COMPARATIVE ANALYSIS OF MOBILE AD-HOC NETWORK AND SENSOR NETWORK

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***Abstract*— Ad-hoc network is a self-configuring network of mobile routers connected by a wireless link. MANET is self-organizing and self-restoring. Sensor network have various nodes distributed randomly in a particular area to monitor physical and environmental conditions. These networks have some similarities and some differences. In this paper, MANET and WSN are compared in many terms by using same routing protocols for both networks. This analysis gives a result that same protocol can have different effect on both networks.**

Keywords—**- Ad-hoc network, Sensor network, AODV, DSR, DYMO, OLSR, ZRP**

I. INTRODUCTION

Mobile Ad-hoc Network (MANET) is an autonomous collection of mobile users that communicate over relatively bandwidth constraint wireless networks. Topology changes rapidly and unpredictably because nodes are mobile. MANET is used in many applications as in tactical networks, emergency services, commercial and civilian environment, home and enterprises networking, education, entertainment etc. Some important features of MANET are: autonomous and infra-structure less, multi-hop routing, dynamic network topology, device heterogeneity, energy constrained operation, bandwidth constrained variable capacity links, limited physical security, network scalability, self-creation, self-organization and self-administration.

Wireless Sensor Network (WSN) is a network that is made of several nodes which are densely deployed in abandoned environment with the capabilities of sensing and computation. Sensor nodes are tiny devices having combination of sensing, computation and communication. WSNs are applicable for environmental data collection, security monitoring and sensor node tracking. Advantages of WSNs are power efficiency, flexibility, robustness, security, time synchronization, size and cost.

MANET and WSN have similar properties, but different routing protocols have different effect in both networks. In this paper, both networks are analysed by using different protocols. Protocols used for analysis are AODV, DSR, DYMO, OLSR and ZRP.

Section II contains brief descriptions of these protocols. Section III describes about simulation environment, scenarios for both type of network. Section IV simulation results are discussed.

II. PROTOCOLS USED

Protocols used in this analysis are described as follows:-

A. *AODV (Ad-hoc On Demand Distance Vector)*

AODV is reactive or on demand routing protocol, uses bi-directional links, uses route discovery cycle for route finding and provides unicast and multicast communication. AODV enables dynamic, self-starting, multi-hop routing between mobile nodes wishing to establish and maintain an ad-hoc network. It allows for the construction of routes to specific destinations does not require that nodes keep these routes when they are not in active communication.

B. DSR (Dynamic Source Routing Protocol)

DSR is also reactive or on demand routing protocol, no periodic activity, utilizes source routing and supports unidirectional links. It includes source routes in packet headers. DSR is a simple and efficient routing protocol designed specifically for use in multi-hop wireless ad-hoc networks of mobile nodes. DSR allows network to be completely self-organizing, self-configuring, without the need for any existing network infrastructure and administration. It manages Route Discovery and Route Maintenance mechanisms. DSR is specially designed for MANETs and to work well in high mobility. DSR operates entirely on demand, with no period activity of any kind required at any level within the network.

C. *DYMO (Dynamic Manet On-demand)*

DYMO enables dynamic, reactive, multi-hop routing between source and destination nodes. Its basic operations are route discovery and management. DYMO uses sequence

number to ensure loop freedom. Routes are discovered on demand when a node needs to send a packet. Each entry in routing table consists of the following fields: Destination Address, Sequence Number, Hop Count, Hop Address, Next Hop Address, Next Hop Interface, Is Gateway, Prefix, Valid Timeout and Route Delete Timeout.

D. *OLSR (Optimized Link State Routing Protocol)*

OLSR is a table driven routing protocol. It is a version of link state routing. Each node selects a set of its neighbour nodes as multipoint relays(MPRs). These MPRs are used to form a route from the given node to any destination in the network and to facilitate efficient flooding of control messages in the network. Its main operation is updating and maintaining information in variety of tables. It has three control messages: HELLO message, Topology control message and Multiple Interface Declaration.

