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ANALYSIS OF ENERGY CONSUMPTION IN AD-HOC ROUTING PROTOCOLS

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ABSTRACT

The demanding element in mobile ad-hoc communication is energy resource. Hence energy disbursed for data transportation beyond the network has to be underestimated. MANET's are constricted by restricted power so energy management has to be targeted. The objective part for energy valuable conversation is calculating energy profitable communication scenarios between source and destination nodes using multi-hop networks. The energy effective scenarios need to recognize the power companion with each route and vacancies during which the paths are to be selected. In this paper, we have shown the protocol that saves energy while transmitting packets from one node to another node. The goals are to minimize end-to-end delay, improve packet delivery ratio and throughput. We have used different battery models to show the consumption during the transmission. It is introduced to diminish power usage and diminish transmission abeyance on useless tasks. The simulation has been done by alternating the routing protocols, transmission power and receiving power level factors using QualNet Developer.

Keywords: Energy efficiency, Power saving techniques, physical layer, QualNet.

INTRODUCTION

Due to the restriction in the power, the calculation and calculation burden of the mobile nodes are hugely constricted. There are various categories of nodes in the network; a few are overloaded with traffic regulations while some have infused energy. The circulation of workload is being equally done so that the nodes with infused energy can also contribute the workload. There is an ample range of utilization domains in the ad-hoc networks, some type of utilizations pursue for calculation energy and some for communication energy. The ratio of estimation energy usage and communication energy usage contradicts from function to functions. To merge the endurance of the nodes, the battery administration schemes, transmission energy schemes and scheme energy authority hits important parts. The energy administration schemes can be categorized as follows: Battery management scheme, System power management and transmission power management. Owing to the case that the prediction of dilemma power levels has been so instilled into the architecture of various protocols in the OSI network layers that any advancement in the power level can result in the defecting of the protocol stack. The power domination problem is to choose the transmission power level for each carton by assuming a few assumptions. QualNet developer is software which is used to develop a scenario in which we can create a network which may be ad-hoc or wired depending upon our requirement. So, that we can set parameters as per our requirement in QualNet developer software. We can get graphical representation so that it will be easy for us to compare the results for our simulation.

RELATED WORK

Cruz and Santhanam [1] introduced an algorithm to calculate an excellent energy control scheme, link lineup and cooperative routing to reduce the average transmission energy in the multi-hop network. Their algorithm is entirely adequate but with bad case exponential intricacy.

Y.C.Tseng [2] introduced an algorithm that agrees that energy saving stage always has at least two full beacon windows that are under the analysis of another nodes active window. This algorithm is located on beacon windows fairly than flooding to search their neighbor nodes.

R. Bhatia and M.Kodialam [3] proposed an energy efficient algorithm S-MAC with the help of message passing procedures. This algorithm has been developed for sensor network and it does not determinate to be applicable to MANETS. This algorithm has preserves overhead.

K. Woo et.al [4] introduced an algorithm for local power-aware routing (LEAR) that is located upon dynamic source routing. The routing agreement depends upon the nodes remaining power of the intermediate nodes.

Jung E.S. and N. H. Vaidya [5] introduced dynamic energy saving mode (DPSM) that covers the IEEE 802.11 PSM that misuses power due to dilemma beacon interval. DPSM adjusts the ad-hoc traffic load. A node arrives the sleep mode after thorough any transmissions that has been declared in the ATIM window.

PROPOSED WORK

In today’s world, there is a need in mobile ad-hoc communication is energy resource, hence energy consumed for data transportation beyond the network has to be minimized. The proposed scenario is to save energy as possible as can with the help of different battery models. In this paper, we did an analysis of energy consumption while transmitting packets from one node to another node. For that we use variety of battery models such as Duracell, Panasonic etc. to get the results i.e. we compares it in last and show that which protocol requires minimum energy consumption for transmission of packets. There are many types of energy models such as Duracell AA (MX-1500), Duracell AA (MN-2400), Duracell AA (MN-1500), Panasonic AA and Panasonic AAA. We use different battery models to different nodes .We get energy consumed in the transmit node, receive mode, idle mode and sleep mode. Also, we get the battery consumed while transmission of the packets. We send 512 packets; each one consists of 1024 bytes each. Our aim is to compare the result of energy consumption of packets transmitting between any two nodes using four different protocols i.e. AODV, DSR, OLSR and ZRP. At last, our aim is to compare the result and show that which protocol is best to do transmission of packets between any two nodes.

