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Review of Power Consumption for AD-HOC Network

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Abstract-**Mobile AD-HOC network communication at the mobile nodes can be achieved by using multiple wireless networks. In ad hoc network is to find valid routers between two communication nodes for power consumption. This protocol must be handling highly mobility the nodes which often cause in change of the network topology. This paper evaluates for ad hoc network protocols DSDV, AODV, DSR and TORA indifferent network scales taking into consideration the mobility.**

In this paper we are introduce the notion of power consumption within the context of wireless ad hoc networks. We are find out that more specifically the effect of using different transmit powers on the average power consumption and end to end network thought in a wireless ad hoc network. This paper about the power consumption approach would help in reducing the system power and hence prolonging the battery life of mobile network. This improves the end to end network as compared to other ad hoc network because that is a very big problem in mobility for same transmit power. Those are high improvement due to the achievement a trade-off between minimizing interference ranges, reduction in the average number of hope to reach a destination, the probability of having isolated clusters and average number of transmission. Minimum power routing is used to further enhance performance .Simulation studies are carried out in order to investigate these deign approaches. It is seen a network with such a power managed scheme would achieve a better throughput performance and lower transmit power then a network without problem in ad hoc network.

Keywords— Ad-Hoc network with Power Saving Mode, Energy Conservation, Battery Power consumption, Receiving Energy and Remaining Energy.

1. Introduction

As a result of the rapid technological advances on electronic, sensor and communication technologies, it has been possible to produce unmanned aerial vehicle (UAV) systems, which can fly autonomously or can be operated remotely without carrying any human personnel? Because of their versatility, flexibility, easy installation and relatively small operating expenses, the usage of UAVs promises new ways for both military and civilian applications.

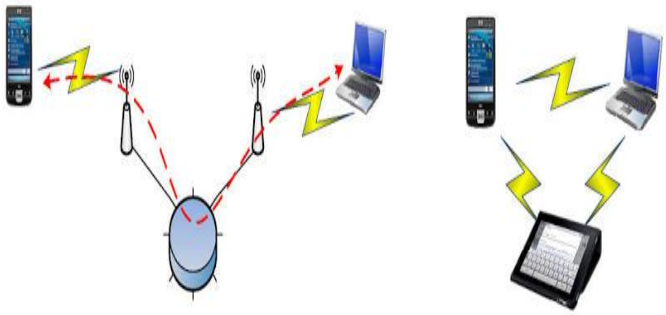

Figure: AD-HOC Network

Along with the progress of embedded systems and the miniaturization tendency of micro electro mechanical systems, it has been possible to produce small or mini UAV sat a low cost. However, the capability of single small UAV is limited Coordination and collaboration of multiple

UAVs can create a system that is beyond the capability of only one UAV. The advantages of the multi-UAV system scan are summarized as follows:

Cost:

The acquisition and maintenance cost of small UAVs is much lower than the cost of a large UAV.

Scalability:

The usage of large UAV enables only limited amount of coverage increases. However, multi UAV systems can extend the scalability of the operation easily.

Survivability:

If the UAV fails in a mission who is operated by one UAV, the mission cannot proceed. However, if a UAV goes off in a multi-UAV system, the operation can survive with the other UAVs.

Speed-up:

It is shown that the missions can be completed faster with a higher number of UAVs

Small radar cross-section:

Instead of one large radar cross-section, multi-UAV systems produce very small radar cross-sections, which is crucial for military applications.

More than a decade the research community has been quite intensively studying the mobile ad hoc networks, popularly known as MANETs. The great vision since the beginning of their development has been to create autonomous and
Self-organizing network without any pre-established infrastructure or centralized administration. This enables the randomly distributed nodes to form a temporary functional network and support seamless leaving or joining of nodes. A tremendous amount of work has been done towards solving research problems.

Related to wireless ad hoc networks and references there in. Although a considerable amount of successful research is done, especially when considering military ad hoc networks, the deployment of large-scale (massive) ad hoc networks in the civilian context has been limited to very few cases. There are certainly many reasons for this lack of commercial success, one of those being that the time has not been ripe for ad hoc networking, and certainly many practical engineering problems have been underestimated during the first phase of enthusiasm. In certain sense all wireless digital communication requires cooperation as the systems are required to share resources, and at the very least the end-to-end
Hosts need to have transmission systems and protocols that are compatible, and somehow standardized. The requirement for cooperation in the case of ad hoc systems, however, is a very stringent one and is present at all system levels.