E. ZRP (Zone Routing Protocol)

ZRP combines advantages of table driven and on demand driving protocol. According to the application it selects the method. It uses table driven method to communicate in node's local neighbourhood, which is known as Zone of that node and uses on demand method when node had to communicate outside its zone. ZRP divides surrounding in different zones with different radius, which overlap each other. ZRP has few components as: IERP, IARP and BRP.

IERP-IntErzone Routing Protocol, a reactive routing protocol that eliminates the need of nodes.

IARP-IntrAzone Routing Protocol, a proactive protocol that keeps up to date view of the zone topology.

BRP-Bordercast Resolution Protocol, controls traffic between zones.

III. SIMULATION ENVIRONMENT

For this analysis Qualnet 5.0.2 Network Simulator is used to evaluate the performance of AODV, DSR, DYMO, OLSR and ZRP in Mobile Ad-hoc Network and Wireless Sensor Network. MAC Protocol used for MANET is IEEE 802.11b and for WSN is IEEE 802.14. In MANET 15 nodes and 2 CBR sources are used. In WSN also 15 nodes are used, where 14 nodes are connected with node 1 through CBR. For WSN, node 1 is static i.e. there will be no movement in this node and node 2-15 will have random waypoint mobility model. Node 1 is a full function device and work as a PAN coordinator and other nodes 2-15 are reduced function device in sensor network. For both the scenarios area is 500m * 500 m. and mobility model is random waypoint with mobility of 10mbps. Scenario properties are described in following table:-

TABLE. SIMULATION PARAMETERS VALUES

Parameters	**Values**	
	MANET	**WSN**
Simulation Time	100 sec	100 sec
Simulation Area	500m*500m	500m*500m
Routing Protocols	AODV, DSR, DYMO, OLSR, ZRP	AODV, DSR, DYMO, OLSR, ZRP
Mobility Model	Random Waypoint	Random Waypoint for node 2-15
No. of Nodes	15	15
Mobility Speed	0-10	0-10
Radio Type	802.11b	802.15.4
MAC Protocol	802.11	802.15.4
Traffic Type	CBR	CBR

