

Performance and Optimization of MANET Routing Protocols

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ABSTRACT

This paper presents a framework for the evaluation of the performance of proactive and reactive routing protocols in MANET. In mobile ad-hoc networks, local link connectivity information is more important for route discovery and maintenance. Periodic Hello messaging is a widely-used scheme to provide local link connectivity information. According to the local network load density, ASR can help to improve the network performance by adjusting the link distance in the route. Collaborative reinforcement learning (CRL) is a self-organizing technique for building a MANET routing protocol, called SAMPLE. To improve the performance MANET of Routing Protocols “checkpoint” method is propose.

General Terms

Mobile ad-hoc networks, route discovery and maintenance, and routing protocols etc

Keywords

MANET, Performance, Network overhead, Local connectivity, Power/energy saving, Throughput.

1. INTRODUCTION

MANET is the mobile ad hoc network which is the group of wireless nodes that are communicating in localized wireless environment. MANET provides three main routing protocols that are following:

1. Proactive
2. Reactive
3. Hybrid

1. Proactive Routing Protocol.

In proactive routing protocols, every node maintains a list of destinations and updates its routes to send packets to other nodes. When a packet arrives, the node checks its routing table and forwards the packet accordingly.

Other nodes update their routing tables accordingly upon receiving the update packet. Examples of this protocol are

- i. DSDV
- ii. OLSR

2. Reactive Routing Protocol

In reactive routing protocols, nodes maintain their routing tables on a needed basis. This implies that when a new traffic session arrives, nodes have to set up the paths between sources and destinations before start to deliver data packets. The process of path setup is called route discovery. In contrast, another process called route maintenances necessary to find an alternative path if a earlier path was broken. Examples of this protocol are

- i. DSR

ii. AODV

Route Discovery: It is a technique initiated by [1] a node ion the arrival of a new traffic session in order to discover new path to a node j.

Route Maintenance: It is a technique [1] in which a node observed that a link along an active path has broken, such that it can no longer reach the destination node j through that route.

3. Hybrid Routing Protocol

Hybrid routing protocols are new protocol that combine the feature of both proactive and reactive. This protocol is designed to increase the scalability and reduce route discovery overhead. Example of this protocol is ZRP.

This paper provides various existing methods to improve performance of MANET Routing Protocol. And also present the propose method to improve performance by increasing network throughput.

2. BACKGROUND

Several studies and work has done on performance and optimization of MANET Routing Protocols. The performance of routing protocols are depend on the number of various parameter such as packet delivery ratio, throughput, Protocol efficiency, Network overhead, Local connectivity, Power/energy saving, Traffic pattern, Network load density. Various schemes are provide to improve such parameters. There are so many optimization problems are produce when building distributed system. Because in MANET topology, resource and location of nodes are frequently changing over the network. Centralized management is not is viable in this dynamic environment. To address such problem CRL technique was used which allows group of reinforcement learning agents to solve optimization problem in dynamic decentralized network.

3. PREVIOUS WORK DONE

HuiXu,et al.[1]had worked on the behavior of various MANET Routing protocols and provide framework which evaluate performance of routing protocols. SeonYeong Han, et al. [2]proposes an adaptive Hello messaging scheme for neighbor discovery by suppressing unnecessary Hello message. This scheme reduces power consumption and packet overhead without affecting throughput within the overall network. Xiaoxin Wu,et al.[3] shows how network throughput is improved through Adaptive Searching Range (ASR) Algorithm. This Algorithm improves network performance by adjusting link distance in the network. Jim Dowling, et al. [4] provides Collaborative Reinforcement learning (CRL) technique to adaptively optimize MANET Routing protocols. CRL is used as self organizing technique to build MANET routing protocols, called as Sample. It is complex distributed system. Scott Linfoot,et al. [5] has focused on effect of physical and virtual carrier sensing in the

route discovery mechanism in AODV protocol. And also provide characteristics of MANET optimization for AODV protocol. D. G. Reina, et al. [6] provides hybrid broadcast scheme for mobile wireless networks which combine various flooding scheme to reduce overhead produced by broken link.

4. EXISTING METHODOLOGY

There are so many Existing Methods to improve the Performance and optimization of MANET Routing Protocols as follows.

Global Time Division Multiple Access (GTDMA), LocalGeni-TDMA (LTDMA) and Contention –Based MAC: These three methods provide analytical framework [1] to evaluate the performance of routing protocols.

Hello Message scheme: This method was used [2] for neighbor discovery in network which suppress unnecessary Hello message and consumed power supply.

ASR Algorithm: This algorithm provides the method [3] for improving network throughput using Searching Range Adaptation for MANET.

CRL Method: This method provides Collaborative Reinforcement learning (CRL) technique [4] to adaptively optimize MANET Routing protocols. CRL method was evaluated using SAMPLE.

Carrier sensing threshold (CST): This method improves the performance using [5] physical and virtual carrier sensing for avoiding collision or interference in AODV protocols.

5. ANALYSIS AND DISCUSSION

5.1 Analysis of Existing Methods

GTDMA method provide very low throughput and hit the bound of network scalability, while LTDMA method gives good performance. MAC method affects performance of protocols and scalability of network.

Hello message method only save the energy by suppressing unnecessary message but does not reduced the detectability of broken links.

ASR algorithm improves the network throughput and the protocols with ASR algorithm are not more sensitive to mobility than general protocols.

