International Journal For Technological Research In Engineering *ISSN (Online): 2347 - 4718*
National Conference on Importance of Inter-disciplinary Studies in Higher Education in the areas of Engineering, Science, Management and Humanities
(February – 2018)

A SURVEY OF ENERGY EFFICIENT ROUTING TECHNIQUES AND RELATED CHALLENGES IN MANET

Luv Sharma[1], Dr. Pranay Joshi[2], Mukesh Sharma[3], Deepak Tak[4]
Department of Electronics & Communication Engineering , SS College of Engineering, Udaipur, Rajasthan, India.

Abstract: MANET is a type of infrastructure less wireless communication technology. MANETs are widely used in the worst case scenario and in military applications. There is several design issues are considered in MANETs such as power management, QOS, multicasting etc. In this paper we are representing a brief survey regarding the power related issues and energy management issues such as routing techniques. Because power consumption is the one of the most important design issues in MANET.
Keywords: MANET, Energy management, Routing, design issues.

I. INTRODUCTION

In last few decades wireless communication network is one of the fast growing technology that allow the users to access the services and information electronically regardless their electronic position. Ad-hoc is a Latin word which means "for this purpose". The term "Ad-hoc" tends toimply "can take different forms" and "can be mobile, stand alone, or networked."[2]. MANET is a type of Infrastructure less wireless communication technology. Ad-hoc network may be also defined as: "An Ad-hoc network is a collection of two or more devices equipped with wireless communications and networking capability."[2]. MANET is a type of distributed control wireless network and is self-organized, self-configured wireless network. In MANET mobile nodes are connected by means of wireless link. MANET supports the dynamic network topology. Ad Hoc wireless network has applications in [4]

- Emergency search and rescue operations
- Decision making in the battlefield
- Data acquisition operations in hostile terrain, etc.

Challenges:

- Dynamic topology
- Multi-hop communication
- Limited resources (bandwidth, CPU, battery, etc.)
- Limited security

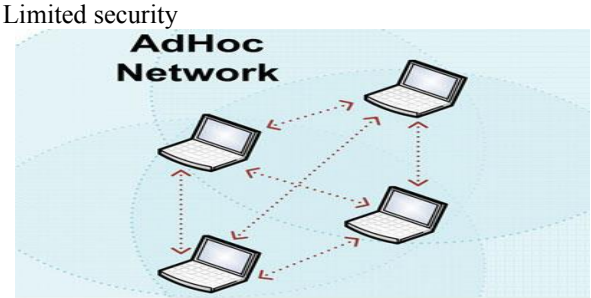

Figure 1 Example of Ad-hoc networks

Figure 1 shows an example of Ad-hoc networks. In this example communication between four computers is shown.

II. ENERGY MANAGEMENT

Since the mobile nodes are battery operated in MANET so the energy management is one of the crucial design concerns in MANET. In MANET each and every process consumes power. To increase the life time of nodes as well as network energy management is necessary. In MANET Power management is done at different level for example MAC layer, Network layer etc. In this paper we are concentrating on network layer energy issue and related problems and the routing protocols that are used to increase the life time of node during the transmission and reception of data packets. Energy management may be defined as "The process of managing the energy of the sources and consumers in a node or in a network as a whole for enhancing the life time of the node". [1]. As we know that, if the energy efficiency is higher than more number packets can be transmitted by the node with the given amount of energy. Need of energy management.[1]

- Problem in battery replacement
- Lack of centralized control
- Selection of optimal transmission power

III. ENERGY/ POWER CONSUMPTION MODE IN MANET

There are four important power components [5] through which a wireless network.
The four power components states are following:-
A. Transmission Power
B. Receiving Power
C. Idle Power
D. Over hearing Power