Scenarios and simulation for both the networks are shown below:-

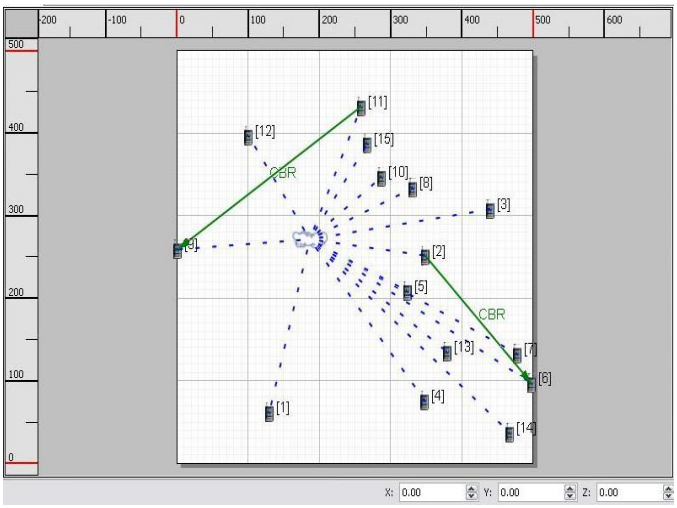

Fig.1. Scenario for Ad-hoc Network

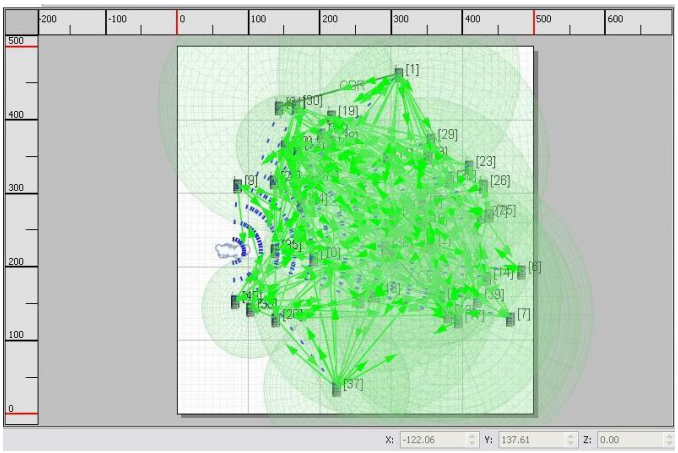

Fig.2. Simulation in Ad-hoc network

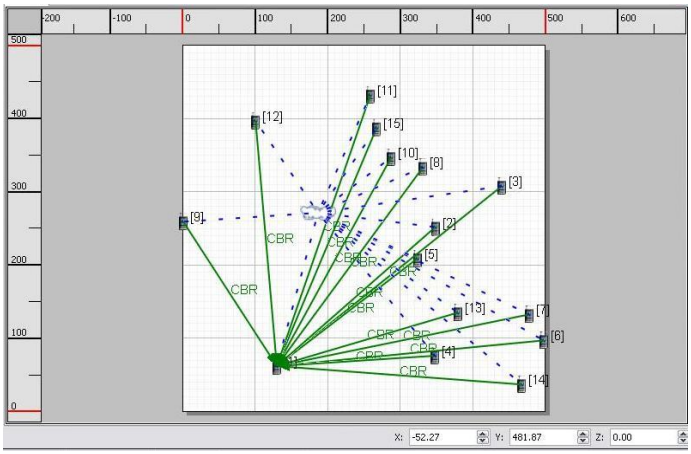

Fig.3.Scenario for Sensor Network

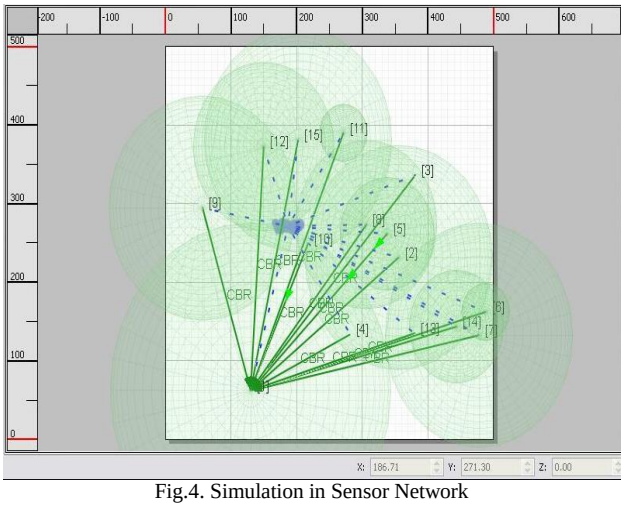

Fig.4. Simulation in Sensor Network

IV. RESULTS AND DISCUSSIONS

Using Qualnet 5.0.2 Simulator different parameters for both networks are analysed. Results of analysis are as follows:-

A. Packets from Application Layer

In MANET maximum packets are received from in OLSR i.e. 22 and remaining protocols (AODV, DSR, DYMO, OLSR and ZRP) receive only 3.

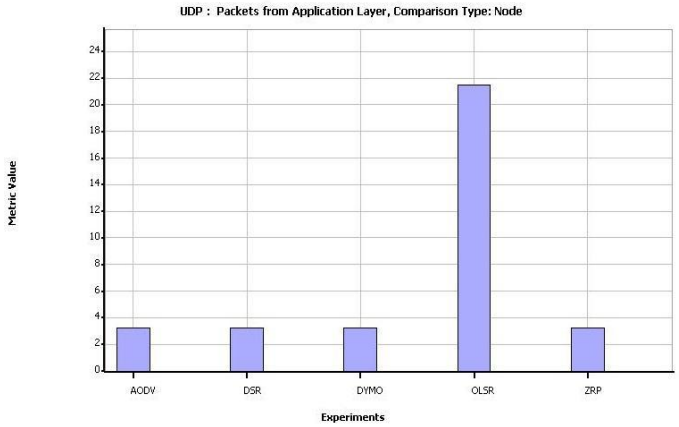

Fig.5. Packets form Application layer in MANET

In WSN, also OLSR receives maximum packets received form application layer i.e. 38 and remaining protocols have receive same packets i.e. 22.

