Sparkling Light Publisher

Sparklinglight Transactions on Artificial Intelligence and Quantum Computing (STAIQC)

Website: **https://sparklinglightpublisher.com/** **ISSN (Online):2583-0732**

Comparative Analysis of AODV and Optimal Residual Energy Selection AODV Protocol for MANET

Soumya S

Assistant Professor, Hira Women's College, Mangaluru, Karnataka, India

Abstract

The energy consumption of Mobile Ad Hoc network has become a crucial issue of Mobile Ad-Hoc networking, the issues such as link break, path loss, and packet loss. In the proposed work a protocol known as Optimal Residual Energy Selection ORES-AODV is introduced and the protocol is able to calculate the sum of mean value of the residual energy of the nodes in the path. Also, the average of least residual energy of the nodes in the path. And the path selection is based on the difference of the mentioned metrics in two separate nodes. Finally, the optimal path is selected for the data transmission by the protocol.

Keywords: MANET, AODV, Energy, Protocol, nodes.

1. Introduction

In this work Optimal Residual Energy Selection ORES-AODV protocol is introduced. This algorithm over comes the problem of identifying the low energy nodes in the path and also the problem of finding the optimal path by selecting the nodes with maximum energy levels. The solution for the problem of energy loss in the path is finding the node with minimum residual energy and using efficient hop count metrics. During the process of choosing the best path selection the protocol always selects the shortest path by counting the number hops from the source to destination, and the protocol always looks for minimal hop count and then the path is selected depending on the hop count minimum. But this technique always leads to selection of path with inefficient energy levels in the nodes and results in path failure during the transmission of packets. So, the protocol which we have proposed is mainly based on AODV protocol, but to overcome the problem of path link failure hop count, minimal residual energy and residual energy as the optimal path selection cost metric. The protocol can sustain the network lifetime for longer duration of time with help of cost metrics a method for determining the best path through a protocol. The AODV protocol transmission taken place with the help of RREQ and RREP, when the transmission initiated by the source

E-mail address of author: pksoumyaa@gmail.com
© 2021 STAIQC. All rights reserved.
Please cite this article as: Soumya, S. (2021). Comparative Analysis of AODV and Optimal Residual Energy Selection AODV Protocol for MANET. *Sparklinglight Transactions on Artificial Intelligence and Quantum Computing (STAIQC),* 2(1), 1-6. **ISSN (Online):2583-0732**

node the RREQ packets are sent and received by all the nodes in the network, the source node is the one who started it all nodes in the network send and receive RREQ packets. , so the RREQ packet is propagated through the path until the destination receives the first RREQ. Once the destination node receives the RREQ, it will generate route reply RREP to source and forwards it via same path.

In Optimal Residual Energy Selection ORES-AODV the route request packet is modified with additional fields such as residual energy, minimal residual energy and the hop count. Two additional fields are also added to calculate the average of residual energy. The first field is to calculate average least residual energy and The threshold field and average total residual energy have also been included to the table. The RREQ packet format of ORES-AODV is described in the Table 1 and two fields of the RREQ is additional in the packet format.

Table 1. Packet Format

Broad Cast ID
Destination IP
Source IP
Destination Sequence Number
Source Sequence Number
Least Residual Energy
Total Node Residual Energy

For the path selection some of the metrics such as the difference between the path with the greatest average residual energy and the path with the highest threshold is used. Another method used, by finding the difference between the highest average of minimum residual energy and the threshold to select the path. Finally, the selection of the path with equal cost factors will again rely on minimum hop count.

2. Objectives

The algorithm proposed has following objectives

1. The proposed algorithm has aim to overcome the problem of link breakages in the selected path.
2. Path selection is normally performed based on the number of hop count, and path with minimum hop count is selected. This trend of AODV has to be changed by choosing the nodes with maximum residual energy.