These challenges have not always been foreseen in the right context. There are many excellent treatments available today, and we refer the reader for example to the excellent book by Siva Ram Murthy & Manoj, one should look also other recent reviews. This chapter is a quick glance to main issues that one must take in account, when one is designing multichip, ad hoc networks. Our subtitle “from theory to practice” is emphasizing the goal to understand the realistic limitations that we encounter with the present day multihop MANET approaches. One of the key issues is to stress the fact (that was not
Cooperation in Ad-Hoc Networks 191 entirely new insight for the first generation packet network researchers, but has sometimes been not valued enough) that routing itself is not the only problem for multi hop wireless ad hoc networks. In fact, for guaranteeing reasonable quality of service, one need to consider many other aspects than routing, and depending on the chosen transmission and network layer technologies, there are always Limits on how many hops and what level of mobility can be supported. This statement is very much a practical engineering based, i.e., regardless of some asymptotic, theoretical limits that are derived on ad hoc capacity, in practice, when one is deploying real systems (at least with the foreseeable technology) there are limits for ad hoc network practicality even in the capacity domain.

Due the chosen “practicality” -theme, we are mostly considering only IEEE 802.11 -type of deployment scenarios in our examples. This is done on purpose as most of the practical experimentation is done by using Wi-Fi-systems. However, this is also a limitation of this chapter, which we are wholeheartedly admitting.

In the following, we start with the quick review on some useful historical facts, and also give some framework suggestions for our work. We are also commenting some possible interesting research domains that may become more important in the future. After the introduction part, we progress on analyzing the case of multichip wireless ad hoc networks, especially

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in IEEE 802.11 context. This work is mostly based on the wireless mesh (low mobility) case, and we have chosen to use mostly experimental treatment from our and

Others' previous research work. Finally, we progress from the multichip capacity work towards some more recent possibilities, such as showing how distributed coloring algorithms and topology control can be used in the wireless ad hoc. We are also specifically commenting as requested by editors on possibility to have ad hoc networks as a part of "4G infrastructure" in the future.

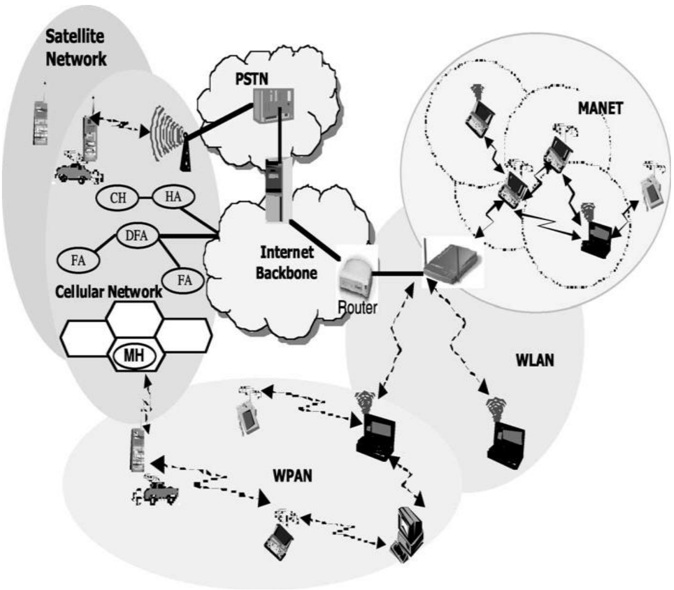

Figure.-4G-Networks

II. Literature Survey of Energy Consumption

A mobile ad-hoc network is an autonomous collection of mobile nodes that communicate over bandwidth constrained wireless links. Ad-hoc network is operated with battery. Energy consumption control is serious problem in mobile ad-hoc network. Literature review focus on energy saving by route discovery, Energy saving by transmission power, Energy Saving by transmission range and energy saving by energy management model.

