International Journal of Advances in Engineering and Management (IJAEM)
Volume 4, Issue 6 June 2022, pp: 2576-2579 www.ijaem.net ISSN: 2395-5252

Stability Based Routing in Mobile Ad hoc Networks

Mandeep Kaur Gulati
PG Deptt. of Computer Science
Khalsa College for Women, Asr

Submitted: 20-06-2022 Revised: 27-06-2022 Accepted: 30-06-2022

ABSTRACT - A Mobile Ad hoc Network (MANET) is an autonomous collection of mobile nodes forming a dynamic network and communicating over wireless links. With the rising popularity of MANETs and demand of users, Quality of Service (QoS) has become major issue to be discussed. One of the most important criteria determining the assurance of QoS support in such networks is link stability. Due to the mobility of the nodes, link failures occur frequently and the route involving those links would no longer work. Stability therefore is an important element to be considered in the design of routing protocols. Stable paths, also called the long-lived paths, can thus be discovered and used to reduce the overhead resulted from route maintenance in ad hoc networks. A number of stability based routing protocols have been proposed in the literature. This paper presents a survey of some of the stability based routing protocols along with their strengths and weaknesses.

Keywords: Mobile Ad hoc Network (MANET), Quality of Service (QoS), Routing Protocol, Link Stability, Signal Strength, Residual Lifetime.

I. INTRODUCTION

A Mobile Ad hoc Network (MANET) is a collection of mobile nodes that form a dynamic infrastructure-less communication network wherever it is required. The nodes in the network not only act as hosts but also as routers that discover and maintain routes to other nodes in the network. Mobile Ad Hoc Networks (MANETs) are becoming the crucial medium of present day communication owing to their self-configuring, easily deployable and infrastructure-less nature. These networks are particularly suitable for emergency situations like warfare, floods and other disasters where infrastructure networks are impossible to operate. Since mobile nodes move in various directions causing existing links to break and the establishment of new routes, routing in such networks is a challenging task. Routing protocols used in these dynamic networks should be designed in such a way that they can adapt fast and efficiently to unexpected changes in network layout. Many routing protocols have been developed for mobile ad hoc networks such as Ad hoc On-demand Distance Vector Routing Protocol (AODV) [1] Destination– Sequenced Distance Vector (DSDV) protocol [2], Wireless Routing Protocol (WRP) [3], Temporally-Ordered Routing Algorithms (TORA) [4], Dynamic Source Routing Protocol (DSR) [5], Associativity Based Routing Protocol (ABR) [6], and Zone Routing Protocol (ZRP) [7], etc. These protocols tend to establish a path with least number of hops. Also, all these routing solutions only deal with the best-effort data traffic.

Currently a lot of applications have been developed for wireless networks, their practical implementation and use in the real world has been limited so far. Many of these applications such as real-time audio and video are sensitive to the Quality of Service (QoS). Hence focus has been shifted from best-effort service to the provision of better defined QoS in ad hoc networks. The most commonly employed QoS metrics [8] are link stability, link reliability, end-to-end delay, node buffer space, delay jitter, packet loss ratio etc. The parameter 'link stability' i.e. the predicted lifetime of a link is the most important criteria determining the assurance of QoS support. Node movements cause link breakages in MANETs. Thus instead of selecting weak links which may break soon and introduce maintenance overhead one can find path involving stable links i.e. having longer predicted lifetime. Stability or lifetime of a path is determined by the number of links that compose the path and the stability of each link in the path. Many stability based routing protocols have been proposed in the literature that enhance network

International Journal of Advances in Engineering and Management (IJAEM)
Volume 4, Issue 6 June 2022, pp: 2576-2579 www.ijaem.net ISSN: 2395-5252

stability. The primary goal of most stability based routing protocols is to find and select the paths that will last longer. These protocols reduce routing overhead and improve QoS performance as compared to the shortest path routing protocols. A few of the routing protocols along with their strengths and weaknesses have been discussed in the paper.

The rest of the paper is organized as follows. In Section II, survey of some of the stability based routing protocols has been presented. Section III concludes the paper and gives possible future directions in this research field.

II. SURVEY OF STABILITY BASED ROUTING PROTOCOLS

In a mobile environment, because of the mobility of mobile nodes in MANETs, the shortest path is not necessarily the best path. If the stability of a routing path is not considered, then wireless links may be easily broken. Many of the stability based routing protocols have been proposed in the literature. A few of these routing protocols having different approaches for finding stable paths are surveyed in this section. For each protocol, the functionality and main features are described briefly:

P. Yang and B. Huang [9] proposed another Stable and Delay Constraints Routing (SDCR) protocol which extends the DSR protocol and adopts source routing mechanism. In the route discovery phase, the protocol finds paths that meets delay requirement with great link stability factor. In the route maintenance phase, it effectively keeps monitoring the network topology changes through delay prediction and performed rerouting in time. The SDCR includes two major phases namely route discovery and route maintenance. In the route discovery process, SDCR finds feasible paths between source and destination node while in the route maintenance phase, SDCR monitors and predicts the future information about availability of link. Link stability factor and delay constraints are taken into consideration in their route discovery and maintenance phases. In the route maintenance phase, SDCR effectively keeps monitoring network topology changes by delay prediction and performs rerouting before the paths become unavailable. The SDCR significantly improves route performance with these route discovery and maintenance mechanisms operating together and it also guarantees QoS request. The simulation results of SDCR show that it reduces the packet losses and guarantees the reliable and rapid transmission. Its advantage is remarkable in high mobility. However, the extra computation for link stability factor in SDCR causes the slightly higher delay.

