Review Of Energy Efficient Routing Protocols In Mobile Ad Hoc Network

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Abstract

A Mobile Ad-Hoc Network (MANET) is a special types of wireless networks. It consists of a collection of mobile nodes that are capable of communicating with each other without help from a fixed infrastructure. In MANET, the topology of network is contantly changing as nodes move in and out of each other's range, breaking and establishing links. Energy efficiency is one of the main problem in MANET , especialy in desinging a routing protocols. In this paper we study some energy efficient routing protocols for MANET.

Keywords: MANET, Energy Efficient Routing, AODV, DSDV, DSR.

1. Introduction

A Mobile Ad-Hoc Network (MANET) is special types of wireless networks. It consists of a collection of mobile nodes that are capable of communicating with each other without help from a fixed infrastructure. In MANET, the topology of network is constantly changing as nodes move in and out of each other's range, breaking and establishing links. In MANET, mobile nodes come together for a period of time to exchange information. While exchanging information, the nodes may continue to move, and so the network must be prepared to adapt continually.

In the area of MANET, routing is one of the prominent issue which surfaces because of highly dynamic and distributed environment in MANET. The power efficiency in mobile ad hoc network has become is one of the critical design factors as the mobile node will be supported by battery with limited capacity. The failure or degradation of energy in mobile nodes will not only influence the node itself but it will also have impact into its potential to forward the packets on behalf of others and therefore influence the cumulative network lifetime. Hence, majority of the researchers has attempted for designing power aware routing algorithms for specific mobile ad hoc network scenario. Unfortunately, it is in infancy stage as it is still not obvious that which one of the list routing protocols is best for majority of scenarios as every routing protocols is designed to work for only specific environment. But, it is also highly feasible to unite and incorporate the current solutions in order to facilitate maximum power efficient routing techniques.

As power efficiency is vital issue in many order network layers , considerable efforts has already been given for designing power aware MAC as well as transport protocols. Each layer believed to function in remoteness in layered network architecture but, as some current research suggested , the cross layer design is indispensable to exploit the highest power performance .They utilize lesser layer techniques such as transmission energy control and sleep mode methods in their routing protocols [1]. In the protocols the energy efficiency can be achieved by using efficient metric for selection of route such as cost, node energy, and battery level. The energy efficiency is not intended only on the less power consumption, it also focuses on increasing the life time of node where network maintains certain performance level [2].

The need for QoS provisioning grows with the growing interest for real time applications like video conferencing, on-line movies and instant messengers. Providing QoS guarantees in terms of throughput, delay, jitter and packet loss ratio

is very challenging due to mobility of nodes and constrained battery capacity. There exist only a few QoS protocols that support both stability and energy issues during transmission. Following are the performance evaluation metrics that determine the determine the performance of ad hoc routing protocols. These metrics evaluate the energy efficient routing in MANET [3].

Performance Metrics

Packet Delivery Ratio: It is the ratio of number of packets received at the destinations and the number of data packets sent by the sources.

Normalized Control Overhead: It is the ratio of control packets sent and the number of packets delivered at the destinations.

End-End Delay: It is a measure of the average time a data packet has taken to reach its destination.

Variance of node residual energy: This metric is to Calculate the distribution of energy usage among the nodes.

Throughput: Throughput of the routing protocol is that in certain time the total size of useful packets that received at all the destination nodes. The unit of throughput is MB/s .

This paper is organized as follows. Section 2 present related work and ad hoc routing protocols are described in section 3. Some energy efficient routing protocols are briefly described in section 4 and finally in section 5, we present our conclusion.

2. RELATED WORK

The REAQ (Route Stability and Energy Aware QoS) model, proposed for reliable route discovery accounting both stability and residual energy metrics for QoS (Quality of Service) routing. The proposed routing strategy significantly increase the network lifetime and reduces the QoS violation and path breakage, by selecting reliable path for data communication. Simulation results show that REAQ outperforms LEAR (Link Stability and Energy Aware Routing) and RSQR (Route Stability Based QoS Routing) in terms of Packet Delivery Ratio, Control Overhead and delay in highly dynamic environment [3]. As the number of nodes and its mobility levels are increased, AODV performs well in both low and high mobility regions and in the present of ambient noise it yields better throughput level with less delay and consumes less energy. Despite having high routing overhead AODV is able achieve less packets drop when compared to DSR protocol [4].

