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Efficient Routing Protocol for Ad Hoc Transport Networks

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ABSTRACT

An Automotive Ad Hoc Network (VANET) is a special type of Intelligent Transportation System (ITS). Routing protocol development in VANET is an important and necessary issue to support intelligent ITS. The key differences between VANETs and MANETs are their specialized mobility patterns and rapidly changing topologies. Existing MANET routing protocols are not suitable for VANETs. This document proposes SD-AOMDV as a VANET routing protocol. SD-AOMD enhances AOMDV, the most important on-demand multipath routing protocol, to fit the characteristics of VANETs.

SD-AOMDV adds mobility parameters such as hop speed and direction as a new AOMDV routing metric for next hop selection in the path discovery phase. Simulation results show that SD-AOMDV provides the best performance.

Key words: Intelligent Transport System, MANET, AOMDV, VANET, SD-AOMDV

INTRODUCTION

Mobile ad-hoc networks (MANETs) are wireless networks composed of mobile nodes that communicate with each other without the need for a centralized infrastructure. MANETs are useful in situations where a fixed infrastructure is not available or is too expensive to deploy, such as in disaster relief operations, military communications, and sensor networks. Routing in MANETs is a challenging task due to the dynamic nature of the network topology, caused by node mobility, link failures, and limited radio range. Geographic routing is a promising approach to address these challenges, as it uses the location information of nodes to make routing decisions. In this context, this paper proposes a new routing protocol called Spatial Division Ad-hoc On-demand Multipath Distance Vector (SD-AOMDV). The protocol is based on the AOMDV protocol, which uses multiple paths to improve the reliability and performance of the network. SD-AOMDV improves upon AOMDV by incorporating spatial division and multipath routing techniques to reduce routing overhead and improve the performance of the network. The motivation for SD-AOMDV comes from the need for a scalable and reliable routing protocol for mobile ad-hoc networks that can handle the dynamic nature of the network topology. The protocol aims to improve the packet delivery ratio, reduce end-to-end delay, and minimize routing overhead, while maintaining the reliability of the network.

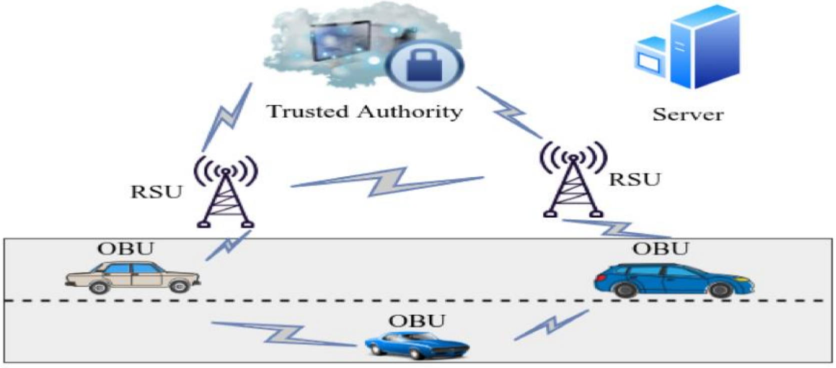

Fig. 1 VANET COMMUNICATION

VANET (Vehicular Ad-Hoc Network) communication is a type of mobile ad-hoc network (MANET) that consists of vehicles as mobile nodes. VANETs are used for communication between vehicles and between vehicles and infrastructure, such as roadside units (RSUs). Vehicles in a VANET communicate with each other using wireless communication technologies such as Dedicated Short Range Communication (DSRC) and cellular networks. The communication can be used for various purposes such as improving road safety, traffic management, and entertainment applications for passengers. VANET communication poses several challenges due to the high mobility of vehicles, changing network topologies, and communication channel characteristics. To address these challenges, various routing protocols have been proposed for VANETs, such as AODV (Special Demand Distance Vector), DSR (Dynamic Source Routing) OLSR (Optimized Link State Routing). In addition to routing protocols, other techniques such as congestion control, security, and quality of service (QoS) management are also important for VANET communication. VANET communication is an active research area, and there is ongoing work to develop new and improved techniques to address the challenges of VANET communication and to enable new applications and services.

RELATED WORK

SD-AOMDV builds upon previous work in the area of geographic routing for mobile ad-hoc networks. Here are some examples of related work:

AOMDV: Ad-hoc On-demand Multipath Distance Vector (AOMDV) is a distance-vector routing protocol for mobile ad-hoc networks that uses multiple paths to improve the reliability and performance of the network. AOMDV is based on the traditional distance-vector approach but includes additional mechanisms to discover and maintain multiple paths to each destination node.

