International Journal of Information and Computation Technology.
ISSN 0974-2239 Volume 4, Number 3 (2014), pp. 293-298

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Benefits and Limitations of Existing Energy Efficient Protocol in MANET

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Abstract

Mobile Ad-Hoc Network is infrastructure less network. MANET consists of randomly deployed nodes connected by various links. Important issues in MANET are link failure, power failure of node, limited bandwidth, and limited transmission power. To overcome these problems energy efficient protocol has become a very interesting and important research area. To improve network lifetime, energy balance is an important concern in MANET. In this paper, we investigate the different protocols proposed to resolve the issue of energy consumption of routing nodes in MANET. We provide parameterised study of energy efficient protocols. We discuss and compare these protocols to provide an overview of the latest approaches in the field.

Keywords: MANET, Energy efficient protocols, Routing nodes, Network lifetime.

1. Introduction

The widely deployed mobile ad hoc networks (MANET's) can establish a dynamic network without a fixed infrastructure. A node in MANET's can function both as a network router for routing packets from the other nodes and as a network host for transmitting and receiving data [1]. MANET's are particularly useful when a reliable or fixed infrastructure is not available. MANET's nodes cooperate with each other to achieve a common goal without centralised control. The major activities involved in self-organization are neighbour discovery, topology organization, and topology reorganization. Mobile ad-hoc network has no fixed topology therefore distributed

topology control consists of two factors that are neighbour selection and transmission power assignment [2].

The energy efficient routing is the most important criteria for MANETs, since mobile nodes will be powered by batteries with limited capacity. Overall network lifetime is affected by power failure of a mobile node and its ability to forward packets. This paper compares and classifies energy-efficient routing mechanisms proposed for MANETs. A mobile node consumes its battery energy when it actively sends or receives packets and when it stays idle listening to the wireless medium for any possible communication requests from other nodes. Thus, energy-efficient routing protocols minimize either the active communication energy required to transmit and receive data packets or the energy during inactive periods. The transmission power control [3] approach is used to determine the optimal routing path that minimizes the total transmission energy required to deliver data packets to the destination. Energy management [4] is needed in MANET because: In ad hoc network, fixed infrastructure cannot be deployed. Moreover the nodes in ad hoc networks have limited energy resources as they are battery powered. It is almost impossible to replace the battery or recharge it.

2. Classification of Routing Protocols

MANET can be classified into three categories: reactive protocol, proactive protocol and hybrid protocol.

2.1 Reactive protocol

Reactive routing protocol is also called as on-demand routing protocol. Protocols that fall under this category do not maintain the network topology information. The main idea behind this type of routing is to find a route between a source and destination whenever that route is needed [5].Hence these protocols do not exchange the routing information periodically. Time delay in reactive protocols is greater comparative to proactive types since routes are calculated when it is required. e.g. and Dynamic Source Routing (DSR)[5], Ad-hoc On Demand Distance Vector (AODV)[6].

2.2 Proactive protocol

Proactive protocol is also called as table driven routing protocol. In this every node maintains the topology information in the form of routing tables. Routing information is generally flooded in the whole network. Path finding algorithm is used to determine require route to a destination. The packet forwarding is faster in proactive protocols but the routing overhead is greater because all the routes have to be differentiate before transferring the packets [7]. Routes are maintained at all the times in proactive protocols that cause lower latency .e.g. DSDV [7].

2.3 Hybrid protocol

Protocol belongs to this category combines the best features of reactive and proactive protocols. Nodes within certain distance from the other nodes or within a particular geographical region and said to be within the routing zone of the given node. For

routing within this area, a table driven technique is used. For nodes that are located beyond this area, an on demand technique is used [8]. It refreshes routes of active destinations which would definitely reduce the delay and overhead to improve the performance of the network and node. e.g. Zone Routing Protocol (ZRP)[9].

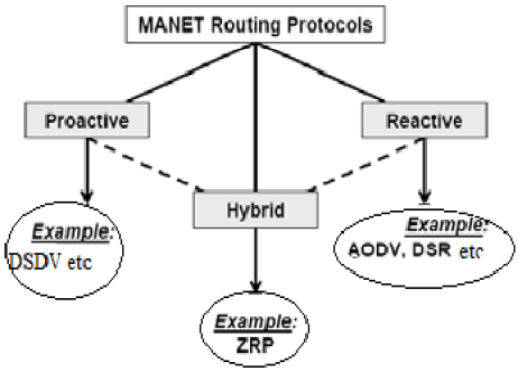

Fig. 1: Classification of Routing Protocols.

