A Comparative Performance in Routing Protocols and Energy Models in MANETs using Qualnet 5.0.2

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Abstract—*MANET stands for Mobile Ad hoc Network. An ad hoc network consists of autonomous self organizing mobile devices that communicate with each other by creating a network and each device in this network move freely, independently and randomly. In ad hoc mobile wireless networks, energy consumption is an important issue since nodes are usually mobile and battery-operated. In this project we compared the performance of energy models (generic, mica-motes & micaz) for different routing protocols (AODV, DSR, DYMO, STAR and ZRP) in transmit, receive and idle mode[1] and also compared the routing protocols (AODV, DSR, DYMO, STAR and ZRP) in respect of energy consumption[2].*

Keywords— MANETs, energy models, routing protocols & Qualnet 5.0.2.

I. INTRODUCTION

A MANET [3], [4] is a network without a fixed infrastructure, in which every node can act as a router. MANET sometimes called mobile mesh network and it is a self configurable wireless network. A MANET consists of mobile nodes, a router with multiple hosts and wireless communication devices. The wireless communication devices are transmitters, receivers and smart antennas. These antennas can be of any kind and nodes can be fixed or mobile. The mobile nodes are free to move arbitrarily in every direction. These nodes may be a laptop, mobile phone, MP3 player and personal computer. One important aspect of ad-hoc networks is energy efficiency since nodes are usually mobile and battery-operated. Energy consumption at the network interface is an issue for all mobile computing devices, whether they operate within a base station infrastructure or in a free-standing mobile ad hoc network (MANETs). Thus, minimizing energy consumption is a major challenge in these networks. Though, [5], [6], and [7] illustrates performance of the protocols. In this project we compared the performance of energy models (generic, mica-motes & micaz) for different routing protocols AODV(Ad hoc On Demand distance Vector), DSR((Dynamic Source Routing), DYMO(Dynamic MANET On demand), STAR(Source Tree Adaptive Routing) & ZRP(Zone Routing Protocol) in transmit, receive and idle mode and also compared the routing protocols (AODV, DSR, DYMO, STAR and ZRP) in respect of energy consumption.

II. ENERGY MODELS

In this we discuss various parameters of radio energy model relating to our comparisons in Qualnet environment.

GENERIC - This is a generic radio energy model that computes power consumption of the radio in different power modes and for variable transmission power.

MICA-MOTES- This is a radio-specific energy model which is pre-configured with the specification of power consumption of Mica motes (embedded sensor nodes).

MICAZ - This is a radio-specific energy model which is pre-configured with the specification of power consumption of MicaZ motes (embedded sensor nodes).

III. SIMULATION SETUP

The simulation is done with the help of Qualnet simulator version 5.0.2[8]. The network contains 100 nodes randomly distributed in a 1500m X 1500m area with 10 CBR traffic load. For the random waypoint model, a simulation time of 120 s and a maximum speed of 10 m/s was used. The simulations parameters are shown in Table1.

3.1 TABLE-1

Parameters	Values
Simulator	QualNet 5.0.2
Simulation area	1500*1500 sq m
Number of nodes	100 nodes
Traffic types	10 CBR
Simulation time	120s
Protocols studied	AODV, DSR, DYMO, STAR & ZRP
Packet Size	512 bytes

3.2 Basic Assumption for energy models

Power Amplifier Inefficiency Factor – 6.5
Transmit circuitry power consumption – 100.0
Receive circuitry power consumption – 130.0
Idle circuitry power consumption – 120.0
Supplly voltage – 6.5

3.3 Nodes Placement Scenarios

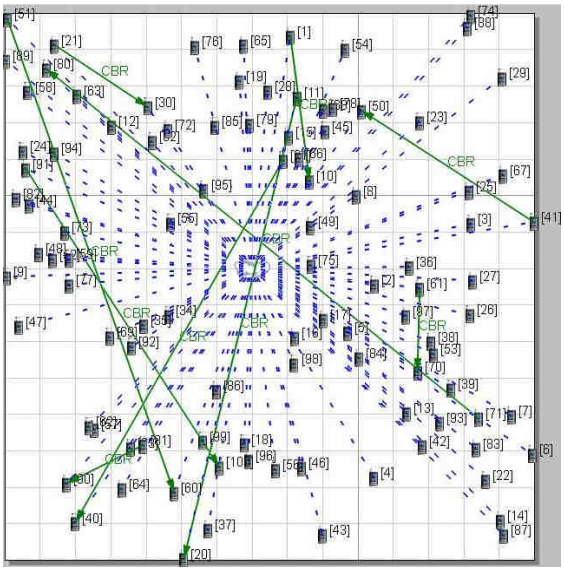

Fig. 1: Nodes placement scenarios for AODV, DSR , DYMO STAR and ZRP Routing Protocols.