Transmission Power

Whenever a node sends a data packet to other nodes in the network, it requires some amount of energy for its transmission, such amount of energy is known as Transmission Energy of that node. [6] Transmission Energy depends on the size of the data packet. On sending the data Packet, some amount of power is consumed.
The transmission energy of a node can be written as,

$$T_x = \frac{(330 \times P_{length})}{2 \times 10^6}$$

Also transmission power can be written as

$$P_T = T_x/T_t$$

Where,

$T_x = Transmission\ energy$

$P_T = Transmission\ power$

$T_t = Time\ taken\ to\ transmit\ a\ data\ packet$

$P_{length} = Length\ of\ the\ data\ packets\ in\ bits$

Reception Power

Whenever a node a data packet from other nodes then some amount of energy is taken by the node to receive data packet, known as reception energy (R_x). [6]

On receiving the data packet some amount of power is consumed.

Reception energy can be written as,

$$R_x = (230 \times P_{length\ h})/\ (2 \times 10^6)$$

Also reception power can be written as,

$$P_R = R_x / T_r$$

Where $R_x = Reception\ energy$

$P_R = Reception\ power T_r$

$= Time\ taken\ to\ receive\ a\ data\ packet$

$P_{length\ h} = Length\ of\ the\ data\ packet\ in\ bits.$

Idle Power

In the situation of idle power mode, a node neither transmits nor receives any data packets. Power is consumed because it needs to listen to the wireless medium continuously in order to detect a data packet that it should receive.

Idle power is wasted power that should be eliminated or reduced to minimum [6]

Idle power can be written as

$$P_i = P_r$$

Where, $P_i = Idle\ power$

$P_r = Reception\ power$

Overhearing Power

In this case a node picks up the data packets that are destined to the other nodes and this is called over hearing . It may consume power. And the power consumption during this stage is called as over hearing power .Over hearing power can be written as,[6]

$$P_{over} = P_r$$

Where, $P_{over} = Over\ hearing\ power$

$P_r = Reception\ power$

IV. ENERGY/POWER EFFICIENT ROUTING TECHNIQUE

To increase the life time of a network, we should have to minimize the node energy not during active communication but also when they are in inactive state. There are following energy/power aware routing approaches that are used to minimize the energy of a node during active and inactive state. [7]

Table -1: Energy/power efficient routing protocols technique

Condition	Name of Approach	Purpose
Minimize Active Communication Energy	Transmission Power Control Approach	The total transmission energy is minimized by avoiding low energy nodes.
	Load Distribution Approach	Distribute load to energy comfortable nodes.
	Power Management Approach	Minimize the energy consumption by using separate channels for data and control
Minimize Inactive Energy	Sleep/Power Down Approach	Minimize energy consumption when node is in idle state.

V. POWER SAVING TECHNIQUES AT DIFFERENT PROTOCOL LAYERS

The Power saving techniques used at different protocols layers are given below in given table.

Table 2 Power Saving Techniques at Different Layers [2]

Protocol Layer	Power Saving Techniques
Data Link Layer	Avoids unnecessary transmissions.
	Avoids Collisions in channel access whenever possible.
	Turn off when not transmitting or receiving.
Network Layer	Consider route relaying load.
	Consider battery life in route Selection
	Optimize size of control overheads.
	Efficient route reconfiguration techniques.
Transport Layer	Avoid repeated retransmissions
	Handle packet loss in localized manner
	Use power efficient error control schemes
Application Layer	Adopt an adaptive mobile quality of (Qos) frame work.

VI. POWER/ENERGY AWARE METRICES

The main objective of power aware metrices is to carefully share the cost of routing which will ensure that node and network life increases. I.e. most of the energy efficient routing protocols for MANET try to reduce energy consumption by means of an energy efficient routing metric used in routing table instead of the minimum hop metric.

These power aware metrics [8] result in power efficient

routes, which are detailed below.
A. Minimize energy consumption per packet
B. Minimize cost per packet
C. Minimum variance in node power levels
D. Maximize network connectivity

Minimize Energy Consumption Per Packet [1]

An efficient method that conserves power efficiently.

