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Aodv Routing Protocol Implementation: Implications For Cybersecurity

Muhammad Naim Abdullah[1], Mafuzah Mohamad[2], MohdNorazmi Nordin[3]

[1]*University Malaysia of Computer Science and Engineering (UNIMY)*
[2]*College of Business Management and Accounting, National Energy University (UNITEN), Malaysia*
[3]*Cluster of Education and Social Sciences, Open University Malaysia (OUM)*

Abstract : From the current literature,routing protocol can be improved by formulating amechanism to help nodes gain further knowledge of othersinside the network. Without exchanging further message andextra processing burden on nodes, the primary challenge wasto enhance the routing protocol, but always kept an eye onavoiding any alteration to the well-designed routing protocoland trying the best not to cause extra overhead that preventsthe enhancement from achieving its goal. Overall, we canconclude that simulation for MD-AODV shows the correctimplementation of the algorithm and the performance metricresults proves the success of the implementation. Thesimulation result also shows previous two that MD-AODVwill cause a slight increase in route discovery. However, itleads to a better End-to-End delay during data transmission.

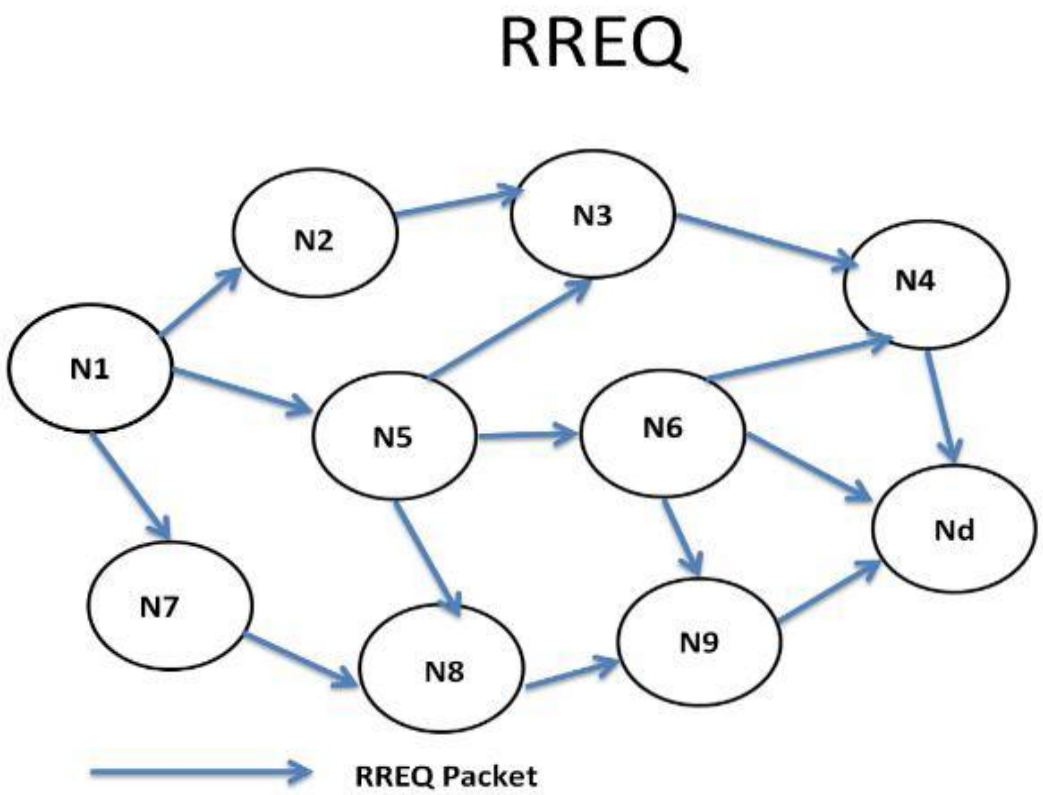
1. INTRODUCTION

With the advancementin wireless devices and the increase of data exchange speed,real time applications become a central source forcommunication among people [1].Data exchange in MANET requires routes that it should beestablished before transmission and nodes participating information of the network have to cooperate and use some of its uses different type of routing protocols that can be classifiedin different ways.The main classification relies on the route discovery policy [2, 3].Proactive or static routing protocols require routes to beestablished between all nodes during the formation of thenetwork as in (OLSR and DSDV). Routing tables used to storepaths to all nodes inside the network and they are updatedperiodically. These routing protocols have the advantage ofroute availability when needed and the disadvantage saw inlarge networks as it causes overhead and consume resources.While