SIMULATION

We simulated our proposed work in QualNet Developer software which runs on Windows 7. In QualNet Developer software, we have used the combination of battery model and different routing protocols to get the results. The procedure of the implementation as follows:

A. Design Mode

1) Place the 8 nodes in the scenario to form a network. Then, place a wireless subnet and connect all the existing nodes to that subnet to create an ad-hoc network. Connect CBR between any two nodes for which we have to compare our result for energy consumption in ad-hoc networks.

2) Set Scenario Properties which includes simulation time as 300 seconds, terrain size as 1500X1500, statistics and tracing; enable Application, Battery model and Routing in it.

3) Set Wireless Subnet properties which include routing protocol as AODV.

4) Enable Energy Model as Generic under which we have to set the following parameters:

Power Amplifier Inefficiency factor=6.5

Transmit Circuitry Power Consumption (mW) =100.0 Receive Circuitry Power Consumption (mW) = 130.0 Idle Circuitry Power Consumption (mW) = 120.0 Sleep Circuitry Power Consumption (mW) = 0.0 Supply Voltage=6.5V

5) Select battery model from node properties as Duracell-AA (MX-1500) to all nodes. Also set routing protocols as AODV to all nodes in the network.

6) Now browse an .utl file from SNT folder.

7) Repeat the above procedure for remaining routing protocols.

B. Visualize Mode

8) Save the simulation and run it.

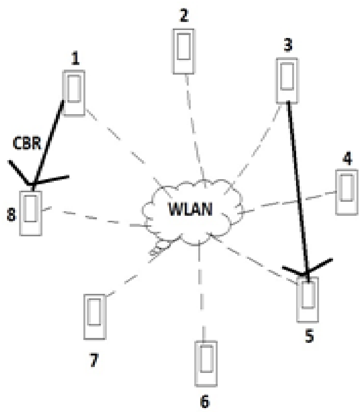

Fig.1 Design Scenario

RESULTS

On the basis of formulas given below, we got the results as mentioned in chart.

- Energy consumed in Transmit mode=Total Transmit Power+(load*actual duration)

TABLE I. AODV Energy Consumption

AODV Characteristics

Node 1

Physical, Energy Model, Energy consumed in transmit mode	0.004063
Physical, Energy Model, Energy Consumed in Receive Mode	0.000087
Physical, Energy Model, Energy Consumed in Idle Mode	0.925434
Physical, Energy Model, Energy Consumed in Sleep Mode	0.000000
Physical, Energy Model, Percentage of time in Transmit Mode	0.003395
Physical, Energy Model, Percentage of time in Receive Mode	0.000800
Physical, Energy Model, Percentage of time in Idle Mode	9.294542
Physical, Energy Model, Percentage of time in Sleep Mode	0.000000

Node 3

Physical, Energy Model, Energy consumed in transmit mode	0.004063
Physical, Energy Model, Energy Consumed in Receive Mode	0.000225
Physical, Energy Model, Energy Consumed in Idle Mode	0.930076
Physical, Energy Model, Energy Consumed in Sleep Mode	0.000000
Physical, Energy Model, Percentage of time in Transmit Mode	0.005395
Physical, Energy Model, Percentage of time in Receive Mode	0.002080
Physical, Energy Model, Percentage of time in Idle Mode	9.300756
Physical, Energy Model, Percentage of time in Sleep Mode	0.000000