3. Mathematical model for ORES-AODV

The mathematical model has a route, R=r1, r2, r3,…..rd, The source node is indicated by the symbol r1 and the destination is denoted by rd. The residual energy of any node is denoted as $r(e_i)$. And the average of Least Residual Energy is calculated as

The mean of the least amount of residual energy R= $(\min_{\forall ei \in R} r(ei))/h$

Average Total of the node Residual Energy R=$\left(\sum_{\forall ei \in R} r(ei)\right)/h$

The ORES-AODV protocol makes the optimal path selection based on two cost metrics, in that first one is, if there exist a path in which the least residual energy is equal or more than the threshold

$$\underset{ei \in A}{\overset{ALRE}{}}(R) * h \geq Thr$$

So, The equation is used to determine the best route, which selects the highest of the mean value of the residual summation and threshold difference i.e.

$$Op(R) = \max_{ei \in A}(ALRE(R)) - Thr$$

The path can alternatively be chosen using the mean value of least node residual energy and threshold.

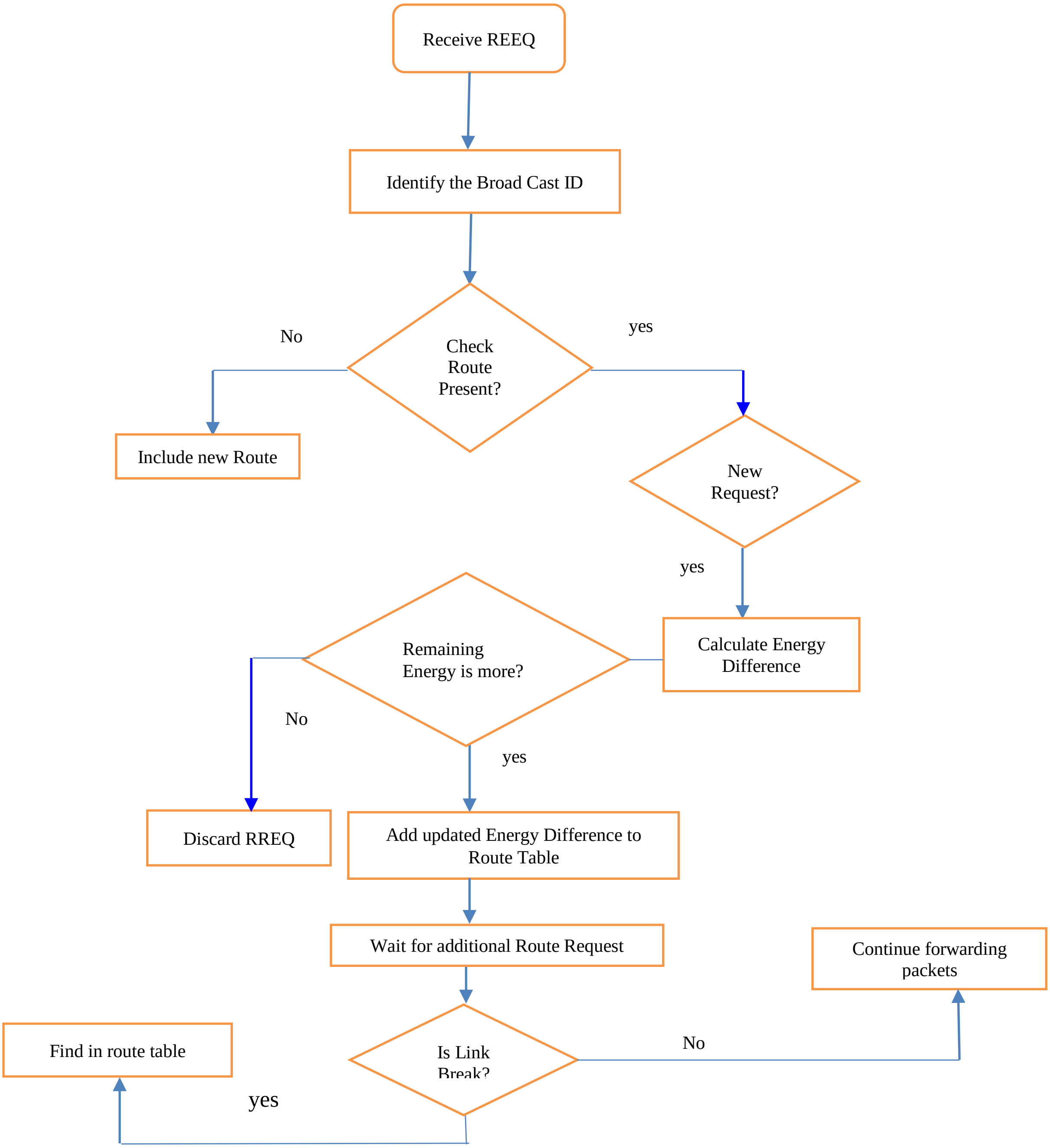
$$Op(R) = \max_{ei \in A}(AHRE(R)) - Thr$$