reactive or dynamic routing protocols establishes pathwhen any node have data want to send as in (AODV andDSR) [4]. The advantage of this type is the small size of routingtable, as nodes do not require storing information about wholenetwork the disadvantage comes from the delay time neededfor route discovery and the delay caused by link break andrepair process that leads to further packet retransmission.(Abdul Jalil et al., 2021; Mohd Noh et al., 2021; Mustafa et al., 2021; Roszi et al., 2021; Tumisah et al., 2021). If it is managed well, various problems can be avoided (Irma et al., 2021; Suzana et al., 2021; Rohanida et al., 2021; Nazrah et al., 2021; Shahrulliza et al., 2021).
Combinations of both previous types create a hybrid type ofprotocols to reduce overhead caused by the two differenttypes. This type usually suits large network in which it isdivided to smaller groups called (clusters, zones….etc.)inter-group communication conducted in a proactive mannerwhile inner-group communication conducted reactively, the disadvantage of these protocols come from the larger memoryrequirement.All aspects require effective

leadership and management (Mohd Arafat et al., 2021; Sumaiyah et al., 2021; Hifzan et al., 2021; Shahrul et al., 2021; Helme et al., 2021).
Generally, nodes in MANET have limited informationabout others beyond transmission range. On the other hand,QoS provisioning require routes that can guarantee servicesand for this needs to share nodes capability with others insidethe discovered path. Sharing knowledge about other nodecapabilities require the exchange of extra messages thatcauses overhead and consume resource. Therefore, it isimportant to use routing protocols that have limited support toQoS. Accordingly, routing protocols messages have to beenhanced to carry extra information about QoS parametersand shared it among nodes residing inside the path [5]. The proposed enhancement modifies the routing protocoland the shortest path concept that relies on number of hopsand adds the processing delay of the nodes.The success of something depends on good and efficient management (Mohd Ali et al., 2021; Parimala et al., 2021; SitiJamilah et al., 2021; Nor Fauziyana et al., 2021; Noel et al., 2021).