2.1 Energy saving by route discovery

Energy saving have described reactive protocol to find a short route to the destination. J. Jun et al. have explained that capacity of a wireless link may be degraded over time due to multi-path fading, noise and signal interference. Tseng et al. have presented power saving protocol, which supports low-power sleep mode to operate across multiple hops. Sungwon et al. have described that diffusive behavior of mobile nodes should be correctly captured and taken into account for the design and comparison study of network protocols. Toh has mentioned that simulation environment may used to analyze the power consumption control in mobile ad-hoc networks. Krishnamurthy et al. have described throughput-oriented based transmission power control schemes to use per-packet power consumption control.

It is observed from literature survey that mobile ad-hoc network arbitrarily motion of nodes results in unpredictable and frequent topology changes.. Hence, routing paths in mobile ad-hoc networks contain multiple hops, and each node in mobile ad hoc networks has the responsibility to act as a router. Because of the importance of routing protocols in dynamic multi-hop networks, a lot of mobile ad hoc network routing protocols have been proposed in the last few years.

2.2 Energy saving by transmission power

Energy saving have described that distributed power control scheme is used to save transmitter power per bit in data transmission. Lee et al. have focused on joint opportunistic power scheduling and end-to-end rate power consumption control scheme to save power for wireless ad-hoc network .Charya et al. have described that dynamic selection of the nodes consumes less power and the network never fails. Chunhua et al. have stated that novel constrained entropy-based multi path routing algorithm is used to reduce the number

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of route reconstruction so as to provide quality of service guarantee and save power in the ad-hoc network. Rodoplu et al. have described power consumption control scheme, which is used for the purpose of energy using the link distance in the routes.

It is observed from survey that saving in large network. Wu et al. have proposed power consumption control protocol, which uses one control channel and multiple data channels.

It is observed from this survey that high transmission power on a link may improve the quality, throughput on that link and increase the levels of interference on other links. A decrease in the transmission power can have the opposite effects. Practically from experimental data, identify three interference scenarios:

a) The overlapping case, where the aggregate throughput is achievable with two overlapping links. Aggregate throughput is not affected by power control.

b) The hidden terminal case, where proper power control can primarily improve fairness and power control.

c) The potentially disjoint case, where proper power control can enable simultaneous transmissions and thus improve throughput. Quality of signal transmission is also maintained by power control in a network. In the overlapping case, power control does not increase the maximum achievable throughput. In the hidden terminal case, power control improves the throughput.

2.3 Energy saving by transmission range

Tseng et al. have explained about power level at which nodes in transmission range can receive and decode packet correctly. Dan Avidor et al. have proposed the distribution of the transmit power of individual nodes under different topology control algorithms to save power in network. Song et al. have presented the minimal achievable broadcast energy consumption scheme to save energy in network. Jang et al. have stated that joint power scheduling and rate control algorithm is used to increase the life time of network. Mumtaz et al. have described about quality of service and power control by using node disjoint multi path routine. Abusalah et al. stated that ad-hoc networks have to meet the requirements like confidentiality, integrity, authentication, non-repudiation and availability. It is observed from survey that radio transmission range as a system parameter affects the energy consumption economy of wireless ad-hoc networks.

On the one hand, a large transmission range increases the expected progress of a data packet toward its final destination at the expense of higher energy consumption per transmission. On the other hand, a short transmission range consumes less per transmission energy, but requires a larger number of hops for a data packet to reach its destination.

2.4 Energy saving by energy management model

It is observed from survey that radio transmission range as a system parameter affects the energy consumption economy of wireless ad-hoc networks.

On the one hand, a large transmission range increases the expected progress of a data packet toward its final destination at the expense of higher energy consumption per transmission. On the other hand, a short transmission range consumes less per transmission energy, but requires a larger number of hops for a data packet to reach its destination. Function dealt with both MAC layer and network layer. It could not determine the remaining energy of node for network lifetime. Nyayate et al. have proposed protocol, which is used the concept of bounded wait state to reduce power consumption and at the same time improve the fairness in the network. The overall network connectivity depends on the battery life. Vijay et al. have described position based routing, in which node mobility and position error also

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affects the network performance. Kumar et al have stated that optimized link state routing protocol is efficient for large and dense networks.

This section describes the some of the existed research on the remaining energy of nodes and network lifetime in the mobile ad-hoc networks. Previous researchers have ignored power consumption control problem in the mobile ad-hoc networks.

