IJCTA, 9(21), 2016, pp. 65-69

Framework of E-AODV

Kavita* A. K. Chaturvedi Kavita Arora*** Sandeep Gupta******

Abstract : Routing is the key feature of Internet at network layer, which involves selecting the best path for the data packets, to travel across the network, from source to destination. Very efficient protocols are required for the purpose of forwarding the data packets without causing data loss. The On-Demand protocol called AODV (Ad-hoc On-demand Distance Vector) is one from the category of such effective and efficient routing protocols in Mobile Ad-hoc Networks (MANET). As in MANET, nodes can freely enter or exit the network, therefore the network topology keeps on changing constantly. This mobility of nodes and instability between nodes causes link breaks between the neighbouring nodes and at times causes the routes to be invalid too.

This paper proposes a new protocol E-AODV (Efficient-AODV), which is an advanced and modified version of existing AODV, featured with objective of resolving the problem of link failure with maximum packet delivery ratio and minimum end-to-end delay.

Keywords : MANET, Routing algorithms, AODV, Link failure, Packet delivery ratio, end-to-end delay.

1. INTRODUCTION

MANET is a subset of ad-hoc networks which is mobile, dynamic and self-constructed in nature. Routing is the key feature of MANET which involves selecting the most efficient and best path for the data packets from source to destination and thus maximising the network performance. The efficiency of the path is measured in various terms like number of hops, traffic and security etc. In MANET, each node performs the job of a router which works on the basis of routing algorithms.

2. ROUTING ALGORITHMS

Routers are based on the routing algorithms to locate the best route from a source to a destination. For a data packet to reach from its source to destination it has to travel through single path or multiple paths and when a packet finds multiple paths to reach to the destination, it has no criteria available to find a right path. So, the router with the help of a certain algorithms calculates the most suitable or best path for the data packet to reach the destination. These algorithms are known as routing algorithms. The basic purpose of a routing algorithm at a router is to decide which output line an incoming packet should go.

There are so many different kinds of algorithms available to locate this best path. For the vast range of characteristics available for the differentiation of the Routing algorithms, a few to be mentioned are:

1. The particular goal of the algorithm;
2. Various types of routing algorithms existing and their impact on network and router resources.
3. Most important is the usage of different metrics which affects the calculation of optimal routes.

2.1. Routing algorithms categories

1. Static VS. dynamic 2. Flat routing VS. Hierarchical 3. Link state VS Distance-Vector

* Department of Computer Science and Engineering Jayoti Vidyapeeth Women's University, Jaipur, Rajasthan, India drkavita@jvwu.ac.in

** Department of Computer Science and Engineering JIMS EMTC,Gr. Noida, Uttar Pradesh, India arunchaturvedi@rediffmail.com

*** Research Scholar, Department of Computer Science and Engineering Manav Rachna International University,Faridabad, Haryana, India Kavitapawan2003@gmail.com

**** Department of Computer Science and Engineering JIMS EMTC, Gr. Noida, Uttar Pradesh, India guptasandeep1093@rediffmail.com

2.1.1. Static *vs* Dynamic algorithms

In static routing algorithm, as the name suggests, the routes are described by the fixed paths and the routing table to be configured is manually configured. The routes are stable and there is no impact of traffic and transmission failures. Static routing is appropriate in the environments where network traffic is predictable and the network design is kept simple.

The major advantages of static routing are minimal CPU/Memory overhead and no extra bandwidth overhead. The disadvantages are need of network administrators all the time for the manual adjustment of topology and impracticality on larger networks.

Another name given to dynamic routing is Adaptive routing. In this type of routing, the routers adjust to changing network circumstances as per the incoming routing update messages. It responds to the changes of the network and optimized route is also selected automatically, when the traffic changes and hence the name given is Dynamic Routing.

The advantages of Dynamic Routing are it is independent of the size of the network and suitable in all topologies where multiple routers are required. The disadvantages are there is requirement of additional resources such as CPU, memory and bandwidth and it is less secure due to the broadcast and multicast routing updates.