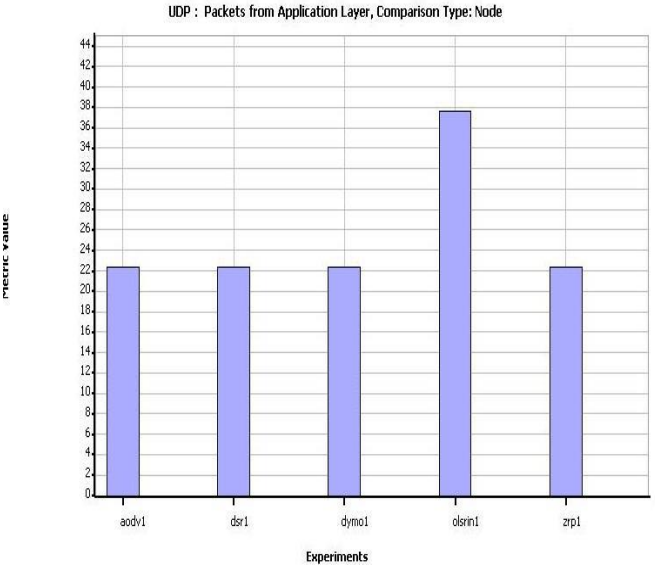

Fig.6. Packets form Application Layer in WSN

It can be noticed that WSNs receive more packets than MANETs. WSN have minimum of 22, which is maximum for MANET.

B. Signal Received and Forwarded to MAC

In MANET, ZRP receives and forwards 1000 packets to MAC layer, OLSR forwards 400 packets, DSR forwards 320 packets and AODV and DYMO forwarded 270 packets.

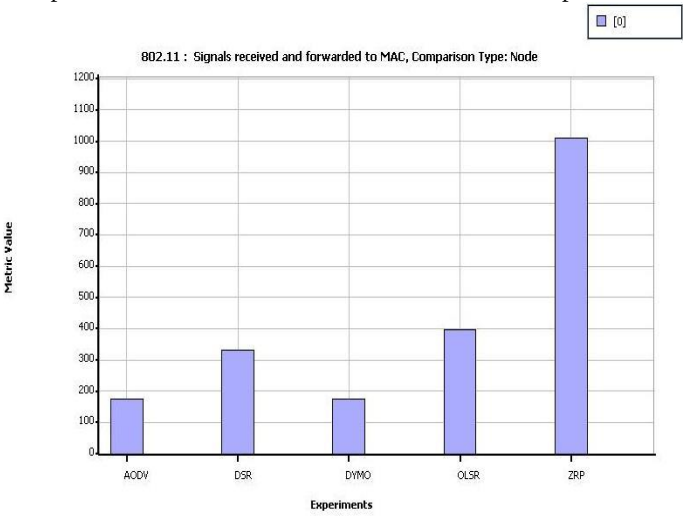

Fig.7. Signal received and forwarded to MAC layer in MANET

In WSN, ZRP forwards maximum packets to MAC layer i.e. 490, OLSR forwards 260 packets and AODV, DYMO and DSR forwards only 220 packets.