CRL method solve optimization problem using SAMPLE protocol. But sample produce much fewer route discovery and route maintenance than AODV and DSR.

CST method gives better performance but when the CST is small, the signal can be sensed over a large range and the chances of collision or interference are increased.

5.2 Attribute and Parameter Considered

To evaluate the performance of routing protocols following attributes and parameters are include in MANET:

- A. Packet delivery ratio: PDR is defined as the ratio of the number of packets received by the destination node to the number of packets sent by the source node.
- B. End to end throughput: Throughput is defined as the total number of packets which is received by destination node from the sender node divided by the time taken for the destination to receive the last packet.
- C. Normalized Routing Load (NRL): The NRL is defined as the total number of routing packets transmitted for each

transmitted data packet. Examples of routing packets are Hello messages, RREQ, RREP, etc.

- D. End to end delay: The end-to-end delay includes all possible delays caused by buffering during route discovery. Another parameter that affects the network those are.

- Protocol efficiency
- Network overhead
- Local connectivity
- Power/energy saving
- Traffic pattern
- Network load density

5.3 Effect of Outcome of Various Attribute and Parameter

As the number of traffic flow increases, the effect of the energy saving decreases because more number of nodes will participate in sending packets. Increasing the size of the data packets can improve the efficiency of the channel utilization and, therefore, improve the network capacity. Increased packet size leads to a reduction of the optimum link distance. PDR is decreased as number of traffic flow increases.

5.4 How Attribute and Parameter Improved

Hello Messaging or ACK Scheme for Neighbor Discovery in On-Demand MANET Routing Protocols is most popular method to reduce the network overhead and also consumed power or energy. The link distance is adjusted according to network load density which improves throughput.

5.5 Trends of Improvement

Following list include trends of improvement and performance parameter.

- End to end throughput
- Power/energy consumption
- Packet delivery ratio
- Network load density
- Packet overhead
- Channel capacity

5.6 Comparison and Drawback

Proactive protocols have low latency and higher bandwidth. These protocols are requiring to always maintaining route table for every node in network. Reactive protocols have high latency and less overhead. This protocol does not require to always maintaining route table for every node in network it maintain route table on needed basis. AODV and DSR protocol have near optimal packet delivery ratio, while SAMPLE has between 1% to 4% packet delivery ratio. For packet loss rates of up to 20%, the SAMPLE has PDR above 85% and 20% packet loss rates, AODV and DSR have PDR 60% and 10% respectively.

6. PROPOSED METHODOLOGY

The performance of the MANET Routing Protocols is totally depending on the Route Discovery Process. As MANET Routing Protocols are dynamic in nature which mean that the

topology, location of node and resource are frequently change which may breaks the route. Because of these nature route discovery is also changes every time and it will create interference and collision in network about route. Therefore it is difficult to recognize earlier path to send remaining packets. So route discovery process becomes noisy. This paper proposed “checkpoint” method to avoid this problem and rebuild the route. Using checkpoint method broken route will be easily establish and remaining operation will be continue without degrading the network performance and it will also helpful to reduce average network delay. When node 1 send packet to node 2 and after some time node 2 is frequently change due to dynamic nature then route is break and only half packet is send then using checkpoint c1, instead of sending whole packet again it send only remaining packet to node 2 by rebuilding route as shown in figure. Nodes have to maintain route table with destination node and checkpoint c1. In this way, this method reduces delay in sending packet and increasing throughput hence improves the performance of MANET Routing Protocols.

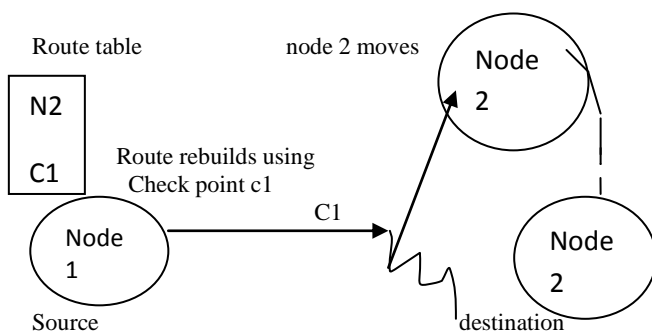


Figure 1: Checkpoint Process

7. EXPECTED RESULT

In this way, this paper presents, how performance and optimization of MANET Routing Protocols is improves. Checkpoint method helps to improve the performance in terms of throughput as it reduce delay time and avoid collision of route in dynamic environment.

8. CONCLUSION

In this way, this paper evaluates the behavior of reactive and proactive MANET Routing Protocols. Each protocol has its own advantages and disadvantages. There are many existing methodology present but still there are some problem are produce in that. So to overcome that problem this paper proposed new method. There are number of parameters to improve the performance of MANET Routing Protocols. So by taking that parameter in mind, this paper tries to improve that parameter. Thus to improve performance of Routing Protocol, “checkpoint” method is propose.

Applications of MANET are

- Emergency rescue.
- Military and low enforcement
- Infantry solders
- Vehicles
- Aircrafts
- In personnel equipment such as mobiles, laptop, earphone, wrist watch etc.

9. FUTURE SCOPE

The main aim of the checkpoint method is to improve the performance by avoiding collision when route was broken. The future work of checkpoint method involves load balancing technique when network load is increases. So it reduce packet overhead of routing protocols and improve the performance.

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