2.1.2. Flat vs Hierarchical Routing

In Flat routing, there is no layering of responsibility whereas all routers are each other's peers. So, the routing information is distributed to all the other routers that are connected to each other without any organization or segmentation structure between them. Thus, every node follows the same routing algorithm as any other node in the network.

In Hierarchical routing, there is a hierarchy of low and high energy nodes and these higher energy nodes are for processing and sending the information and lower energy nodes are used to sense the environment. Basically in hierarchical structure, there are multiple layers where the topmost layers act as the master of the lower layer nodes.

2.1.3. Link-state vs Distance Vector Routing

The Link state routing is also known as Shortest –Path routing. In this routing mechanism, the routers share the knowledge only about their neighbours by sending small updates through flooding. This routing method is based on the way how a routing table is updated.

The advantages of Link-state routing are there is faster convergence time and ability to handle very large networks too. The disadvantages are that it require more CPU power and memory and it is expensive to implement and support too.

Table 1. Comparison table of the routing algorithms

Algorithm/ Characteristics	***Static vs Dynamic***	***Flat vs Hierarchical***	***Link-state vs Distance Vector***
Scalability	Dynamic routing protocols are superior because of their high scalability and adaptability features	Scalable than link-state.	High scalability and
Latency	Dynamic protocols outperforms as compared to others in terms of average through put.	Less latency as compared toAODV	low latency.
Bandwith Consumption	Bandwith is used as network metric	Consumes more bandwidth when the size of the network	Unnecessary bandwith consumption due to periodic updation of routing tables.

The other name given to Distance-Vector routing algorithm is Bellman-Ford algorithm. As the name suggests, it uses distance measured in the terms of the number of hops a packet takes to reach the destination and the direction to find the best path to reach the destination. The advantages of Distance-Vector routing are that it is a relatively simple approach and easy to be used and there is less requirement of bandwidth, CPU resources and memory. The disadvantages are limited scalability due to slow convergence time, bandwidth consumption and routing loops and for larger networks, it results in larger a routing table which leads to congestion in the network.

3. PROBLEMS IN ROUTING ALGORITHMS

As the ad-hoc networks are quite dynamic in nature, due to their dynamicity the nodes move at a very fast speed. This causes the entire network topology to change many times and thus routing also becomes a complex process.

The other critical issue with routing in MANETs is that the transmission range of these networks is quite limited and the reason behind this is their high degree of mobility, limited power, processing and memory resources. As a result, routing becomes a critical issue in the ad-hoc networks.

Another problem here is the wireless environment itself. As in a Wireless LAN, the bandwidth is limited, so the situation of collisions occurs. In Infrastructure networks, the protocols like RIP and BGP perform this job quite often and thus the link quality is also affected. Poor link quality leads to link failures, decreased packet delivery ratio and end-to-end delay too.

As most of the wireless tools run on batteries, so energy level also become a constraint, the reason being immense power is required for transmitting packets.

In nutshell, the problems faced by routing algorithms in ad-hoc environment are :

1. Dynamically changing topology
2. Energy constrained nodes
3. Bandwidth constrained wireless links
4. Absence of fixed infrastructure
5. Frequent Link breaks
6. End-to-End delay
7. Decreased packet delivery ratio

4. PROTOCOL OF MANET

Our focus for research is on the Distance-Vector routing algorithm called AODV. Ad-hoc On-Demand Distance Vector (AODV) protocol has been designed for use in MANET. It provides a dynamic and multi-hop routing topology among the mobile nodes. The main features of AODV are that as it is a reactive protocol, so it initiates the route discovery only when it there are data packets to be transferred and it can't find a route to the destination node. AODV, in that case uses the sequence numbers maintained at each destination to ensure the avoidance of the routing loops and to determine the originality of routing information too. Another important feature of AODV is the maintenance of timer-based states in each node, for the proper utilization of individual routing table entries.