2. METHODOLOGY

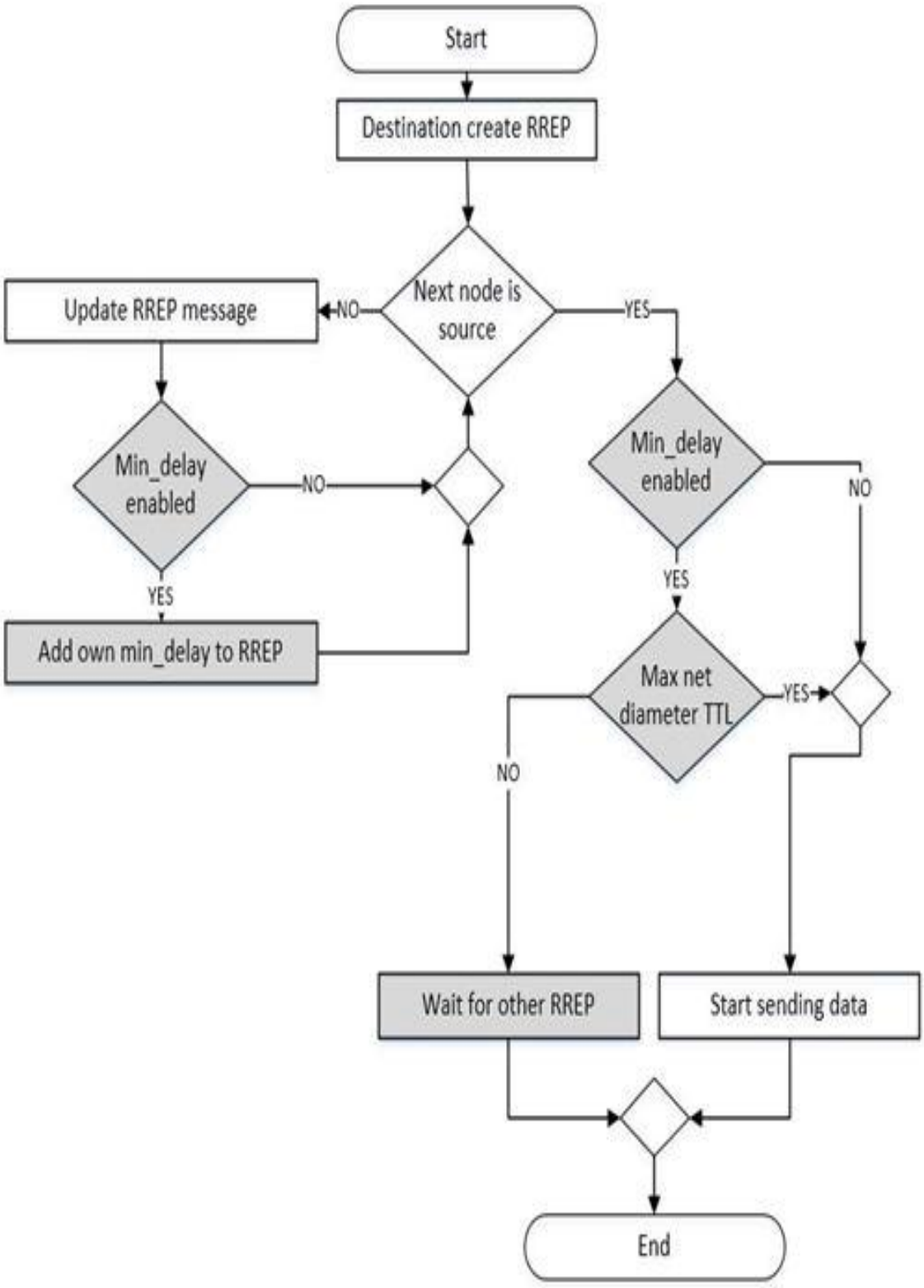
The proposed modification to AODV routing protocolconsists of modification of the RREP process and source node,route selection. Therefore, the RREQ process was executed in thesame manner as in normal AODV. While the RREP process,contains the following change:
1- A 32 bit filed added to the RREP message to store theaccumulative value of the Minimum processingdelay.
2- Starting with the destination every node processes theRREP message insert its own processing delay andforward back the RREP message.
3- When the source receives the RREP message it delaysthe data transmission to allow other RREP messageto arrive until maximum net diameter time expires.
4- Then the source compares the minimum delay of eachpath and the no of hops to select the path. In which isused for data transmission.
5- A reference for other paths stored to be used in case ofcongestion or link breakage.



3. RESULTS AND DISCUSSION

During transmission routingerror occurs as a result of link break or congestion, inwhich route repair starts leading to packet drop andrequires retransmission. Simulation results showthat both protocols gradually have an increase in thepacket retransmission, which is due to increase inthe data rate as previously explained. However,we notice that MD-AODV have an average of50 packets for deferent data rates while the normalAODV have 55.