TABLE II. DSR Energy Consumption

DSR Characteristics

Node 1

Physical, Energy Model, Energy consumed in transmit mode	0.001743
Physical, Energy Model, Energy Consumed in Receive Mode	0.000049
Physical, Energy Model, Energy Consumed in Idle Mode	1.552669
Physical, Energy Model, Energy Consumed in Sleep Mode	0.000000
Physical, Energy Model, Percentage of time in Transmit Mode	0.001457
Physical, Energy Model, Percentage of time in Receive Mode	0.000448
Physical, Energy Model, Percentage of time in Idle Mode	15.526694
Physical, Energy Model, Percentage of time in Sleep Mode	0.000000

Node 3

Physical, Energy Model, Energy consumed in transmit mode	0.001743
Physical, Energy Model, Energy Consumed in Receive Mode	0.00113
Physical, Energy Model, Energy Consumed in Idle Mode	1.55260
Physical, Energy Model, Energy Consumed in Sleep Mode	0.00000
Physical, Energy Model, Percentage of time in Transmit Mode	0.001457
Physical, Energy Model, Percentage of time in Receive Mode	0.001045
Physical, Energy Model, Percentage of time in Idle Mode	15.526096
Physical, Energy Model, Percentage of time in Sleep Mode	0.00000

TABLE III. OLSR Energy Consumption

OLSR Characteristics

Node 1

Physical, Energy Model, Energy consumed in transmit mode	0.031184
Physical, Energy Model, Energy Consumed in Receive Mode	0.005544
Physical, Energy Model, Energy Consumed in Idle Mode	9.931832
Physical, Energy Model, Energy Consumed in Sleep Mode	0.000000
Physical, Energy Model, Percentage of time in Transmit Mode	0.026058
Physical, Energy Model, Percentage of time in Receive Mode	0.051179
Physical, Energy Model, Percentage of time in Idle Mode	99.318220
Physical, Energy Model, Percentage of time in Sleep Mode	0.000000

Node 3

Physical, Energy Model, Energy consumed in transmit mode	0.031727
Physical, Energy Model, Energy Consumed in Receive Mode	0.005634
Physical, Energy Model, Energy Consumed in Idle Mode	9.931704
Physical, Energy Model, Energy Consumed in Sleep Mode	0.000000
Physical, Energy Model, Percentage of time in Transmit Mode	0.026511
Physical, Energy Model, Percentage of time in Receive Mode	0.052009
Physical, Energy Model, Percentage of time in Idle Mode	99.317036
Physical, Energy Model, Percentage of time in Sleep Mode	0.000000

- Energy consumed in Receive mode=Total Receive Power+(load*actual duration)
- Energy consumed in Idle mode=Total Idle Power+(load*actual duration)
- Energy consumed in Sleep mode=Total Sleep Power+(load*actual duration)

We basically concentrate on load which we are sending. Energy consumption totally depends on load and actual duration of transmission.

TABLE IV. ZRP Energy Consumption

ZRP Characteristics

Node 1

Physical, Energy Model, Energy consumed in transmit mode	0.132548
Physical, Energy Model, Energy Consumed in Receive Mode	0.019997
Physical, Energy Model, Energy Consumed in Idle Mode	9.969282
Physical, Energy Model, Energy Consumed in Sleep Mode	0.000000
Physical, Energy Model, Percentage of time in Transmit Mode	0.110753
Physical, Energy Model, Percentage of time in Receive Mode	0.184592
Physical, Energy Model, Percentage of time in Idle Mode	99.692822
Physical, Energy Model, Percentage of time in Sleep Mode	0.000000

Node 3

Physical, Energy Model, Energy consumed in transmit mode	0.109810
Physical, Energy Model, Energy Consumed in Receive Mode	0.019953
Physical, Energy Model, Energy Consumed in Idle Mode	9.971224
Physical, Energy Model, Energy Consumed in Sleep Mode	0.000000
Physical, Energy Model, Percentage of time in Transmit Mode	0.091759
Physical, Energy Model, Percentage of time in Receive Mode	0.184177
Physical, Energy Model, Percentage of time in Idle Mode	99.712237
Physical, Energy Model, Percentage of time in Sleep Mode	0.000000