A unique power aware routing protocol using AODV is presented. In the route discovery process of the proposed scheme, transitional and intermediate nodes estimate the current mean power of the cumulative network as an evaluation threshold to establish how to retort to the received route request packets. An evaluation algorithm to accomplish the network mean residual power is highlighted in [1]. The performance of DSDV and AODV routing protocols for Adhoc networks is evaluated and showed that the overall performance of AODV routing protocol for performance matrices, Packet Delivery Fraction, End to End Delay as well as Throughput is better than that of DSDV routing protocols [5].

A survey on power efficient routing protocols for Mobile Ad-Hoc Networks is presented and suggest one power aware technique which will reduce power consumption as well as increase the lifetime of node and network [2]. The realistic comparison of three routing protocols DSDV, AODV and DSR are performed in [6].

3. AD HOC ROUTING PROTOCOLS

There are number of ad hoc routing protocols that are flat routing, hierarchical routing and geographic positional assisted routing. Flat routing is categorized into two: Proactive routing and reactive routing-

3.1 Proactive (Table driven) Routing Protocol: In proactive routing protocols, every node maintains a list of destinations and updates its routes to them by analyzing periodic topology broadcasts from other nodes. When a packet arrives, the node checks its routing table and forwards the packet accordingly. Every node monitors its neighbouring links and every change in its neighbours results in a topology broadcast packet. That is flooded over the entire network. Other nodes update their routing tables accordingly upon receiving the update packet. In a well-connected network, the same topology broadcast packet could reach nodes multiple times and therefore enjoy a good packet reception probability [5].

The advantage of these protocols is that a source node does not need route-discovery procedures to find a route to a destination node. On the other hand the drawback of these protocols is that maintaining a consistent and up-to-date routing table requires substantial messaging overhead, which consumes bandwidth and power, and decreases throughput, especially in the case of a large number of high node mobility. There are various types of Table Driven Protocols: Destination Sequenced Distance Vector routing (DSDV), Wireless routing protocol (WRP), Fish eye State Routing protocol (FSR), Optimized Link State Routing protocol (OLSR), Cluster Gateway Switch Routing protocol (CGSR), Topology Dissemination Based on Reverse Path Forwarding (TBRPF) [6].

3.2 Reactive (On demand) 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 starting to deliver data packets. The process of path setup is called route discovery. Complementarily, another process called route maintenance is necessary to fmd an alternative path if a former path was broken [5].

Route Discovery: a mechanism initiated by a node i upon the arrival of a "new traffic session" in order to discover a new path to a node}. Node i floods the whole network with route request (RREQ) packets. Upon receiving the RREQ packet, node i sends out a route reply packet (RREP) along the reverse path to i. As a result, node iusually gets a shortest path to node j.

Route Maintenance: a mechanism by which a node i is notified that a link along an active path has broken, such that it can no longer reach the destination node j through that route. Upon reception of a notification of route failure, node i can initiate a route discovery again to find a new route for the remaining packets destined to j. In reactive routing protocols, each node does not maintain routing tables before a routing task is triggered. They only find a route on demand by flooding the network with RREQs, i.e., before sending data packets sender broadcasts router request and initiates a route discovery process. If a link breakage is detected during packet delivery, a new RREQ is generated.

The advantages of these protocols is that source node does not require up-to-date routing table. There are various types of On-demand protocols are the dynamic source Routing (DSR), ad hoc on-demand distance vector routing (AODV).

4. ENERGY EFFICIENT ROUTING PROTOCOLS

4.1 Destination Sequenced Distance Vector Routing

Destination Sequenced Distance Vector (DSDV) routing is a table driven routing scheme for ad hoc mobile networks based on Bellman-Ford algorithm. It eliminates route looping, increases convergence speed, and reduces control message overhead. In DSDV, each node maintains a next hop table, which it exchanges with its neighbors. There are

two types of next hop table exchanges: periodic full-table broadcast and event driven incremental updating. The relative frequency of the full-table broadcast and the incremnetal updating is determined the node mobility[6].