It is observed from literature review that On-demand power management frame work is not effective for large size network due to dynamic configuration of network. Powers saving algorithms are not effective in case of high speed dynamic network. Ad-hoc medium access layer cannot maintain quality of service with low transmission power. Multiple input multiple output communication system could not maintain lifetime of network. Network efficiency could not improved by using routing algorithm. Power control is not maintained by power.

III. Types of MANET Routing Protocols

The MANET routing protocols [5] are mainly developed to maintain route inside MANET, and they do not use any access points to connect to other nodes in the network and Internet. Routing
Protocols can be classified into three categories depending on their properties. The classifications are:

- Centralized versus Distribute
- Static versus Adaptive
- Reactive versus Proactive

- Table 1:-

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LITERATURE REVIEW

Topic Name	Protocol	Description	Mechanism / Algorithm	Methodology	Performance / QoS
A Novel Energy-Efficient Approach to DSR Based Routing Protocol for Ad Hoc Network	NCE-DSR	NCE-DSR calculate the cost function by considering two values Mean and Max for elongate the duration of network lifetime	Number of times send Constraint Energy DSR	Route selection using cost function	Energy consumption, Hardware overhead, Network lifetime
Energy-Efficient Reliable Routing Considering Residual Energy in Wireless Ad Hoc Networks	RMECR, RMER	New routing protocol use genetic routing algorithm which calculate the MECP between every two nodes of the network	Genetic Routing Algorithm	Energy reduction using MECP (Minimum Energy Cost Path)	Energy efficiency, Reliability, Network lifetime, End-to-end delivery
Efficient Routing Algorithm for MANET using Grid FSR	Grid FSR	GFSR partitioning the network in two dimensional virtual grid and select the best gateway through minimum distance between virtual grid and node	Fisheye State Routing Algorithm	Path selection by choosing alternative gateway in grid	Bandwidth

In centralized algorithms, all route choices are made by a central node, while in distributed algorithms, the computation of routes is shared among the network nodes. In static algorithms, the route used by source destination pairs is fixed regardless of traffic condition. It can only change in response to a node or link failure. This type of algorithm cannot achieve high throughput under
a broad variety of traffic input patterns.

IV. Description of selected Routing Protocols

- TORA:

TORA routing protocol is based on “link reversal” algorithm. Every node has information regarding it adjacent nodes.

In this way TORA provides multiple routes for any pair of nodes. Moreover it has the ability to quickly follow the topological changes that may occurred and re-create valid routes. Hence when a node
Seeks a route to a given destination it sends a QUERY message which includes the address of the destination node. This packet travels through the network until it reaches the destination or an

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Intermediate node that has a route to the destination node. The receiver node then broadcasts an UPDATE packet listing the number of direct links that has been used in order to reach the destination.

As this node propagates this UPDATE information packet through the network, each node updates its list by adding another pair of nodes (source-destination). This creates a series of directed links

From the node that originated the QUERY to the destination node. When the node finds a specific destination which is unreachable, it sets a local maximum value of direct links for that destination. If there is a network partition then the node sends a CLEAR message that resets all routing states and removes invalid routes from the network. TORA operates on top of Internet MANET Encapsulation Protocol (IMEP) providing reliable delivery of route-messages and informs the routing protocol of any changes to the links to its neighbors. IMEP tries to aggregate IMEP and TORA messages into a single packet (called block) in order to reduce overhead. For link-status sensing

And list maintenance, IMEP sends out periodic BEACON messages which are answered by each node that hears it with a HELLO reply message.

- DSDV: In DSDV protocol messages are exchanged between nearby mobile nodes (i.e. mobile nodes that are within range of one another). Routing updates may be triggered or routine. Updates are caused when routing information from one of the neighbors forces a change in the routing table. If there is a packet which the route to its destination is unknown it is cached while routing queries are sent out. The packets are cached until route replies are received from the destination. The buffer has a size and time limit for caching packets beyond which packets are dropped. All packets which have destination to the mobile node are routed directly by the address dmux (dmux port hands the packets to the respective destination agents) to its port dmux. In the event that a target is not found (which happens when the destination of the packet is not the mobile node itself), the packets are forwarded to the default target which is the routing agent. The routing agent designates the next hop for the packet and sends it down to the link layer.
- DSR:

  In DSR [2] protocol the agent checks every data packet for REPLY which contains the number of hops that are require to reach the destination. All nodes that participate in forwarding this reply to the source node create a forward route to destination. This route created from each node from source to destination is a hop by-hop state and not the entire route as in source routing.