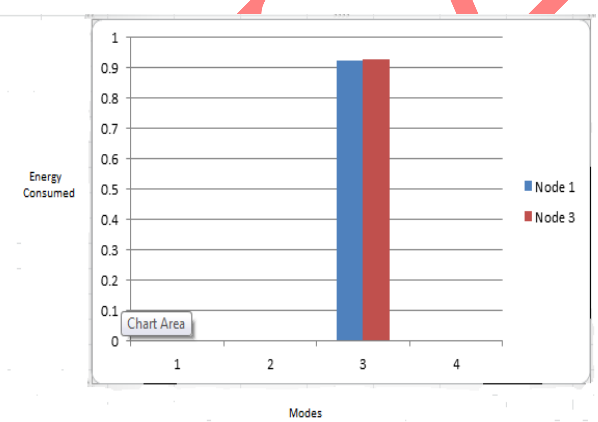

Fig. 2. Energy Consumed for AODV protocol

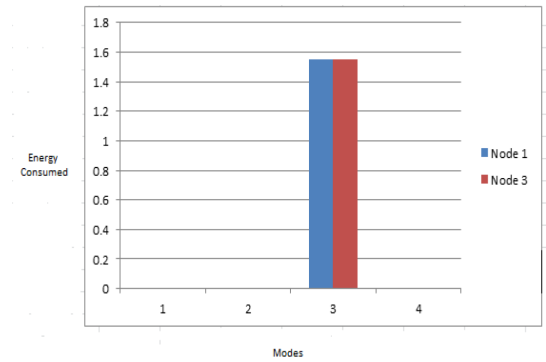

Fig. 3. Energy Consumed for DSR protocol

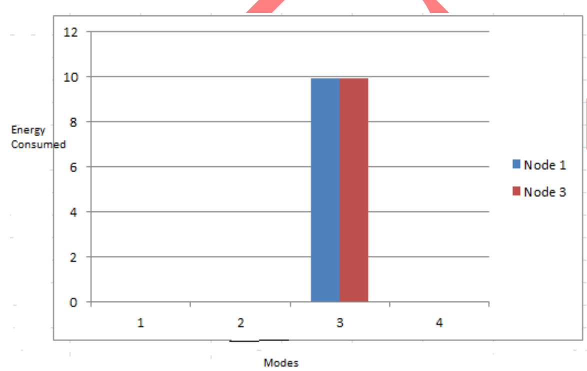

Fig. 4 Energy Consumed for OLSR protocol

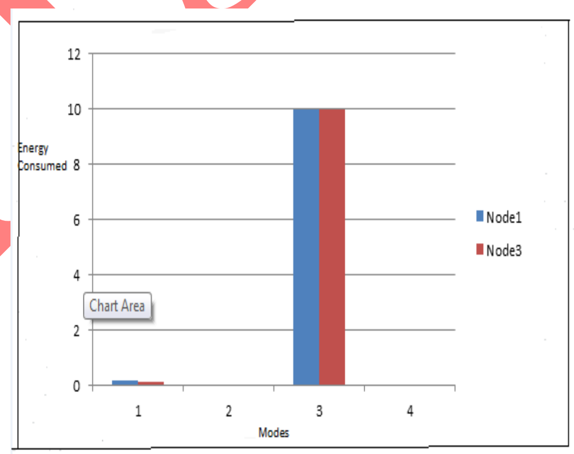

Fig. 5 Energy Consumed for ZRP protocol

CONCLUSION

Energy conservation is necessary for battery life in portable devices. We used four different routing protocols and compared their results. We got the measurements of the battery consumption; which we have used during the transmission of the packets. We got energy consumed in DSR protocol in almost all the modes is 40% lower than the other protocols which we used (that is) AODV, OLSR, ZRP. Finally, we came to know that DSR protocol is the best among the other protocols which can be used in the transmission of the packets in an ad-hoc network.

For DSR protocol, energy consumption in

Transmit mode=0.001743

Receive mode=0.000049

Idle mode=1.552669

Sleep mode=0.0000

This energy consumption in all the modes in DSR protocol is almost 40% lower than energy consumption in the other protocols.

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