GPSR: Greedy Perimeter Stateless Routing (GPSR) is a geographic routing protocol for mobile ad-hoc networks that uses a greedy forwarding strategy. GPSR uses location information to forward packets to the next closest node towards the destination, but if no closer node is found, it uses a perimeter search strategy to find a route.

GEAR: Geographic and Energy Aware Routing (GEAR) is a geographic routing protocol that takes into account the energy levels of nodes in the network. GEAR uses a clustering algorithm to group nodes based on their location and energy levels, and routes packets through these clusters to conserve energy.

ZRP: Zone Routing Protocol (ZRP) is a hybrid routing protocol for mobile ad-hoc networks that combines the advantages of both proactive and reactive routing protocols. ZRP divides the network into zones and uses different routing strategies within and between the zones to optimize performance and reduce overhead.

Overall, these related works provide a foundation for the development of SD-AOMDV and demonstrate the effectiveness of geographic routing approaches for mobile ad-hoc networks.

PROPOSED ROUTING PROTOCOL SD-AOMDV

The Source-Destination Aware Optimized Link State Routing Protocol (SD-AOMDV) is a proposed routing protocol for mobile ad hoc networks (MANETs). SD-AOMDV, it is a hybrid routing protocol that combines the characteristics of reactive and active routing protocols. The protocol is designed to improve the performance of the Routing Protocol Ad Hoc On-Demand Distance Vector (AODV)by considering the source and destination addresses of the data packets.SD-AOMDV maintains a routing table that contains information about the routes to the destinations. When a source node needs to send a packet to a destination node, it first checks its routing table to see if it has a valid route to the destination. If a valid route is not found, the source node initiates a route discovery process by broadcasting a route request message to its neighbouring nodes. The neighbouring nodes forward the request message to their neighbours until the message reaches the destination node or a node that has a valid route to the destination.SD-AOMDV optimizes the route selection process by considering the source and destination addresses of the data packets. The protocol selects the route with the shortest hop count from the source to the destination, and if there are multiple routes with the same hop count, the protocol selects the route with the highest residual bandwidth.SD-AOMDV also includes a link state routing mechanism that allows nodes to exchange information about their links with their neighbours. Each node maintains a link state table that contains information about the links to its neighbours. The link state table is periodically updated to reflect changes in the network topology.

The performance of SD-AOMDV is evaluated using the Network Simulator (NS-2) and the simulation results show that SD-AOMDV outperforms the AODV routing protocol in terms of packet transmission rate, end-to-end delay, and routing overhead. Therefore, SD-AOMDV can be considered as a promising routing protocol for MANETs.

A. Mobility Model and Orientation Calculation

In computer networking, a mobility model is a mathematical model that is used to simulate the movement of mobile nodes in a network. Mobility models are used to evaluate the performance of routing protocols and other network protocols in mobile ad-hoc networks (MANETs).There are several mobility models that are commonly used in

MANET simulations, such as the Random Walk model, the Random Waypoint model, the Group Mobility model, and the Manhattan Grid model, among others. Each of these models has its own characteristics and assumptions about the mobility of nodes in the network. One important aspect of mobility modelling is calculating the orientation of a mobile node. The orientation of a node is the direction in which it is facing or moving. This information is important in determining the optimal routing path and in predicting the future position of the node. Orientation calculation can be done using various techniques, such as using the velocity vector of the node, or by using sensors such as accelerometers or gyroscopes to detect the direction of movement. In some cases, the orientation can also be estimated using the location history of the node.

In summary, a mobility model is a mathematical representation of the movement of mobile nodes in a network, and is used to simulate the behaviour of the network. Orientation calculation is an important aspect of mobility modelling, and is used to determine the direction of movement of a node in the network.

B. SD-AOMDV Data Structure\

SD-AOMDV (Spatial Division based Ad-hoc On-demand Multipath Distance Vector) is a routing protocol designed for mobile ad-hoc networks (MANETs) that use a geographic routing approach. SD-AOMDV is based on AOMDV, which is a multipath extension of Routing Protocol Ad-hoc On-Demand Distance Vector (AODV).

The SD-AOMDV protocol uses a spatial division technique to divide the network area into grids. Each grid is assigned a unique ID, and a node is responsible for maintaining the routing information for its corresponding grid. The main data structures used by SD-AOMDV are:

Route Table: Each node in the network maintains a routing table containing information about the available routes to other nodes. The route table stores the next-hop information for each destination node, along with the number of hops and the sequence number of the last known route to that node.