V. Result of the Power Consumption

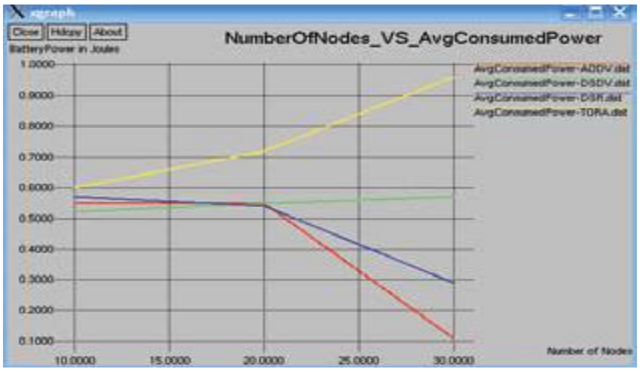

Figure1. The average consumed power versus the number of nodes using 30 nodes.

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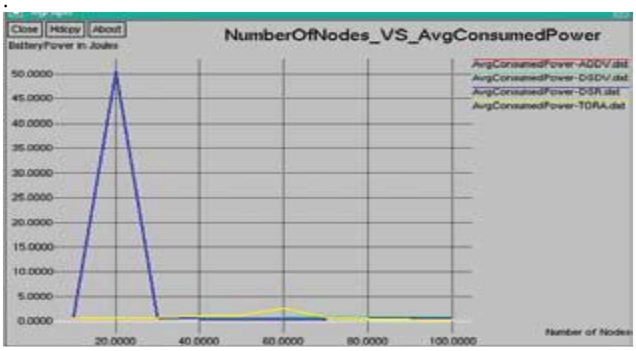

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Figure 2. The average consumed power versus the number of nodes using 100 nodes.

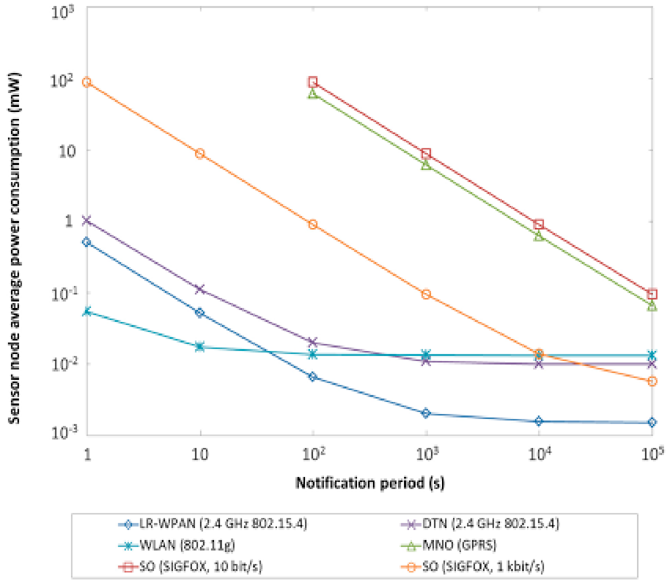

Figure 3. Power consumption in sensor node

Figure 1 shows that the consumed power of networks using AODV and DSR decreases significantly when the number of nodes exceeds 20. On the contrary, the consumed power of a network

Using the TORA protocol increases rapidly whilst that of DSDV based network shows stability with increasing number of nodes

Figure 2 depicts that the remaining power when DSR protocol is decreases significantly when the number of nodes is 20, whilst the other three protocols have the same behavior.

VI. Energy Consumption in Multihop

The nodes in a mobile ad hoc network rely on batteries for proper operation. Since they need to relay their messages through other nodes toward their intended destinations, depletion of the batteries will have a great impact on the overall network performance. Especially if the power consumption rate is not evenly distributed across all nodes, some nodes may expire sooner than others

Leading to partitioning of the network.

Increasing the lifetime of each node is a rather complex process and can be done at different layers. The so-called non-communication power consumption is very dependent upon the actual hardware implementation. Further on an adaptive power control at the physical layer can help to conserve the battery life of the hosts. On the other hand, data link and routing protocol design can

also significantly impact the processing and the transceiver power dissipated in wireless communication. At the data link layer, energy conservation can be achieved by using effective retransmission schemes.