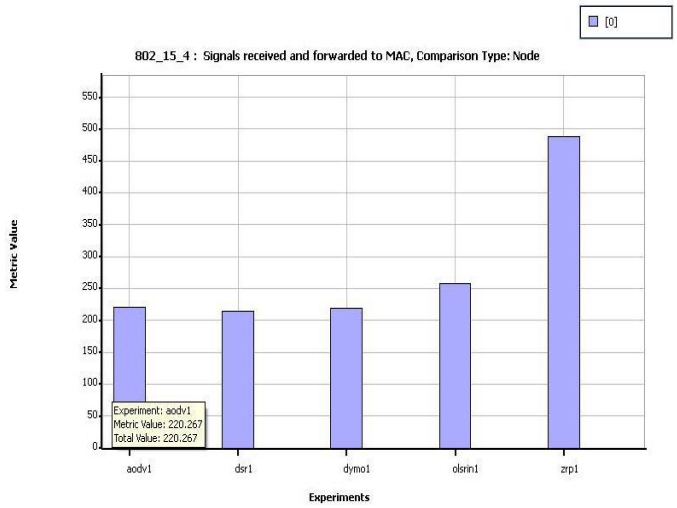

Fig.8. Signal received and forwarded to MAC layer in WSN

More signals are received and forwarded to MAC layer in MANET than WSN.

C. Signal Received with Errors

In MANET, AODV and DYMO received less signals with errors. OLSR and DSR have average signals with errors. ZRP receives maximum signal having errors.

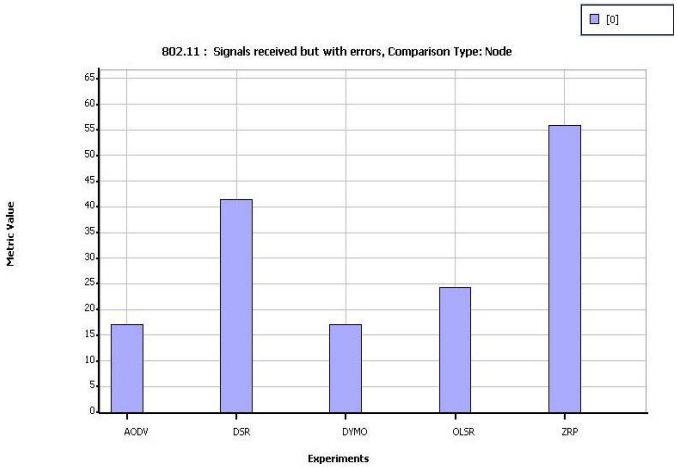

Fig.9. Signal received with errors in MANET

In WSN, OLSR and AODV receives minimum signals with errors. DYMO and DSR receives average amount of signals with errors. ZRP receives maximum signals with errors.

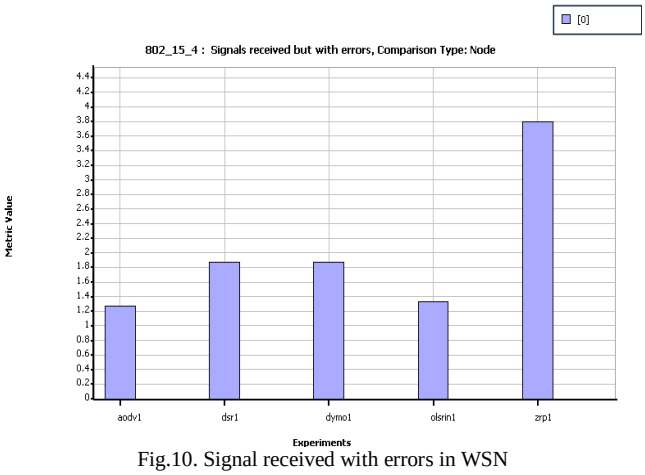

Fig.10. Signal received with errors in WSN

In comparison with MANET, WSN receives less error signals.

IV. CONCLUSION

This analysis of MANET and WSN shows that routing protocols almost have different effect on both networks. In MANET fewer packets are received from application layer as compared to WSN, but more signals are forwarded to MAC layer as compared to WSN. MANET receives more signals with errors than WSN. It can be noted here that values for MANET are always higher than WSN.

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