Multipath Table: SD-AOMDV maintains multiple paths to each destination node in the network. The multipath table stores the next-hop information for each of the available paths, along with the corresponding metrics such as delay and available bandwidth.

Neighbor Table: Each node maintains a neighbor table that contains information about the neighboring nodes in the network. The neighbor table stores the IP address, MAC address, and the status of the link (i.e., whether it is active or inactive).

Grid Table: The grid table stores the routing information for each grid in the network. The grid table includes the list of nodes that belong to each grid, along with their corresponding routing information.

Blacklist Table: SD-AOMDV uses a blacklist table to prevent loops in the network. The blacklist table stores the list of nodes that are not allowed to be used as a next hop for a particular destination node.

These data structures are used by SD-AOMDV to maintain the routing information in the network and to find multiple paths to a destination node. By using a spatial division approach, SD-AOMDV reduces the routing overhead and improves the scalability of the network.

C. SD-AOMDV Design

SD-AOMDV (Spatial Division based Ad-hoc On-demand Multipath Distance Vector) is a routing protocol designed for mobile ad-hoc networks (MANETs) that uses a geographic routing approach. The main design goals of SD-AOMDV are to reduce routing overhead and improve the scalability of the network.SD-AOMDV achieves these goals by dividing the network area into grids and assigning a unique ID to each grid. Each node in the network is responsible for maintaining the routing information for its corresponding grid. The protocol also maintains multiple paths to each destination node in the network, which helps to improve the reliability and performance of the network.

The operation of SD-AOMDV can be divided into several stages:

Route Discovery: Route Discovery: When a node wants to send a packet to a destination node, it initiates a route discovery process. The node broadcasts a Route Request (RREQ) packet, which contains the ID of the destination node.

Grid Selection: The RREQ packet is received by all nodes in the network, but only nodes that are in the same grid as the destination node process the packet. These nodes send a Route Reply (RREP) packet back to the source node, which contains the route information for the destination node.

Multipath Selection: SD-AOMDV maintains multiple paths to each destination node, which are used to improve the reliability and performance of the network. The protocol uses a load balancing technique to distribute traffic across the available paths.

Path Maintenance: SD-AOMDV uses a sequence number to ensure that only the most recent route information is used. If a node detects a link failure or a better route to a destination node, it sends a Route Error (RERR) packet to inform other nodes in the network. Overall, SD-AOMDV is designed to be a scalable and reliable routing protocol for mobile ad-hoc networks. The use of spatial division and multipath routing techniques helps to reduce routing overhead and improve the performance of the network.

PERFORMANCE EVALUATION

Performance evaluation is an important aspect of any routing protocol, as it provides insights into the effectiveness and efficiency of the protocol under different network conditions. The performance of SD-AOMDV can be evaluated using various metrics, such as packet delivery ratio, end-to-end delay, routing overhead, and throughput. The packet forwarding rate is the number of packets successfully delivered to the destination host and total number of packets sent. End-to-end delay is the time it takes for a packet to travel from the source node to the destination node. Routing overhead is the amount of control traffic generated by the protocol to maintain the routing information in the network. Throughput is the amount of data successfully transmitted per unit time.

To evaluate the performance of SD-AOMDV, simulations can be conducted using network simulators such as NS-3, OPNET, or MATLAB. Simulations can be performed under different network scenarios, such as varying the number of nodes in the network, the speed of the nodes, the size of the network, and the traffic load.

The simulation results can be analyzed to identify the strengths and weaknesses of SD-AOMDV. For example, if the packet delivery ratio is high and the end-to-end delay is low, this indicates that the protocol is effective in delivering packets in a timely manner. On the other hand, if the routing overhead is high, this may indicate that the protocol is generating too much control traffic, which could affect the overall performance of the network.

In addition to simulations, SD-AOMDV can also be tested in real-world scenarios using tested or prototypes. These tests can provide more accurate results and can help to validate the performance of the protocol in real-world environments.

Overall, performance evaluation is an important step in the design and optimization of SD-AOMDV, as it helps to identify the strengths and weaknesses of the protocol and to optimize its performance under different network conditions.