Algorithm for RREQ handling in ORES-AODV

Step 1: Receival of new RREQ packet, the Routing Table is searched for the Broad Cast ID of the RREQ packet.

Step 2: Checking for whether route is present or not. If present, then update the routing path.
Step 3: if the RREQ packet is new then calculate the energy difference in the nodes.
Step 4: If energy level is less, then discard the Route Request Packet.
Step 5: If node has sufficient levels of energy, then add the updated energy difference in the route table.
Step 6: Wait for additional route request, if link break is observed, again check in route table for the path otherwise continue forwarding the path.

The flowchart of the above algorithm is shown in Fig 1.



ISSN (Online):2583-0732

Fig 1. Flowchart defining the operations of ORES-AODV

4. Understanding and Analysing the Operations of AODV and ORES-AODV

The AODV and the ORES – AODV operations can be deeply analysed with an example case study, the analysis assumes that each node has threshold of 6 Joules as shown in Fig 2.

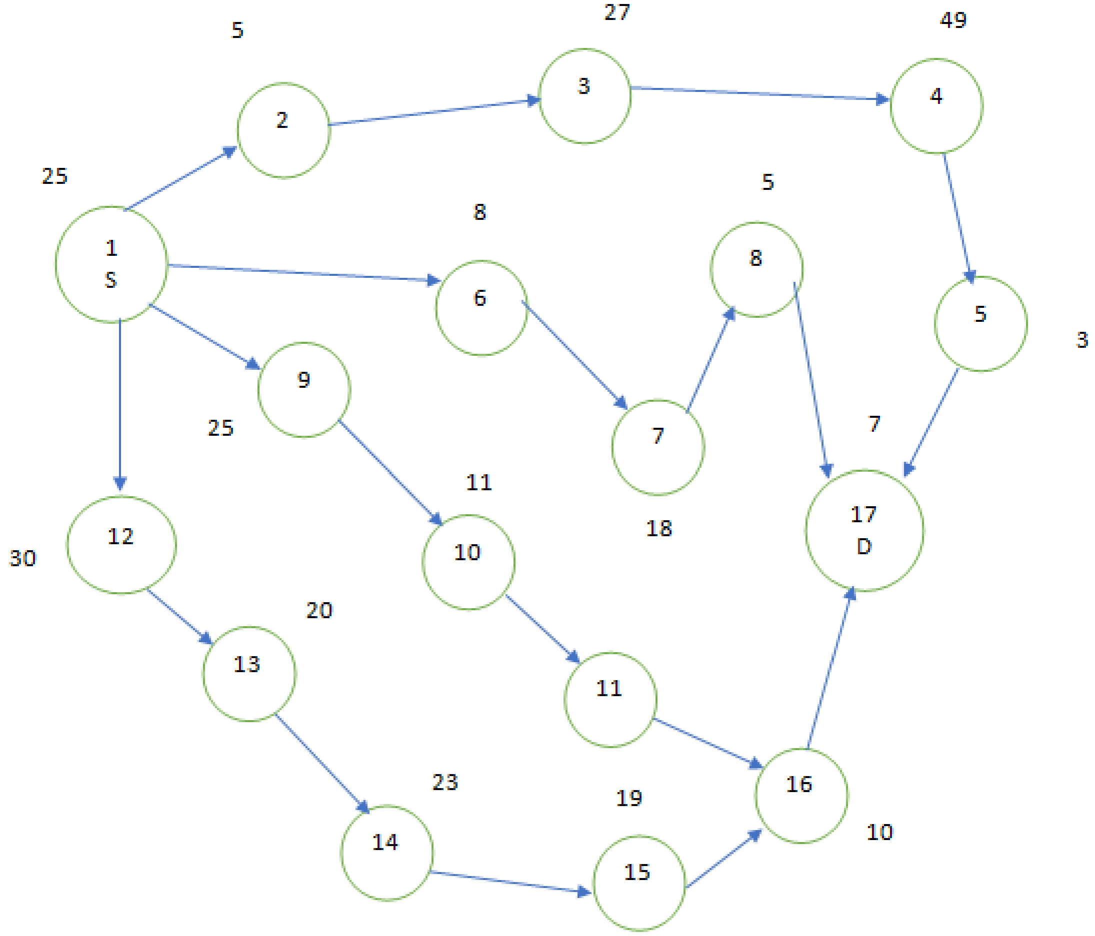


Fig 2. Operational analysis of ORES-AODV

Case 1: The AODV protocol normally chooses the path with a smaller number of hops, and as shown in the Fig.5 the AODV protocol chooses the path <S: -6: -7: -8:-D>, The number of hops on the specified path is three.

Case 2: The ORES – AODV is proposed will find the path between the source and destination, such as <S: -6: -7: -8:-D>, <S: -9: -10: -11: -16:-D>, <S: -12: -7: -8:-D> and here the algorithm finds the sum of the nodes residual energy and chooses the path with highest of the mean value of sum of residual energy.

Case 3: The ORES – AODV will use another step to choose optimal path by selecting path, such as <S: -12: -13: -14: -15: -16:-D>, <S: -9: -10: -11: -16:-D>, <S: -12: -7: -8:-D> with minimum hop count and if Case 2 is not applicable to any path, then the protocol will choose the path with highest mean value of the sum of minimum residual energy.

Network lifetime analysis of AODV and ORES-AODV protocol is shown in Fig 3.