3. Benefits and Limitations

3.1 EAODV

EAODV can maintain the benefits of the route cache mechanism and solve its problems by applying the selective route cache mechanism to the route discovery procedure. EAODV is very simple to implement and guarantees compatibility with the AODV, which has already been standardized. Packet Delivery Ratio, Average End-to-End Delay, Normalized Routing Overhead of EAODV is better than that of AODV. Limitation of EAODV is that it has worst packet delivery ratio than DSDV, TORA and DSR has similar packet delivery ratio.

3.2 AODV

The benefit of AODV protocol is that it uses the least congested route instead of the shortest route and it also supports both unicast and multicast packet transmissions even for nodes in constant movement. In AODV, the route which spends less energy and owns larger capacity is selected by synthetic analysis [3].It also responds to the topological changes that affects the active routes. AODV performs better for longer duration of traffic than other protocols [4]. There is also possibility of expiring valid route. The reason behind this is that the nodes are mobile and their sending rates may differ widely and can change dynamically from node to other node. As the size of network increases, various performance metrics begin to decrease. AODV is based on the assumption that all nodes must cooperate and without their cooperation no route can be established. Hence AODV is vulnerable to various kinds of attacks. The limitation of AODV protocol is that it requires that the nodes in the broadcast zone can detect each others' broadcasts. It may be possible that a valid route is expired and expiry time is difficult to determine. The reason behind this is that the nodes are highly mobile and their sending rates differ widely and can dynamically change from node to

node. In addition, as the size of network increases, various performance metrics begin decreasing.

3.3 DSDV

It removed the shortcomings of contemporary distance vector protocol which was not suited for ad-hoc networks. Sequence number is used to avoid loop freeness. Due to avoidance of loop freeness it reacts immediately on topology changes which provide the availability of route to destination. In DSR, TORA, AODV routes are not always available to destination. Traffic load and time delay are the two limitations of DSDV as it support to low density network.

3.4 DSR

This protocol uses a reactive approach which eliminates the need of periodically flood the network with table update messages [7]. In reactive approach route is established only when needed. The disadvantage of this method is that the route maintenance mechanism does not locally repair a broken link.DSR is not scalable to large networks and also it need more resources to accomplish its task than that of other protocols [5]. To obtain the routing information in DSR, every node must spend lot of time to process any control data it receives, even if it is not the recipient node.

3.5 TORA

The Temporally Ordered Routing Algorithm (TORA) is a highly adaptive, well-organized and scalable distributed routing protocol as compare to other routing protocols. Multiple routes are maintained between source and destination in TORA. Hence it is easy to detect the failure node. The dependence of this protocol on intermediate lower layers for certain functionality presumes that the link status sensing, neighbour discovery, in order packet delivery and address resolution are all readily available[7]. Limitations of TORA are it can undergo from unbounded worst-case convergence time and protocol responds when all the routes to destination are lost.

Table 1: Comparison of Routing Protocols.

Protocol	Route	Route Selection Criteria	End to End Delay	Energy Consumption	Throughput
EAODV	Single	Shortest Path	0.2 s	0.16	9.6
AODV	Single	Shortest Path	0.2 s	0.12	9.3
DSDV	Multiple	Link stability	0.18 s	0.08	6.6
DSR	Multiple	Shortest Path	0.2 s	0.12	9.7
TORA	Multiple	Shortest Path	0.28 s	0.07	6.0

4. Conclusion

This paper discusses parameterized study of energy efficient protocols and how energy is one of the most important constraints for networks such as MANET. In this paper

we have study benefits & limitation of various routing protocols for energy management in MANET by representing three main parameters that are energy, delay and throughput. We have concluded that we can use the particular protocol according to our requirement. But as the MANNET covers the very vast area it is applicable to both small and large scale area but none of the above protocol satisfies the criteria. So there is a need to develop an adaptive energy efficient routing protocol which is suitable for Mobile Ad-Hoc Network and also reduce the cost.

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