3.4 Animation View of Scenario

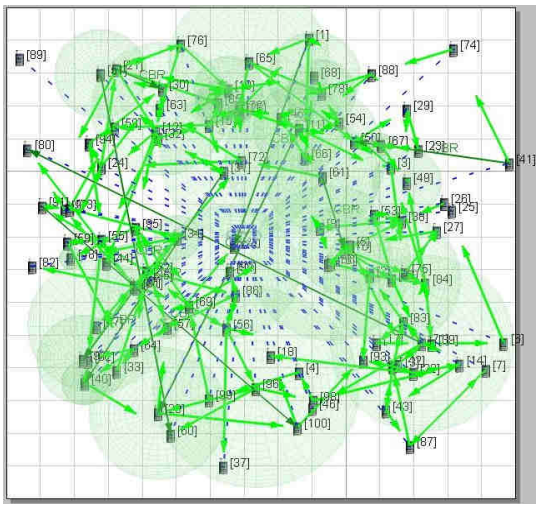

Fig. 2: Animation View of scenarios for AODV, DSR DYMO, STAR and ZRP Routing Protocol

IV. SIMULATION RESULTS

4.1 Energy Consumption in Transmit Mode

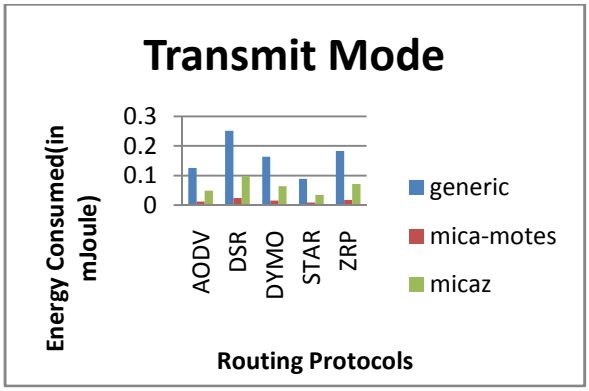

Fig. 3: Energy Consumed(in mJoule) in Transmit Mode

In the transmitting mode the energy model Mica-Motes consumes less energy compared to generic and micaz energy models and routing protocol STAR consumes lower energy among all five protocols.

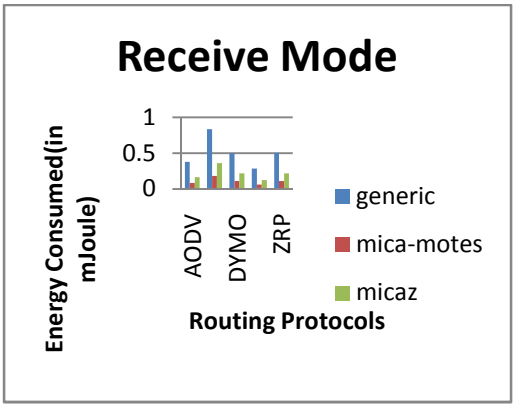

Fig. 4: Energy Consumed(in mJoule) in Receive Mode

In the receiving mode the energy model Mica-Motes consumes less energy compared to generic and micaz energy models and routing protocol STAR consumes lower energy among all five protocols same as in the transmitting mode.

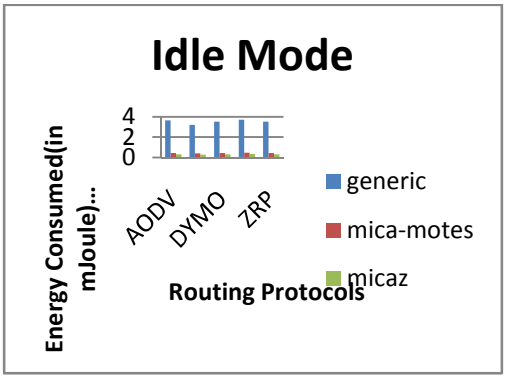

Fig. 5: Energy Consumed(in mJoule) in Idle Mode

In the idle mode the energy consumption by three models and five routing protocols yields the same.

V. CONCLUSION

In the above illustrated comparison MICA-MOTES consumes less energy when compared to other models

and STAR consumes lower energy among all the other routing protocols in both transmit mode and receive mode. The generic energy model has more power/energy consumption in the transmission and reception. While Micaz has moderate power consumption in both the cases. The order of the best routing protocol is STAR>AODV>DYMO>ZRP>DSR in transmission & reception. In idle mode the energy consumption by three models and five routing protocols yields the same. Thus we conclude that Mica-Motes is the best energy model that can be correlated with the best routing protocol STAR.

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