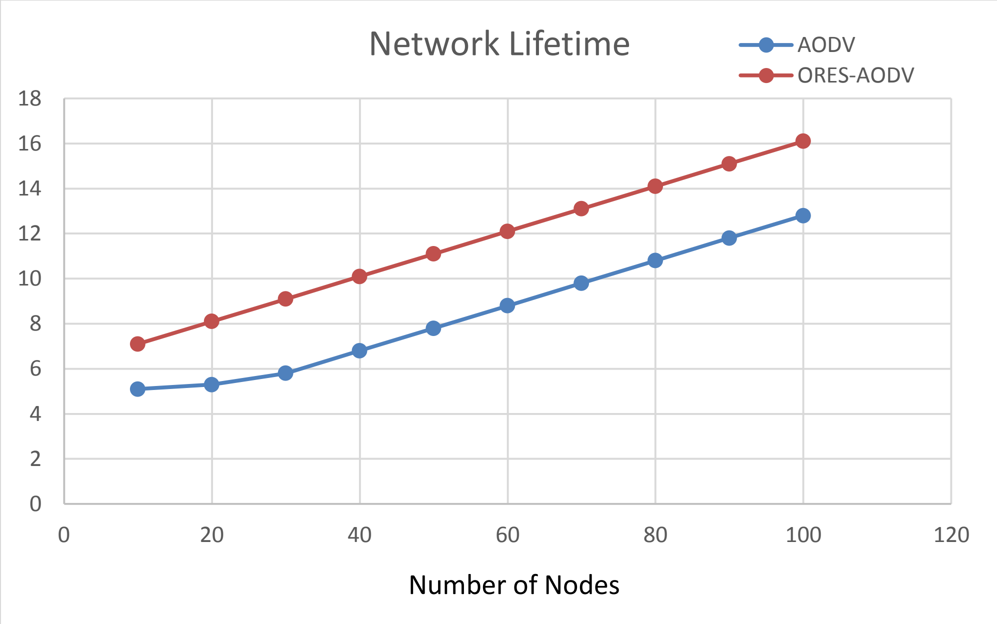


Fig:3. Network lifetime analysis of AODV and ORES-AODV protocol

5. Conclusion

The AODV protocol is conventionally selects the path by counting the number of hop count and threshold energy in the node. Since the hop count cannot alone decide the life time of the network, energy is also another important factor, which needs to be prioritised due to the link brakeage in the path. The life time of the network is mainly based on the residual energy levels within the nodes. The path selection also has to consider the residual energy and threshold as the parameter and based on these parameters the path selection process is performed in the proposed protocol ORES – AODV. The protocol is able to increase the life time of the network at large extent and improves the efficiency of the entire network.

Acknowledgements

We thank everyone who contributed to the article.

References

[1] Ramanathan, R., & Redi, J. (2002). A brief overview of ad hoc networks: challenges and directions. *IEEE communications Magazine*, *40*(5), 20-22.
[2] Chlamtac, I., Conti, M., & Liu, J. J. N. (2003). Mobile ad hoc networking: imperatives and challenges. *Ad hoc networks*, *1*(1), 13-64.
[3] Weiser, M. (1993). Some computer science issues in ubiquitous computing. *Communications of the ACM*, *36*(7), 75-84.
[4] Grimm, R. (2004). One. world: Experiences with a pervasive computing architecture. *IEEE Pervasive Computing*, *3*(3), 22-30.
[5] Esler, M., Hightower, J., Anderson, T., & Borriello, G. (1999, August). Next century challenges: data-centric networking for invisible computing: the Portolano project at the University of Washington. In *Proceedings of the 5th annual ACM/IEEE international conference on Mobile computing and networking* (pp. 256-262).
[6] Goldberg, L. (1995). Wireless lans-mobile computings 2nd wave. *Electronic design*, *43*(13), 55.
[7] Xu, W., Xin, Y., & Lu, G. (2007, August). A system architecture for pervasive computing. In *Third International Conference on Natural Computation (ICNC 2007)*, *5*(1), 772-776.. IEEE.
[8] Basagni, S., Conti, M., Giordano, S., & Stojmenovic, I. (Eds.). (2013). *Mobile ad hoc networking: cutting edge directions*, 35(1), John Wiley & Sons.
[9] Chiti, F., Fantacci, R., Maccari, L., Marabissi, D., & Tarchi, D. (2008). A broadband wireless communications system for emergency management. *IEEE Wireless Communications*, *15*(3), 8-14.

[10] Frodigh, M., Johansson, P., & Larsson, P. (2000). Wireless ad hoc networking: the art of networking without a network. *Ericsson review*, *4*(4), 249.
[11] Wibling, O. (2005). *Ad hoc routing protocol validation* (Doctoral dissertation, Uppsala University).
[12] Tønnesen, A. (2004). *Impementing and extending the optimized link state routing protocol* (Master's thesis).
[13] Helen, D., & Arivazhagan, D. (2014). Applications, advantages and challenges of ad hoc networks. *Journal of Academia and Industrial Research (JAIR)*, *2*(8), 453-457.
[14] Ayyash, M., Alsbou, Y., & Anan, M. (2015). Introduction to mobile ad-hoc and vehicular networks. In *Wireless Sensor and Mobile Ad-Hoc Networks* (pp. 33-46). Springer, New York, NY.

****