VII.Energy conservation

Mobile devices rely on batteries for energy. Battery power is finite, and represents one of the greatest constraints in designing algorithms for mobile devices. Projections on progress in battery technology show that only small improvements in the battery capacity are expected in next future. Under these conditions, it is vital that power utilization be managed efficiently by identifying ways to use less power, preferably with no impact on the applications. Limitation on battery life, and the additional energy requirements for supporting network operations (e.g., routing) inside each node, make the energy conservation one of the main concern in ad hoc networking. The importance of this problem has produced a great deal of research on energy saving in wireless networks in general, and ad hoc networks in particular. Strategies for power saving have been investigated at several levels of a mobile device including the physical-layer transmissions, the operating system, and the applications points out battery properties that impact on the design of battery powered devices.

VIII. Benefits and Limitation

As the entire route is contained in the packet header, there is no need of having routing table to keep route for a given packets. The caching of any initiated or overheard routing data can significantly reduced the number of control message being sent, reducing overhead. But DSR is not scalable to large networks. The internet draft acknowledges that the protocol assumes that the diameter of the network is not greater than10 hops. Additionally DSR requires significantly more processing resources than most of other protocols. The other drawback of DSR is selecting the path for routing on the basis of minimum hop counts from the source to the destination. As it selects the path of having minimum hops count, lesser will be the number of intermediate nodes, more will be the distance between each pair of nodes. As the distance is more we need to have more transmission power to communicate between any pair of nodes and hence it consumes more battery power as it is one of the limited resources.

IX. Conclusion

Communication is one of the most challenging design issues for multi-UAV systems. In this paper, ad hoc networks between UAVs are surveyed as a separate network family, Flying Ad-hoc Network (FANET). We formally define FANET and present several FANET application scenarios. We also discuss the differences between FANET and

Other ad hoc network types in terms of mobility, node density, topology change, radio propagation model, power consumption, computational power and localization. FANET design considerations are also investigated as adaptability, scalability, latency, UAV platform constraints, and bandwidth. We provide a comprehensive review of the recent

Literature on FANETs and related issues in a layered approach. Furthermore, we also discuss open research is- sues for FANETs, along with the cross-layer designs. The existing FANET test beds and simulators are also presented. To the best of our knowledge, this is the first article which surveyed flying ad hoc network as a separate ad hoc network family. Our main motivation is to define multi-

UAV ad hoc network problem, and to encourage more researchers to work for the solutions to open research issues as described in this paper.

As there are many energy efficient routing protocols exist, it is very difficult to compare them directly since each method has different assumptions and has different means to achieve the goals. For example to reduce the power consumption we can go for dynamic adjustment of transmitting power at each node. But due to mobility it may suffer from network partition as any node moves away from another node. DSR routing protocol has provided the basic for any energy efficient routing protocols where by modifying its structure of control packet and considering some new energy matrices power consumption can be reduced.

This study has evaluated four ad-hoc routing protocols in different network environment taking into consideration node mobility. Overall, the findings show that the energy consumption and

Throughput in small size networks did not reveal any significant differences. However, for medium and large ad-hoc networks the TORA performance proved to be inefficient in this study. In particular,

The performance of AODV, DSDV and DSR in small size networks was comparable. But in medium and large size networks, the AODV and DSR produced good results and the performance

Of AODV in terms of throughput is good in all the scenarios that have been investigated.

Whilst experimenting with TORA in ns2, TORA seems to be providing poor performance which is very controversial to the theoretical expectations. Finding the reason for this poor behavior's and correcting it is not simple. It is

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more than complex that of writing a new protocol.

X. Acknowledgments

We thank Prof. Ian F. Akyildiz for his constructive feedbacks and suggestions. We also would like for her valuable comments. It is very difficult to conclude which one of the protocol is the best among all energy efficient routing protocols, because all these protocols are based on different methodologies, performances matrices, different implementation environments and different techniques. But all these protocols have proved that they are better than the DSR routing protocol. Still many scopes are there in DSR to add on new functionally and to modify the basic mechanism of DSR as an Energy Efficient Routing protocols.

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