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Performance Analysis of Energy Efficient Routing Zone Routing Protocol over AODV and DSR Routing Protocols on CBR

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Article

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ABSTRACT

A Mobile Ad-Hoc Network (MANET) is a collection of wireless mobile nodes that communicates with each other without using any existing infrastructure, access point or centralized administration. In MANET, due to mobility of nodes network topology changes frequently and thus, routing becomes a challenging task. A variety of routing protocols with varying network conditions are analyzed to find an optimized route from a source to some destination. This article presents performance comparison of four popular mobile ad-hoc network routing protocols i.e. Ad hoc On-demand Distance Vector (AODV), Dynamic Source Routing (DSR), and Zone Routing Protocol (ZRP). We used well known network simulator QualNet 5.0.2 from scalable networks to evaluate the performance of these protocols. The performance analysis is based on different network metrics such as Energy Consumed in Transmit Mode, Energy Consumed in Received Mode, idle mode and Residual Battery Capacity (in mAhr) with percentages all performance metrics.

INTRODUCTION

In MANET [1, 3, 7, 9], nodes can move randomly thus, each node function as a router and forward packet to each other device. Due to high node mobility network topology changes frequently. Therefore, routing in ad-hoc network becomes a Challenging task. A Mobile Ad-Hoc Network (MANET) is a set of Wireless mobile nodes which form a temporary network communicate without using any existing infrastructure, access point or central administration. Mobile ad hoc networks are quick and easy deployment of ad-hoc network makes them feasible to use in military, search and rescue operation, meeting room and sensor networks. The aim of this article is to perform comparative analysis of four routing protocols Ad hoc on-demand Distance Vector (AODV) [3, 6, 12], Dynamic Source Routing (DSR) [2, 5, 7, 9] and Zone Routing Protocol (ZRP) [1, 5, 9, 12] in variable pause time for a constant number of nodes.

ENERGY EFFICIENT ROUTING PROTOCOL AODV ,DSR AND ZRP IN MOBILE AD HOC NETWORK (MANET)

- **The Ad Hoc On-demand Distance Vector Routing (AODV) protocol**

Reactive routing protocol AODV [3, 6,12] only needs to maintain the routing information about the active paths. Routing information is maintained in routing tables at nodes. Every mobile node keeps a next-hop routing table, which contains the destinations to which it currently has a route. A routing table entry expires if it has not been used or reactivated for a pre-specified expiration time. Moreover,

AODV adopts the destination sequence number technique used by DSDV [5, 7] in an on-demand way. In AODV, when a source node wants to send packets to the destination but no route is available, it initiates a route discovery operation. In the route discovery operation, the source broadcasts route request (RREQ) [1, 11] packets. A RREQ [2, 7, 8] includes addresses of the source and the destination, the broadcast ID, which is used as its identifier, the last seen sequence number of the destination as well as the source node's sequence number. Sequence numbers are important to ensure loop-free and up-to-date routes. To reduce the flooding overhead, a node discards RREQs that it has seen before and the expanding ring search algorithm is used in route discovery operation. The RREQ starts with a small TTL (Time-To-Live) value. If the destination is not found, the TTL is increased in following RREQs.

- **Dynamic source routing (DSR) protocol**

The dynamic source routing protocol (DSR) [2, 5, 7, 9] is an on demand routing protocol. DSR is simple and efficient routing protocol designed specifically for use in multi-hop wireless ad hoc networks of mobile nodes. Using DSR the network is completely self-organizing and self-configuring requiring no existing network infrastructure or administration. The DSR protocol is composed of two main mechanisms that work together to allow the discovery and maintenance of source route in the ad hoc network. Route discovery is the mechanism by which a node S wishing to send a packet to a destination node D obtains a source route to D .Route discovery is used only when S attempts to sent a packet to D and does not already know a route to D. Route maintenance is the mechanism by which node S is able to detect .while using a source route to D if the network topology has changed such that it can no longer use it route to D because a link along the route no longer works. When route maintenance indicates a source route is broken. S can attempts to use any other route it happens to know to D or it can invoke route discovery again to find a new route for subsequent packets to D. route maintenance for this route is used only when S is actually sending packets to D.

- **Zone Routing Protocol (ZRP)**

Zone Routing Protocol (ZRP) [1, 5, 9, 12] combines the advantages of both reactive and pro-active protocols into a Hybrid scheme, taking advantage of pro-active discovery within a node's local neighborhood, and using a reactive Protocol for communication between these neighborhoods. In a MANET, it can safely be assumed that the most Communication takes place between nodes close to each other. The ZRP is not so much a distinct protocol as it provides a framework for other protocols. The separation of a nodes local neighborhood from the global topology of the entire network allows for applying different approaches - and thus taking advantage of each technique's features for a given situation. These local neighborhoods are called zones each node may be within multiple overlapping zones, and each zone may be of a different size. The ``size" of a zone is not determined by geographical measurement, but is given by a radius of length, where is the number of hops to the perimeter of the zone. By dividing the network into overlapping, variable-size zones, the Zone Routing Protocol consists of several components, which only together provide the full routing benefit to ZRP.