Even though AODV enjoys so many advantages, yet like any other routing algorithm, it suffers from so many limitations too. The issues faced by this routing algorithm are like any other routing algorithm discussed above as:

1. **Link failure :** Link failure is a major problem with AODV which also leads to the performance degradation and problem of packet loss too. As the physical condition of the channel and the terrain where the networks are deployed to change, transmission errors also occur.
2. **Number of packets dropped :** The number of packets dropped in AODV is more. This may happen in many ways. First is either a packet may be dropped at the source if route to the destination is not available or the buffer that stores the pending packets is full. The second is, it may be dropped at an intermediate host, if the link to the next hop is broken.
3. **Limited battery energy :** As all the mobile communication devices in the ad-hoc networks are operated by battery and have limited energy too, the network becomes an energy constrained system. If the energy of the nodes in the network get exhausted so fast, as a result, the devices get switched off quickly and thus leads to disconnected sub-networks. Therefore, energy usage is also a biggest challenge in the path of AODV.

4. **High route discovery latency :** As AODV is reactive routing protocol, so it does not discover a route until a flow is initiated. This latency in route discovery latency can be high in large -scale mesh networks.
5. **Overhead on the bandwidth :** Overhead is basically a combination of excess or indirect computation time, memory, bandwidth, or a few other resources which are required to attain a particular goal. When an RREQ (Route Request) travels from the source node to the destination node, for the discovery of the route info on demand, it simultaneously sets up the reverse path in itself, with the addresses of all the other nodes it passes through & it carries all this information with itself. This causes an extra overhead on the bandwidth.
6. **Dynamic topology :** Due to dynamic change of position of nodes in mobile ad-hoc networks, the links between nodes are not permanent. Many times, because of this reason a node is unable to send the packets to the desired next hop node and thus, the packets may be lost. The loss of packets may leave an adverse effect on route performance. Apart from that, the loss of route reply also brings problems like source node needs to re-initiate route discovery procedure.

5. PROPOSED SOLUTION

In this section of the paper, we are going to propose an enhancement over the basic AODV routing protocol which will certainly have better performance than the conventional AODV. As an improved version of AODV, E-AODV (Efficient-AODV) routing algorithm inherits many characteristics from its origin, yet they differ in some aspects too.

The new methodology which is adapted, tries to enhance the RREQ and RREP handling processes in order to save the energy level in the mobile devices.

E-AODV with all the modifications introduced, in order to reduce the number of route discovery cycles and delay time for finding a path, can discover a better path and if required can change the path too.

In AODV routing algorithm, the end-to-end routing delay differs a lot with the variation in moving speed of the nodes, while in the case of E-AODV , end-to-end delay is much lower which ensures the on-time transmissions which are required in case of real-time traffic transmissions in VANETs.

In the case of AODV routing algorithm, the packet delivery ratio decreases as when the traffic increases, and the performance of AODV in larger networks decreases. The criterion to look for the difference between the sizes of the networks is the average path length to be covered by the data packets. The greater the path, more it is vulnerable to link breakages and requires high control overhead for the purpose of its maintenance too. On the contrary, the packet delivery ratio with E-AODV is improved as in this there is a control over the traffic and the number of data packets to be transferred. It helps to save the data rate as well.

6. CONCLUSION AND FUTURE WORK

In the case of traditional AODV protocol, the route from the source to destination is chosen on the basis of the hop counts and the sequence number. The route which has minimum number of hop counts and highest sequence number is regarded as the best route. This sequence numbers also indicates the freshness of the route. In this paper, we conclude with the notion that in mobile ad-hoc networks, when the mobile nodes change their respective locations, the problem of link failure occurs. In order to overcome this problem, a new technique named as E-AODV is proposed. In our future work, we will implement this proposed technique through simulation and compare the simulation results with the previous techniques.

7. REFERENCES

1. Saleh Ali K, Al-Omari , Putra Sumari, **"**An Overview of Mobile Ad-Hoc networks for the Existing Protocols and Applications", International Journal On Applications Of Graph Theory In Wireless Ad Hoc Networks And Sensor networks , Volume 2 Issue 1, pp. 87-110 ,2010.
2. Viradia P. Vinay, "Improved AODV Routing Protocol for MANET", International Journal of Engineering Research and Applications, Volume 4 Issue1 (Version 3),pp. 368-374, 2014.