W.Yang et al. [10] proposed a Link lifetime based multipath mechanism to improve route stability, which is called Link lifetime based Backup Routing protocol (LBR). It obtains the shortest path between source and destination through limited flooding as the primary path, and then sets up a local backup path for each link in the primary path concerning link lifetime. During the local backup paths setup, LBR conducts a local optimization, which guarantees the backup path to have the maximum lifetime in local area. This scheme effectively avoids backup paths being out-of-date prematurely and increases the availability of backup paths. Both theoretical analyses and simulation results show that LBR has an improvement in route lifetime, packet delivery ratio, end-to-end delay, and so on, compared with singlepath routing protocols. However, the protocol needs to be explored in terms of features like load balancing, security and resource reservation etc.

S. M. Tamilarasan and K. Eswaria [11] proposed Link Stability with Energy Aware multipath routing protocol (LSEAMRP). It is extended from AOMDV. The key idea of the protocol is find the link quality, maximum remaining energy and lower delay. Minimum and maximum delay times of this function are determined by balancing the performance improvement related to packet delivery ratio, network lifetime and side effects of time delayed flooding. The LSEAMRP was simulated on NS-2 and evaluation results show that the protocol improves the network lifetime in all mobility spans. In addition, the protocol increases the packet delivery ratio and throughput because the lifetime of links becomes longer and also decreases the energy consumption. Comparing with AOMDV [12], the proposed protocol reduces the route discovery overhead and end to end delay.

B.Xu and Y. Li [13] proposed a Novel Link Stability And Energy Aware Routing Algorithm with tradeoff strategy, and implement it on Ad Hoc On-demand Distance Vector Routing Protocol (AODV) [1], namely NLSEAAODV. The new protocol sets up routes with high stability in route discovery based on link stability and node energy information, and predict the breaking link in route maintenance. Besides, the routing takes a route stability-hop count tradeoff strategy to select routes with high stability and low hop count. Simulation results show that the protocol has a better overall performance than original AODV protocol, which improved the network utilization greatly. However

the protocol has higher delay as compared to AODV.

S. Palaniappan and K.Chellan [14] proposed a cross-layer based stable and energy-efficient routing technique in which quality of service (QoS) monitoring agents collect and calculate the link reliability metrics such as link expiration time (LET), probabilistic link reliable time (PLRT), link packet error rate (LPER) and link received signal strength (LRSS). These types of metrics help to find the most reliable link and reduce the number of route reconstructions in wireless network. In addition, residual battery power (RBP) is implemented to maintain the energy efficiency in the network. Finally, route selection probability (RSP) is calculated based on these estimated parameters using fuzzy logic. Simulation results show that the proposed routing technique improves the packet delivery ratio and reduces the energy consumption. However the protocol needs to be combined with data security to find more reliable solutions for wireless network transmission.

F. Zhang et al. [15] proposed a novel routing algorithm called as power controlled and stability-based routing protocol (PCSR) aiming to improve the energy efficiency and route stability. In PCSR, a novel table LCT is constructed and maintained at each node based on energy, load, interference, and transmitted power. Utilizing the local state information in LCT, a power controlled routing protocol is designed for improving route stability. Employing the data transmission power control scheme, PCSR saves energy, especially in high-mobility scenarios. In addition, due to the accurate route cost metric and power control in RREQ broadcasting, PCSR can guarantee a stable route with reliable packet delivery and decreased delay. Extensive simulations demonstrate that compared with existing routing protocols, proposed PCSR consumes less energy and prolongs network lifetime with guaranteed packet delivery. However the protocol lacks security feature which needs to integrated into it.

S. Hamad et al. [16] proposed the A-LSEA (Average Link Stability and Energy Aware) routing protocol for Mobile Ad-hoc Networks (MANETs). The main idea behind this algorithm is on the one hand, a node must have enough Residual Energy (RE) before retransmitting the Route Request (RREQ) and declaring itself as a participating node in the end-to-end path. On the other hand, the Link Life Time (LLT) between the sending node and the receiving node must be acceptable before transmitting the received RREQ. The combination of these two conditions provides more stability to the path and less frequent route breaks. The average results of the simulations collected from the suggested A-LSEA protocol showed a fairly significant improvement in the delivery ratio exceeding 10% and an increase in the network lifetime of approximately 20%, compared to other re-active routing protocols. However, the protocol needs to be further explored in terms of finding optimal value for the LLT and the RE with respect to the decision to rebroadcast the received RREQ packet or not, rather than using a fixed or average values threshold.