In each data packet sent during a next-hop table broadcast or incremental updating, the source node appends a sequence number. This sequence number is propagated by all nodes receiving the corresponding distance-vector updates, and is stored in the next-hop table entry of these nodes . A node, after receiving a new next-hop table from its neighbor, updates its route to a destination only if the new sequence number is larger than the recorded one, or if the new sequence number is the same as the recorded one, but the new route is shorter. In order to further reduce the control message overhead, a settling time is estimated for each route. A node updates to its neighbors with a new route only if the settling time of the route has expired and the route remains optimal.

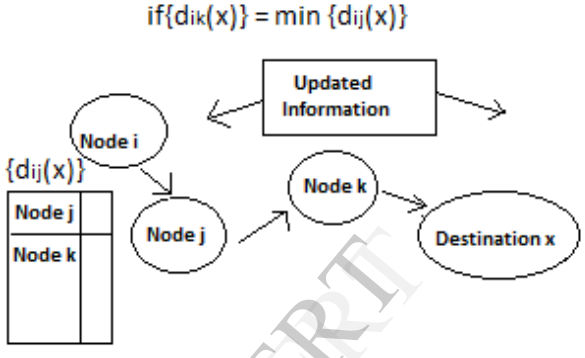

Fig : Illustration of DSDV

4.2 Dynamic Source Routing

Dynamic Source Routing (DSR) is on-demand protocol that is the routes are established only on- demand. It eliminates the concept of table driven strategy. It doesn't use the hello packet to informits neighbors' of its presence. It uses source routing mechanism. To establish tha route it send the route request (RREQ) packet to all node in the network where RREQ is a broadcast packet. After recieving the RREQ packet the intermediate node will broadcast the packet to its neighbors if they have not forwarded already. RREQ packet contains sequence number and the path it travelled on its header. DSR uses a route cache at intermediate nodes [4]. Route cache a memory that store all information extracted from the source route contained in the data packet. On recieving the RREQ it responses to source node with a unicast packet in the reverse pathof RREQ packet. In DSR, one a route is ebtablished between sourece and destination node the sender specifies tha complete path on the packet headerthat the packet need to traverse in that orute to reach the destination. Once the link is broken between nodes route error messages are generated and to all nodes in the network. It maintain multiple routes per destination . In peactical scenario, it consumes more power when compared to AODV protocol.

4.3 Ad hoc On demand Distance Vector Routing

The Ad hoc on demand Distance Vector (AODV) routing algorithm is a reactive routing protocol designed for MANET and is capable of both unicast and multicast routing AODV forms trees which connect multicast group members. The trees are composed of the group members and the nodes needed to connect the members. AODV uses sequence numbers to ensure the freshness of routes. It is loop-free, self-starting, and scales to large numbers of mobile nodes. The AODV protocol uses route request (RREQ) messages flooded through the network in order to discover the paths required by a source node. An intermediate node that receives a RREQ replies to it using a route reply message

only if it has a route to the destination whose corresponding destination sequence number is greater or equal to the one contained in the RREQ. The RREQ also contains the most recent sequence number for the destination of which the source node is aware. A node receiving the RREQ may send a route reply (RREP) if it is either the destination or if it has a route to the destination with corresponding sequence number greater than or equal to that contained in the RREQ. If this is the case, it unicasts a RREP back to the source[5].

A new architecture based on enhancement in AODV is proposed for conducting energy efficient routing in MANET. It achieves the energy information exchange among neighboring nodes through already existed signalling packets in AODV and introduces a new network parameter as the comparison threshold, called current average energy of the network, which can estimated the mean power utilization of the network in this scheme , each intermediate node determines whether to forward RREQ packet by comparingits remaining energy with current mean powerof network. If the energy of node is larger than the threshold, it will forward the RREQ packet immediately. Otherwise, the node will wait for a while to decide whether the packet should be forwarded or dropped according to the number of the identical RREQ packets recieved during the waiting period [1].

5. CONCLUSION

A mobile ad hoc network is a collection of node that can communicate with one another without any fixed networking infrastructure. In this paper we present a survey on ad hoc routing protocols and classified ad hoc routing protocols and gave overview of energy efficient routing protocols .

6. REFERENCES

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