3. Ambhaikar Asha, Sharma R. H, Mohabey K.V, "Improved AODV Protocol For Solving Link Failure In MANET", International Journal of Scientific & Engineering Research, Volume 3, Issue 10, October-2012.
4. Singh Reeta, Gupta Shilpa, "EE-AODV: Energy Efficient AODV routing protocol by Optimizing route selection process", International Journal of Research in Computer and Communication Technology, Volume 3, Issue 1, January-2014.
5. Moond Jitendra, Singh Dharm, Choudhary Naveen,. "National Conference on Recent advances in Wireless Communication and Artificial Intelligence" (RAWCAI-2014).
6. Zamani Elham, Soltanaghaei Mohammadreza. "Journal of Computer Networks and Communications", Volume 2016, Article ID 6463157 .
7. Hinds Alex, Ngulube Michael, Zhu Shao ying and Hussain Al – Aqrab, "A Review of Routing Protocols for Mobile Ad - Hoc NETworks (MANET)", International Journal of Information and Education Technology, Vol. 3 No. 1, February 2013.
8. Kumar Deepak, Kaur Sapanjot, "Enhancement in AODV protocol to isolate link failure problem in Mobile Ad-hoc Network", International Journal of P2P Network trends and Technology , Volume 3 Issue 3,April 2013.
9. Balakrishna R. , Rao Rajeswar U., N. Geetahnjali N, "Performance Issues on AODV and AOMDV for MANETS", International Journal of Computer Science and Information Technologies, Volume 1(2), 2010.
10. Maamar Sedrati, Abderezzak Benyahia, "Predict Link Failure in AODV Protocol to provide Quality of Service in MANET", I.J. Computer Naetwork and Information Security, Volume 3, 2016.
11. Kapoor Shivinder, Pal Pushpraj, Gupta Scahin, Sharma Monika, " Stable AODV protocol in Mobile Ad-hoc Network", Volume 4, Issue 6, June 2014.
12. Bansal deepti, Vij Megha, "Enhancement in AODV Protocol to provide Best Path According to Signal Strength", *International Journal Of Scientific And Research Publications*, Volume 5 , Issue 5, May 2015.
13. Singh Meeta, Yadav K. A., "Efficient and Secure protocol for Mobile Ad-hoc Networks", *International Journal of Computer Applications*, Volume 77, Issue 16, September 2013.
14. Jeni Jasmine P.R., Julie Vimala A., Bose Messiah A., " An Enhanced Route Failure Recovery Model for Mobile Ad-hoc Networks", Journal of Computer Science, Volume 10, Issue 8, 2014.
15. Marandin Dimitri, " Performance Evaluation of failed Link Detection in Mobile Ad-hoc Networks", Chair for Telecommunications, Electrical Engineering Department,Technical University of Dresden, Dresden, Germany.
16. Kumar Senthil R. , Sureshkumar C., " Minimizing the Route Discovery Process in MANET", Journal of Theoretical and Applied Information Technology, Volume 61, Issue 3, March 2014.
17. Reddy K.Ramesh, Venkatadri N., "Performance Metrics Comparison for On-demand Routing Protocols using NS-2", International Journal of Advanced Research in Computer Science and Software Engineering, Volume 5, Issue 3, March 2015.
18. Maamar Sedrati, Abderezzak Benyahia, "Predict Link Failure in AODV protocol to provide Quality of Service in MANET", I.J. Computer Network and Information Security, Volume 3, Issue 1, March 2016.
19. Dwivedi Pushpendra, Gupta Saurabh, "A Survey on Route Maintenance and Attacks in AODV Routing Protocol", International Journal of Computer Applications, Volume 133, Issue 9, January 2016.
20. Ashoor Shaker Asmaa, "Performance Analysis between Distance Vector Algorithm (DVA) & Link State Algorithm (LSA) For Routing network", International Journal of Scientific & Technology Research, volume 4 , Issue 2, February 2015.