Parameters For Simulation Setup

Parameter Name	Parameter Values
Area	700m*700m
Simulation Time	120 sec
Weather Mobility Interval	100 m sec
Channel-Frequency	2.4 GHz
Path loss-Model	Two Ray Model
Shadowing-Model	Constant
Number of Nodes	20 nodes
Routing Protocols	AODV,DSR and ZRP
PHY-Model	PHY802.11b
Data-Rate	2 mbps
Antenna-Model	Omni directional
Energy-Model	Mica Motes Model
Battery-Model	Linear Model
Mobility Model	Random-Waypoint Model
Traffic Source	CBR

Tables1. Parameters for simulation setup scenarios

Nodes Placement Scenarios

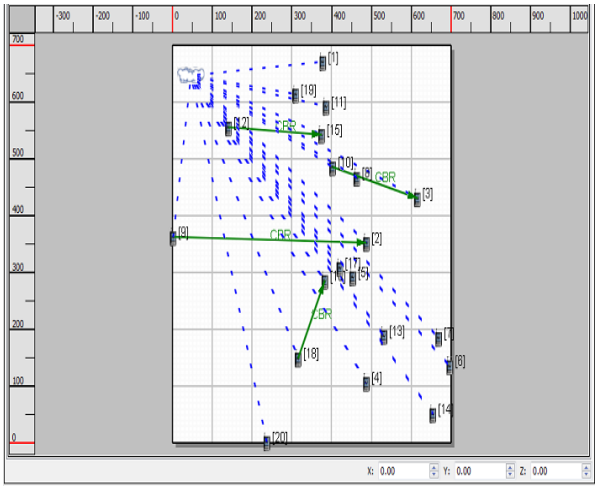

Figure 1. 20 Nodes palcement Scenarios

Animation Veiw Of Scenarios

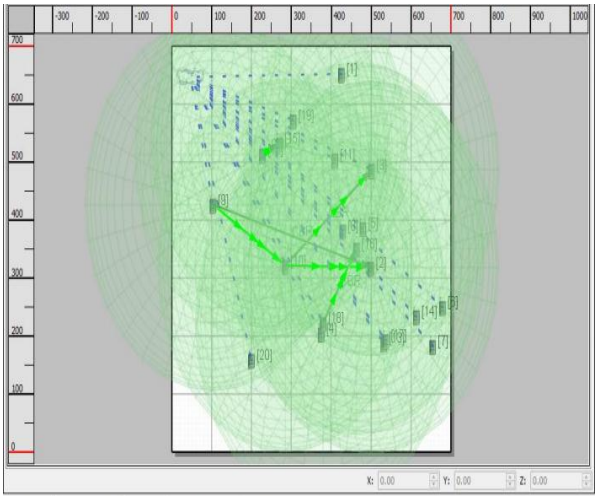

Figure 2. Animation Veiw of Scenarios

Performance metrics

Radio Energy Models a radio energy model computes the energy consumed in transmitter and receiver circuitry baseband circuits and circuits of power amplifier and power amplifier of the transmitter in the various power state functions of the radio primarily like transmit, receive, idle, and sleep modes.

- **Mica Motes**[13,15,16]**:** This is a radio-specific energy model which is pre-configured with the specification of power consumption of Mica motes embedded sensor nodes in wireless networks. Shows mica-motes energy model for the radio interface. All the nodes in this scenario are battery-operated devices and are configured by simple linear battery model. The radio interfaces for all nodes are configured with Mica therefore energy is consumed by those interfaces according to the energy specification of included in the Energy Model reference lib document.

- **Energy consumed (in mJoule) in Transmission mode** [15, 16]**:** Total energy (power) consumed (in mJoule) by radio interface in Transmission mode.

- **Energy consumed (in mJoule) in Reception mode** [15, 17]**:** Total energy (power) consumed (in mJoule) by radio interface in reception mode.

- **Energy consumed (in mJoule) in IDLE mode** [11, 15]: Total energy (power) consumed (in mJoule) by radio interface in idle mode.
- **Energy consumed (in mJoule) in SLEEP mode** [11, 15]: Total energy (power) consumed (in mJoule) by radio interface in sleep state.