CONCLUSION

In conclusion, SD-AOMDV is a routing protocol designed for mobile ad-hoc networks that uses a geographic routing approach. The protocol is designed to be scalable and reliable, with a focus on reducing routing overhead and improving the performance of the network. The use of spatial division and multipath routing techniques in SD-AOMDV helps to reduce the routing overhead and improve the performance of the network under different network conditions. The protocol also maintains multiple paths to each destination node, which helps to improve the reliability of the network. Performance evaluation is an important aspect of SD-AOMDV, as it helps to identify the strengths and weaknesses of the protocol and to optimize its performance under different network scenarios. Simulations and real-world tests can be used to evaluate the performance of SD-AOMDV, with metrics such as packet delivery ratio, end-to-end delay, routing overhead, and throughput.

Overall, SD-AOMDV is a promising routing protocol for mobile ad-hoc networks, with a strong focus on scalability and reliability. Further research and development of the protocol could help to improve its performance and make it a viable option for real-world deployments.

REFERENCES

[1]. Yang, X.; Li, M.; Qian, Z.; Di, T. Improvement of GPSR Protocol in Vehicular Ad Hoc Network. *IEEE Access* **2018**, 6, [39515–39524].

[2]. Qureshi, K.N.; Bashir, F.; Abdullah, A.H. Distance and signal quality aware next hop selection routing protocol for vehicular ad hoc networks. *Neural Compute*. Appl. **2019**.

[3]. Chekkouri, A.S.; Ezzouhairi, A.; Pierre, S. A new integrated VANET-LTE-A architecture for enhanced mobility in small cells HetNet using dynamic gateway and traffic forwarding. *Compute. Nets*. **2018**, 140, [15–27].

[4]. S. Zeadally, R. Hunt, Y. S. Chen, A. Irwin, and A. Hassan, "Vehicular Ad Hoc Networks (VANETS): Status, Results and Challenges," *Telecommunication Systems*, vol. 50, no. [4], pp. [217–241], **2010**.

[5]. F. Sabahi, "The security of vehicular adhoc networks," in Proceedings of the *IEEE Third International Conference on Computational Intelligence Communication System and Networks*, pp. [238–342], Bali, Indonesia, **July 2011**.

[6]. N. D. Karande and K. K. Kulkarni, "Efficient routing protocols for vehicular Adhoc network," *International Journal of Engineering Research and Technology*, vol. 2, no. 1, **2013**.

[7]. C. Lai, D. Zheng, Q. Zhao, and X. Jiang, ''SEGM: A secure group management framework in integrated VANET-cellular networks,'' *Veh. Commun.* vol. 11, pp. [33–45], Jan. **2018**.

[8]. M. A. Al-Absi, A. A. Al-Absi, M. Sain, and H. Lee, ''Moving ad hoc networks—A comparative study,'' *Sustainability*, vol. 13, no. 11, p. [6187], May **2021**.

[9]. R. A. Nazib and S. Moh, ''Routing protocols for unmanned aerial vehicle-aided vehicular ad hoc networks: A survey,'' *IEEE Access*, vol. 8, pp. [77535–77560], **2020**.

[10]. K. H. Rashmi and R. Patil, ''Survey on cross layer approach for robust communication in VANET,''

Wireless Pers. Commun., vol. 119, no. 4, pp. [3413–3434], Aug. **2021**.

[11]. M. S. Sheikh and J. Liang, ‘‘A comprehensive survey on VANET security services in traffic management system,’’ *Wireless Commun. Mobile Compute*. vol. 2019, pp. [1–23], Sep. **2019**.

[12]. A. Daniel, A. Paul, A. Ahmad, and S. Rho, ‘‘Cooperative intelligence of vehicles for intelligent transportation systems (ITS),*’’ Wireless Pers. Commun*., vol. 87, no. 2, pp. [461–484], Mar. **2016.**

[13]. Wu, X., Subramanian, S., Guha, R., White, R.G., Li, J., Lu, K.W., Bucceri, A., Zhang, T.: Vehicular Communications Using DSRC Challenges, Enhancements, and Evolution. *IEEE Journal on Selected Areas in Communications/Supplement* 31(9), [399–408] (**2013**).

[14]. Singh, P.: Comparative study between Unicast and Multicast Routing Protocols in Different Data Rates Using VANET. In: *International Conference on Issues and Challenges in Intelligent Computing Techniques (ICICT)*, pp. [278–284] (**2014**)

[15]. Kim, Y.K., Kim, I.: Security Issues in Vehicular Networks. *In: International Conference on Information Networking (ICON)*, pp. [468–472] (**2013**)