Let us assume the some packet j traverses $n_1, n_2 \dots \dots \dots \dots n_k$ nodes.

Where

$n_1 = Source\ node$

$n_k = Destination\ node$

Let T (a, b) denotes energy consumed in transmitting and receiving are packet over one hop from a to b.

Energy consumed for packet j can be written as

$$e_j = \sum_{i=1}^{k-1} T(n_i, n_{i+1})$$

The energy consumption is the sum of power consumed on every hop in the path from packet. power consumption on a hop is a function of the distance between the neighbor and the load of the hop[18] .It is useful for shortest distance.

Minimize Cost per Packet

This metric is used to maximize the life of all nodes in the network. The path selected using this metric should be such that nodes with depleted power serves do not lie on many paths. Basically it minimizes the maximum cost per nodes for a packet after a specific period. [9]

Minimum Variance in Node Power Level

In this metric, load is distributed among all the nodes , hence power Consumption remains same form to all nodes.The problem is very complex when the route and size of data packets vary. When node has the same level in power then the network function longer. [1]

Maximize Network Connectivity

It attempts to balance the routing load among all the nodes in the network. It assumes significance in environments where network connectivity is to be ensured by uniformly distributing the routing load. [1]

VII. ENERGY/POWER AWARE ROUTING

Routing in MANET is unique due to the following reason
A. Energy of node is battery dependent
B. Due to mobility of nodes frequent failure of routes
C. Variation in the bandwidth of channel.

Energy aware routing is the best solution to these problems. [9] Main aim of energy aware routing protocols is to reduce energy consumption during the transmission of packets between source and a destination through, and avoid routing of packet through nodes with low energy, to optimize flooding of routing information over network and to avoid interference and medium collision.

VIII. CONCLUSION

As we know that the node in MANET is battery orientated and consumes power whenever they are active or inactive. So to increase the life time of a node it is necessary that power consumption may be reduced during active and in active communication mode. In this paper we have produced some techniques and approaches that are useful in conservation of power. As we see that it is one of the emerging fields in wireless infrastructure less communication network so it more advanced required in the designing of network and system. Therefore more research are required in the field of power management.

REFERENCES

[1] C. Siva Ram Murthy, B. S. Manoj. “Ad-hoc Wireless Networks”, Architecture and Protocols. Pearson Publication Fifteen Impression, Fourteen Impressions, 2012J

[2] C. K. Toh “Ad-hoc Mobile Wireless Networks”, Protocols and System.Prentice Hall,2002.

[3] C.E.Perkins, “ Ad-hoc networking”, Addison Wesley , 2001.

[4] Sirisha Medidi and Peter Cappetto, “History Based Route Selection for Reactive Adhoc Routing Protocols” . 15 th IEEE International Conference on Networks, 10. 1109/ ICON 20074444056 19-21 November 2007.

[5] K. Arunlanandam and B. Parthasarathy, “ A New Energy Level Efficiency Issues in MANET” IJRIC PP 104-109, 2009.

[6] Ankit Bhardawaj, Divya and Sanjeev Sofat , “ An Efficient Energy ConservationScheme for IEEE 802.11 Ad-hoc Networks” IEEE Vol 3 Issue 7 2007.

[7] Mrs.Suganaya Senthal, Dr Palanammal Sennappan, “ A Detailed Study on EnergyEfficient Techniques For Mobile Ad –hoc Networks.” IJCS International Journal of Computer Science issues, Vol 5 issues 5 N0 1 September 2011.

[8] Suresh Singh and Mikehoo, C.S. Raghvendra, “Power Aware Routing in Mobile Adhoc Netwotks.” Mobicom 98 Dallas Texas USA

[9] N. Kumar, Dr. C.Suresh Gnana. Dhass, “ A Complete Study on Energy EfficientTechniques for Mobile Ad-hoc Networks” International Journal of Advanced Research in Computer Science and Software Engineering Vol-2