Simulation Result for Energy Efficient Routing Zone Routing Protocol over AODV and DSR Routing Protocols

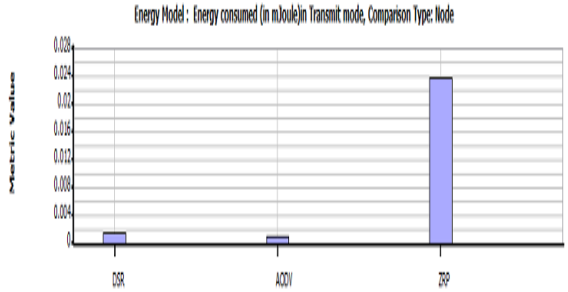

Figure 3. Enargy Consumed (in mJoule) Transmit modeVs Routing Protocols AODV,DSR and ZRP

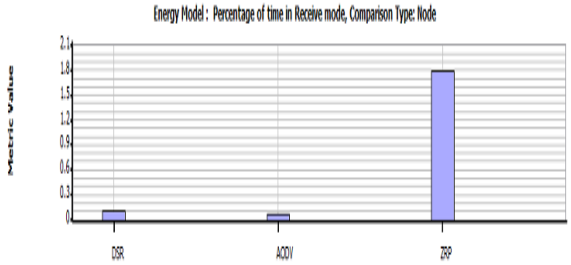

Figure 4. Enargy Consumed (in mJoule) Received modeVs Routing Protocols AODV,DSR and ZRP

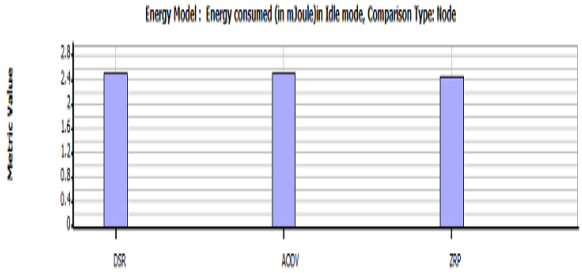

Figure 5. Enargy Consumed (inmJoule) Ideal modeVs Routing Protocols AODV,DSR and ZRP

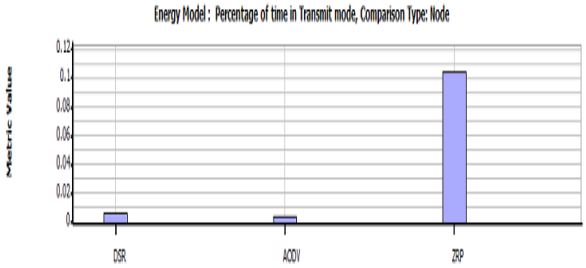

Figure 6. Persentage of time in Transmit modeVs Routing Protocols AODV,DSR and ZRP

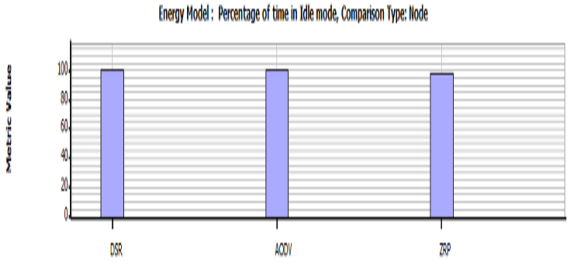

Figure 7. Persentage of time in Ideal modeVs Routing Protocols AODV,DSR and ZRP

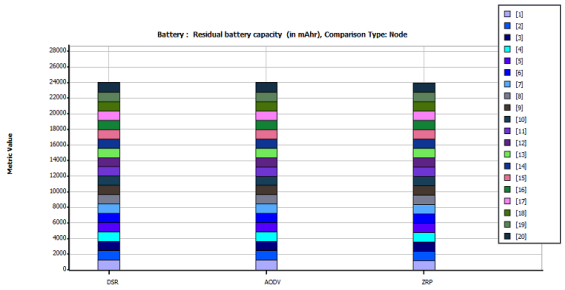

Figure 8. Residual battery capacity (in mAhr) Vs Routing Protocols AODV,DSR and ZRP

CONCLUSION AND DISCUSSION

In this article, we examine the performance of energy efficient AODV, DSR, and ZRP routing protocol for mobile ad-hoc networks on radio energy model using constant bit rate. We measure the, Energy Consumed in Transmit Mode, Energy Consumed in Received Mode, idle mode and Residual Battery Capacity (in mAhr) with percentages all performance metrics Our simulation results shows ZRP consuming largest energy in transmit mode .055 rest all routing protocol energy consuming in transmit mode is.011 and percentage of transmit mode of routing protocol AODV is .02%, DSR is .018%, and ZRP is .13% and Receive mode ZRP is .034, AODV is .03, DSR is .025 and in case of percentage ZRP is .25%, AODV is .03%.DSR is .28% and Ideal mode all routing protocol energy consuming in transmit mode is 5 and percentage of all protocol 100% and finally discuss residual battery capacity all routing protocol is 24000 (in mAhr). In future, different node placement strategy, more sources traffic, additional metrics such as packet delivery ratio, average packet size of routing packets and normalized routing overhead with and may be used in Mobile ad hoc network (MANET).

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