F. Zhang and G. Yang [17] proposed a novel Stable Backup Routing (SBR) scheme which consists of the establishment of backup routes and route maintenance. In SBR, backup routes are set up by overhearing MAC signals, and the bit error rate is considered in path selection for improving stability. To repair broken links effectively and reasonably, qualified backup routes are classified into three categories with different priorities, based on which the relevant nodes decide how to reconstruct the forwarding path. Extensive simulations demonstrate that the proposed method outperforms other comparable backup routing mechanisms in terms of packet delivery ratio, average delay and control overhead.

III. CONCLUSION

In this paper, a brief description of a few of the stability based routing protocols in MANETs has been presented. The protocols are selected in such a way so as to highlight the different approaches to stable path routing in MANETs, while simultaneously covering most of the important advances in the field. Strengths and weaknesses of these protocols have been summarized so as to explore the future areas of research. However, routing protocols that are based only on link stability have either been shown to exhibit little improvement over hop-count based algorithm or the improvement comes when link lifetime can be accurately predicted. A crucial issue with stability based routing protocols is that much longer routes can be obtained as compared to hop-count based routing. Thus these protocols need to be further extended in the areas of multipath routing, load balancing, resource reservation, energy efficiency and security to improve their performance.

REFERENCES

[1]. C.E. Perkins, E.M. Royer and S.R. Das, “Ad hoc on-demand distance vector (AODV) Routing protocol,” IETF Draft, RFC 3561, February 2003.

[2]. C. Perkins and P. Bhagwat, "Highly dynamic destination-sequenced distance vector routing (DSDV) for mobile computers," in Proceedings of ACM SIGCOMM'94, pp. 234-244, 1994.
[3]. S. Murthy and J. J. Garcia-Luna-Aceves, "An efficient routing protocol for wireless networks," ACM Mobile Networks Applications, J. Special Issue on Routing in Mobile Communication Networks, 1996.
[4]. V. D. Park and M. S. Corson, "A Highly adaptive distributed routing algorithm for mobile wireless networks," in Proceedings of IEEE INFOCOM'97, pp. 1405-1413.
[5]. D.B. Johnson, D.A. Maltz, and Y. Hu, "The dynamic source routing protocol for mobile ad hoc networks (DSR)," IETF Draft, July 2004.
[6]. C-K. Toh, "Associativity-Based Routing for Ad Hoc Mobile Networks," International Journal on Wireless Personal Communications, Vol. 4, No. 2, pp. 103-139, March 1997.
[7]. Z. J. Haas and M. R. Pearlman, "The performance of query control schemes for the zone routing protocol," in Proceedings of IEEE Symposium Computers and Communication, 1998.
[8]. L. Hanzo and R. Tafazolli, "A Survey of QoS Routing Solutions for Mobile Ad Hoc Networks," IEEE Communications Surveys, Vol. 9, No. 2, 2007.
[9]. P. Yang and B. Huang, "QoS Routing Protocol Based on Link Stability with Dynamic Delay Prediction in MANET," IEEE, Pacific-Asia Workshop on Computational Intelligence and Industrial Application, Vol.1, pp. 515-518, 2008.
[10]. W. Yang, X.Yang, S.Yang & Y. Gong, "Improving Route Stability in Mobile Ad hoc Networks Based on Link Lifetime," Journal of Communications, Vol.6, No.3, pp. 205- 214, May 2011.
[11]. S. M. Tamilarasan & K. Eswariah, "Link stability with energy aware ad hoc on demand multipath routing protocol in mobile ad hoc networks," American Journal of Applied Sciences, Vol.10, No. 8, pp. 844-848, 2013.
[12]. M. K. Marina, and S. R. Das, "On-demand Multipath Distance Vector Routing in Ad Hoc Networks," in Proceedings of International Conference for Network Protocols (ICNP), pp.14-23, Nov 2001.
[13]. B .Xu & Y. Li, "A Novel Link Stability and Energy Aware Routing with Tradeoff Strategy in Mobile Ad Hoc Networks," Journal of Communications, Vol. 9, No. 9, pp. 706-713, Sept. 2014.
[14]. S. Palaniappan and K.Chellan, "Energy-efficient stable routing using QoS Monitoring agents in MANET," EURASIP Journal on Wireless Communications and Networking, Vol. 13, pp.1-11, 2015.
[15]. F. Zhang, L. Kang, X. Xinyan, J. Shen & L. Zhou, "Power controlled and stability-based routing protocol for wireless ad hoc networks," Journal of Information Science and Engineering, (33), pp. 979-992, 2017.
[16]. S. Hamad, S. Belhaj & M.M.Muslam, "Average Link Stability with Energy- Aware Routing Protocol for MANETs," International Journal of Advanced Computer Science and Applications, (IJACSA), Vol.9, No.1, 554-562, 2018.
[17]. F. Zhang & G.Yang, "A Stable Backup Routing Protocol for Wireless Ad Hoc Networks," Sensors, Vol. 20, 6743, 2020.