This is another indication that a path with less delay causesfewer packets to get dropped and retransmitted again.The PDR for both protocolsshows an increase of 0.1msec on average in favoriteof MD-AODV, because of the enhancement avoids paths that contain nodes with high processing delay,which in return leads more packet drop that in resultleads to less PDR.The best way is to do efficient management (Ahmad Shafarin et al., 2021; Junaidah et al., 2021; Farah Adibah et al., 2021; Ahmad Shakani et al., 2021; Muhamad Amin et al., 2021). This demonstrates that the importance of something being managed well (Santibuana et al., 2021; Nor Diana et al., 2021; Zarina et al., 2021; Khairul et al., 2021; Rohani et al., 2021; Badaruddin et al. , 2021, Abdul Rasid et al., 2021)



We notice from thesimulation result that the RDT pattern is similarto previous scenario. Theaverage RDT for AODV is 1.5msec while forMD-AODV is 2.5msec on average. This timethe differences between the two protocols areincreased to 1 msec or 0.9msec more

forMD-AODV.This is due to the mobility of the nodes which forces thesource to take longer time to select a path and starttransmitting the data.
The simulation result showsa similar impact for nodes mobility on theEnd-to-End delay for both AODV versions withan increase of approximate 0.5 msec on average. Furthermore, and for thesame reason we notice that the delay increasesfor MD-AODV this time increase with data rate.Unlike the previousscenario, the PR results of this simulation showsthat the packet retransmission pattern varies fordifferent data rates, this is due to the movementof the nodes. However, we seesimilarity in the advantage of MD-AODV of7.28 packets on average. Furthermore, differentresults changed when the simulation wasrepeated several times but the pattern andadvantage of MD-AODV stayed the same onaverage.Simulation result showsa reduction in PDR which is due to packetsdrops occurs due to nodes movement, butMD-AODV still have the advantage of 0.912 to0.855 for AODV because of node processingdelay. Indeed, MANET routing protocol improvement motivatedresearchers to explore different ways to enhance its support toQoS. In this section, we explore some of these efforts andanalyze the results.A Research study evaluated different reactive routingprotocol support to QoS, and for this purpose AODV, DSRand TORA protocols considered. The review studies manydifferent parameters such as (route discovery, packet deliveryand delay).The result show different performance for eachprotocol, but overall AODV outperforms the other protocols.Load-Balancing DSR Based QoS Routing Protocol inMANETs (RTLB-DSR) is another enhanced routing protocolthat adds some QoS parameters to DSR protocol to achieveadaptability and strengthen the protocol [2]. Various policies applied to obtain flexibility for loadbalancing. The promising results obtained from differentscenarios prove that adding some of QoS metrics to routingprotocols will improve the performance and a similarapproach was adopted in our work.A different concept in another research tries to reduce theoverhead caused by link break of paths due to mobility, whichin return requires constant route discovery attempts. Theproposed method tries to minimize the broadcast messages.
Cybersecurity refers to a state in which systems are protected against electronic data use by unauthorized individuals, groups, or criminals. For the case of the software industry, it constitutes businesses for the publication, maintenance, and development of software via various business frameworks, including cloud-based systems (such as AaaS, MaaS, IaaS, PaaS, and SaaS) and maintenance or license-based systems (such as on-premise platforms). Technical components of cybersecurity include secure email gateway (SEG), end-point protection (EPP), Generation Firewall (NGFW), wireless intrusion detection, intrusion detection, and intrusion prevention systems, data loss prevention (DLP), and the secure web gateway (SWG). For the software industry, its history stretches from the period before the 1960s up to the recent times that have witnessed the evolution of SaaS (software-as-a-service), whose aim has been to minimize unauthorized copying. Regarding cybersecurity usage in the software industry, findings demonstrate that around the world, many companies are at the starting and developing stages. Some of the benefits that have been felt through the usage of this technology include minimized computer crashes and freezing, and protection of company computer systems against unwanted programs such as spyware, worms, and viruses. Challenges have also been felt. These challenges revolve around issues of management support, the business or industry environment, and the nature of the awareness culture. In the future, some of the projected trends include the use of the cloud, the incorporation of Artificial Intelligence (AI), and the role of the 5G technology in shaping the interplay between software industry vulnerability and the ability to counter cyber threats. In this study, the technology on the focus involves cybersecurity, while the industry on the focus entails the

software industry. The main aim is to discern the stages at which most software industries are in relation to the adoption and implementation of cybersecurity systems. Also, this secondary study aims to establish some of the beneficial effects that the software industry players have witnessed after implementing cybersecurity as a technology, as well as some of the challenges that have accrued from the same trend. The motivation is to predict the future implications of the perceived intersection. The analysis of data entails a content analysis approach.

