unavoidable. The use of filter conditioning to improve filter performance is a relatively recent development in drinking water treatment. Different advantages claimed by such use of filter aid includes lessening ripening period, superior turbidity removal and relatively stable filtrate quality. It also has limitations like reduction in filter run and comparatively higher back washing requirement. To assess the suitability of such method, under the existing conditions is of enormous importance. Current research explains the impact of filter media conditioning on the overall performance of conventional rapid sand filter. The study was carried out by installing a pilot plant at Ichalkaranji municipal water treatment plant. Different doses of alum as filter conditioner were tested and the comparison was made with the performance of conventional filter without filter aid. The parameters for evaluation were turbidity removal, filter run and backwash requirements. The dose of alum as filter conditioner was given as slug dose. The effect of zeta (ζ) potential change was observed to be one of the major reasons of the performance improvement, accelerating the surface removal since initial phase. Keyword: backwash requirement, media conditioning, rapid sand filter, ripening period, turbidity log removal, zeta (ζ) potential. References: 1. IS 10500:2012, Indian standard Drinking water- Specification (second revision)', Bureau of Indian standards, New Delhi, 1. 2015 2. Cranston, K.O., and Amirtrajah, A. "Improving the initial effluent quality of a dual media filter by coagulants in back wash," Journal American Water Works Association, 79(12), 1987, p.p. 50-63. 3. Colton, J.F.; Hillis, P.; and Fitzpatrick, C.S.B. 'Filter Backwash and Start-up Strategies for Enhanced Particulate Removal'. Water Research 30(10), 1996, p.p. 2502-2507 4. Amburgey, J.E., 'Optimization of the Extended Terminal Sub-fluidization Wash (ETSW) Filter Backwashing Procedure.' Water Research 39, 2005, p.p. 314-330. 5. Logsdon, G.S.; Symons, J.M.; Hoye, R.L. & Arozarena, M.M. 'Alternative Filtration Methods for Removal of Giardia Cysts and Cysts Models'. Journal America Water Works Association, 27(2), 1981, p.p. 111. 6. Gary S. L., Alan F. H., Michael J. C., John G., Jack L., Claudia H., and John Wi 'Controlling Turbidity Spike with Alum, Iron' .American Water Works Association, Opflow. 2005. 7. Kwok L.C., 'Enhanced Particle Capture in Slow Sand Filters using a Filter Aid', New England water treatment technology assistance center, project summery report. 2005 8. Po-Hsun Lin, Leonard W., and Monroe L., 'Post sedimentation Application of Polyaluminum Chloride to Enhance Dual Media Filter Performance,' Journal of Environment Engineering, vol. 139, 612-617. 2013 9. Po-Hsun Lin, Leonard W., and Monroe L., 'Comparison of the Ability of Three Coagulants to Enhance Filter Performance,' Journal of Environment Engineering, vol. 137, 2011, p.p. 371-376. 10. Po-Hsun Lin., Leonard W., and Monroe L., 'Enhanced Particle Capture through Aluminum Hydroxide Addition to Pores in Sand Media,' Journal of Environment Engineering, vol. 138, 2012, p.p. 8-16. 11. Salkar V.D. and Tembhurkar A.R., "Experimental Evaluation of Ripening Behavior: Down-flow vs. Up-flow Rapid sand Filters", KSCE Journal of Civil Engineering, 20(4), 2016, p.p. 1221-1227 12. Owens J., Miltener R., Schaefer F. and Rise E. "Pilot scale inactivation of cryptosporidium and Giardia". Proceeding of AWWA WQTC, San Francisco, CA, 1994 13. Bean, E.L., Campbell, and Anspach, F.R., "Zeta Potential measurement in control of coagulation chemical doses" Journal of American Water Works Association, 56(2), 1964, p.p. 214-224. 14. Yao, K.M., Habibian, M.T., and O'Melia, C.R., "Water and Waste Water Filtration: Concepts and applications", Environmental Science Technology, 5(11). 1971, 1105-1112. 