In the findings, the software industry lags slightly when cybersecurity leaders are assessed. However, in the category of cybersecurity beginners, the software industry's percentage is seen to be higher. From these affirmations, a resultant inference is that when the subject of the software industry's usage, exploitation, or implementation of cybersecurity is investigated, most of the software companies are found to be at the beginning stage, with fewer firms emerging as leaders in cybersecurity technology implementation (or usage). The figure below summarizes these observations.

While software companies are expected to have exhibited heightened awareness regarding cyber threat evolution and led in cybersecurity usage, it is worth noting that resource and budgeting pressures associated with the cybersecurity function explain the trend in which most of the industry's players are at the beginner stage, rather than intermediate or leaders (Al-shukri, Lavanya, Sumesh and Krishnan, 2019). In particular, software companies are seen not only to focus on cybersecurity usage but also to compete with other initiatives and functions such as user experience improvement, digital transformation, and research and development (Farris, Taleb, Khettab and Song, 2019). Indeed, these multiple functions confirm the resource and budgeting pressures explain why many software companies, as reported in most of the recent scholarly studies, are at the beginner stage when the aspect of cybersecurity usage is evaluated. Giannakas, Papasalouros, Kambourakis and Gritzalis (2019) confirmed this observation by stating that there is a direct correlation between adequate cybersecurity funding and cybersecurity usage and function maturity in the software industry and that resource pressures imply that most of the firms are yet to allocate adequate funds to the cybersecurity functions, making most firms to remain (and operate) at the beginner stage – when it comes to cybersecurity usage.

The findings above demonstrate that an early stage of development characterizes most of the software companies' usage of cybersecurity. Additional scholarly studies have examined the subject of cybersecurity key functions at different stages of firm implementation and reported variations in the technology's perception based on the stage of implementation. For example, Haus, Orsag, Nunez, Bogdan and Lofaro (2019) focused on the perceived differences in software company executives' perception of cybersecurity usage depending on the cybersecurity maturity level and reported that in situations where firms are at the early-stage cybersecurity function, they are likely to emphasize specific functions such as reduced risks and incident prevention. On the other hand, the study demonstrated that in situations where software firms are at the leader stage, marked by advanced-stage cybersecurity functions, most of the executives tend to express a strategic function of cybersecurity, with most of the emphasis put on issues such as market share ability, customer engagement, and drivers of speed to market. As such, the findings suggest that the level of cybersecurity function and usage has not only seen many software companies remain at the beginner stage, but the level of cybersecurity function maturity accounts for differences in the functions that executives in the affected companies perceive of the technology, with most of the beginners emphasizing risk reduction and incident protection while most leaders emphasize market share, customer engagement, and cybersecurity functions as drivers of speed to market.

4. CONCLUSION

This research work presented in this paper shows thatrouting protocol can be improved further by formulating amechanism to help nodes gain further knowledge of othersinside the network. Without exchanging further message andextra processing burden on nodes, the primary challenge wasto enhance the routing protocol but I always kept an eye onavoiding any alteration to the well-designed routing protocoland trying the best not to cause extra overhead that preventsthe enhancement from achieving its goal. Overall, we canconclude that simulation for MD-AODV shows the correctimplementation of the algorithm and the performance metricresults proves the success of the implementation. Thesimulation result also shows previous two that MD-AODVwill cause a slight increase in route discovery. However, itleads to a better End-to-End delay during data transmission.

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