15. Pizzi, Nick, 'Optimizing Your Plant's Filter Performance.' Journal America Water Works Association, Op-flow, June 2000. 26(6), 2000, p.p. 37-38. 16. Franchi, A., and O'Melia, C. R., "Effects of natural organic matter and solution chemistry on the deposition and re-entrainment of colloids in porous media." Environmental Science Technology, 37(6), 2003, p.p. 1122-1129 17. Amburgey, J.E., 'Optimization of the Extended Terminal Sub-fluidization Wash (ETSW) Filter Backwashing Procedure.' Water Research 39, 2005, p.p. 314-330. 18. O'Leary, K., Eisnor, J., Gagnon and Graham. 'Examination of plant performance and filter ripening with particle counters at full-scale water treatment plants.' Journal of Environmental technology. 24. 2003, p.p. 1-9. 19. Amburgey, J.E., 'Optimization of the Extended Terminal Sub-fluidization Wash (ETSW) Filter Backwashing Procedure.' Water Research 39, 2005, p.p. 314-330. 20. Suthaker, S. Smith, D. and Stanley, S., 'Optimization of filter ripening sequence.' Aqua, 47, 2008, p.p. 107-118. 21. Franchi, A., and O'Melia, C. R. "Effects of natural organic matter and solution chemistry on the deposition and re-entrainment of colloids in porous media." Environmental Science Technology, 37(6), 2003, p.p. 1122-1129. 22. Pernitsky, D. J., and Edzwald, J. K. "Selection of alum and polyaluminum coagulants: Principles and applications." Journal of Water Supply: Res. Technol.-AQUA, 55(2), 2006, p.p. 121-141 23. Zou R.P and Yu A. B., 'The packing of sphere in a cylindrical container, the thickness effect', Chemical Engineering Science, 50(9), 1995, p.p. 1504-1507. 24. Amirtraj, A and Wetstein, D.P. (1980), 'Initial degradation of effluent quality during filtration', Journal of American Water works Association, 72(2), 1980, p.p. 518-524		
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319.	Authors: Lavanya. Poluboyina, Sivakumar Reddy. V, Mallikarjuna Prasad. A Paper Title: Multimedia Transmission through Mobile Ad hoc Networks using Multicasting Abstract: Mobile ad hoc networks, abbreviated to MANETs are covering various application fields with the significant advancements in wireless networks. In the recent past, the multimedia transmission over such networks has drawn the attention from researchers and scientists. In wireless medium, it is always advantageous to go for multicast routing than unicast routing. This paper focuses on the performance analysis of a multicast routing protocol, multicast ad hoc on-demand distance vector (MAODV), and its modified version QoS-MAODV, to support multimedia transmission over ad hoc environments. Keyword: MANET, MAODV, mobile ad hoc network, multimedia, VoIP transmission, video transmission. References: 1. De Morais Cordeiro, Carlos, Hrishikesh Gossain, and Dbarma P. Agrawal, "Multicast over wireless mobile ad hoc networks: present and future directions," IEEE network 17, no. 1, 2003, pp. 52-59. 2. Lavanya, P., V. Siva Kumar Reddy, and A. Mallikarjuna Prasad, "Research and survey on multicast routing protocols for MANETs," In 2017 Second International Conference on Electrical, Computer and Communication Technologies (ICECCT), IEEE, 2017, pp. 1-4. 3. Royer Elizabeth. M, and Charles E. Perkins, "Multicast operation of the ad-hoc on-demand distance vector routing protocol," in Proceedings of the 5th annual ACM/IEEE Int. Conf. on Mobile computing and Networking, ACM, 1999, pp.207-218. 4. Lavanya, P., V. Siva Kumar Reddy. V, and Mallikarjuna Prasad. A, "Exploring QoS multicast routing protocols for mobile ad hoc networks," in Proceedings of the 5th Int. Conf. on Computing, Communication and Sensor Network, 2016, pp.170-174. 5. Charles E. Perkins, and Elizabeth. M. Belding-Royer, "Quality of service for ad hoc on-demand distance vector routing," Mobile Ad hoc Networking Working Group, Internet Draft, 14 Nov 2001. 6. For Network Simulator 2, http://www.isi.edu/nsnam/ns/	1928-1933
320.	Authors: Sonali Sen, Arup Kumar Bhaumik, Jaya Sil	

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Abstract: Mobile Adhoc Networks enforces certain level of challenges for the researchers since they operate without a fixed infrastructure. Moreover the constant movement of nodes gives additional challenges while implementing any type of solutions. Similarly enforcing secure mode of routing in mobile adhoc networks creates lot of hurdles for the implementers. This paper addresses these issues, by computing the trust of each node and updating the trust tables of the respective nodes and the cluster head. This paper focus in designing a trusted secure mechanism for routing. The objective of this work is to calculate the trust of nodes using various trust methods. Later the calculated trust is updated with the trust table of the cluster head by forming a web of trust. This will enable a secure channel of communication among the adhoc nodes. After incorporating the newly computed trust, the routing performance of well known routing protocol say AODV, is evaluated for various routing parameters and it is compared with the performance of Trusted AODV(TODV).

Keywords : Direct Trust, Indirect Trust, Web of Trust, Clusters, throughput, packet delivery ratio

I. INTRODUCTION

Adhoc Networks are decentralized networks that bypasses the centralized router. Unlike the wired counterpart, this network does not depend on the existing infrastructure for their operations. As the word 'ad hoc' means 'for this purpose', this network finds its application where fixed networks cannot be configured. Since this network, functions in a decentralized manner, here, each node acts as a router while forwarding a packet to the destination. Hence this networks operates as a multihop network. Moreover, the nodes in the adhoc network are inherently mobile which makes frequent disconnections in the links. So, when a node wants to route a packet to the destination, the routing protocol's functioning is highly challenging[1]. In order to handle these challenges, researchers strive to find lot of solutions. One such solution to handle the mobility of nodes is that, they tried to build some hierarchy among nodes, by forming clusters. Clusters enable the division of entire network into small and manageable groups and these small groups of clusters will operate on a whole for various operations like routing, secure communication and service discovery process. Mostly in any network infrastructure,

communication among the nodes is achieved through the routing protocols specifically designed for that network. Similarly in adhoc networks, various routing protocols have been designed for the purpose of node communication and data transmission. But, all the different categories of protocols that are designed for adhoc network does not enforce secure communication. Hence, in this paper, it is proposed to bring in a security mechanism for routing, using the concept of trust. The trust value of each node is calculated and the trust table of the cluster head is updated. The cluster head uses this table to decide which node can actively participate in the routing process based on the trust values by eliminating the malicious nodes. The trust tables of all cluster heads will be used for node communication by forming a web of trust.

The remaining part of this paper is formulated as stated herewith. Basic aspects of trust is detailed in Section 2. A survey of the existing literature of trust calculation process is done and the findings are listed in section 3. The mathematical background for calculating the direct and indirect trust is presented in section 4. The proposed methodology for calculating the trust and updation of the trust table is given in section 5. Experimental evaluation of the trusted routing with untrusted routing protocol is simulated and the outcome are discussed in section 6, and section 7 ends with conclusion.

II. BASIC ASPECTS OF TRUST

Trust is a characteristics of a node based on its behavior of both positive and negative experiences it imparts to its neighboring node during a data transmission[2-3]. Trust metrics can be used to quantify the level of trust. It can be either continuous and discrete. If it is a continuous measure the values can be $[0,1]$ and if it is discrete then it can have values in the range of $[-1,1]$. Trust metrics can be modeled as fuzzy model, probability model, similarity model, mobility models, context based models like energy, signal, measure of hops etc. In MANET, there is no central authority to monitor the network infrastructure. Moreover, they are highly dynamic nature of the network, does not allow pre-computed fixed secure routes. This type of open network cannot follow any security policy defined by the owner of the information. Cryptographic security mechanisms for providing confidentiality of communication and authentication of nodes will not help against packet dropping and delayed packet attack or rushing attack nor it can help in rating the services[4].

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