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Implementation and Performance Comparison of AODV and IAODV on the Basis of Energy, Utilization, and Hop Count in WiMax on NS_2

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Abstract: ***Wireless Bandwidth allocation and routing mechanisms are two it is big challenges to develop routing protocol that can must different application needs and optimize routing paths according to the topology change in mobile ad hoc networks (MANET). Inaccurate local topology knowledge and the outdated destination position information can lead to inefficient geographic forwarding and enter routing failure. [2] In this paper improve the AODV protocol (IAODV) by creating a Cycle on a node where the congestion probability is high i.e. at near sink node to find all those nearer nodes where buffer occupancy is high and proposed to minimize the energy, decrease the hop count and increase the utilization as compared to AODV protocol.***

Index Terms: Wi Max 802.16, AODV, IAODV, MANET

I. INTRODUCTION

WiMax is the known IEEE 802.16 standard and most reliable access technology. It provide high bit rate and reaching large area with a single base station to end user in an economical way.[1] The main consideration of Mobile Wimax is to achieve seamless handover such that there is no loss of data. In Wimax both mobile station (MS) and base station (BS) scans the neighboring base stations for selecting the best base station for a potential handover. The key property of Mobile WI Max is the all-IP (both IPv4 and IPv6) platform which leaves out the traditional circuit switched alternatives. This allows financial saving as there is no need to maintain both types of core networks. The WI Max Forum has established a Network Working Group (NWG) that defines the

1. MS is Mobile Station or user equipment.
2. BS is Base Station.
3. ASN is Access Service Network. It is also known as Network Access Provider (NAP).
4. CSN is Connectivity Service Network
5. ASN-GW is Access Service Network Gateway. It is also known as Access Concentrator (AC).

The architecture of mobile WI MAX is consists of mobile stations (MS) that communicate freely via radio link with base stations (BS) which act as relays with the terrestrial infrastructure of IP network. The base stations themselves are connected to the network element called ASN that manages their connection with the IP network.

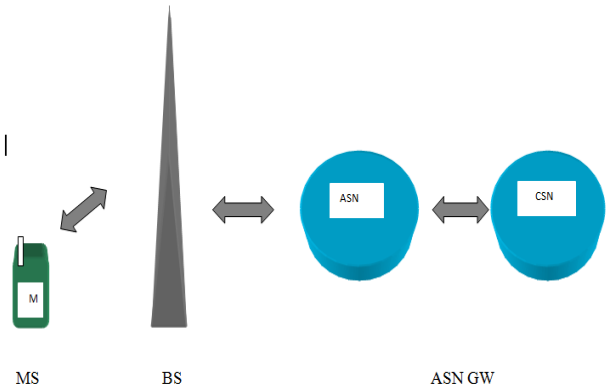

Figure 1. Architecture of WiMax

Bandwidth estimation techniques is combined with route discovery and set up in order to find a best route to increase the throughput and bandwidth utilization in AODV(R. Murali Prasad and P.Satish (2010)).Improve the AODV by creating a cycleon a node where the congestion proability is high to minimize the end to end delay ,increase the throughput and increase the PDF as compare to AODV(lovenish kumar, sunita rani(2013)) Hybrid scheme comprising WBAODV and DSD protocol to minimize the delay, increase throughput and increase the PDF as compare to AODV to WBAODV and DSDV protocol. (Deepak Kumar Garg, Balraj Singh, Darshan Singh Sidhu(2013)).

II. PROTOCOL USED IN WIRELESS AD-HOC NETWORK

The protocols are being used; On Demand (Reactive), Improved Ad-Hoc on demand distance vector (IAODV). The Brief details are discussed below.

A. On Demand (Reactive) Protocol

Ad-hoc On Demand Distance Vector (AODV) protocol is designed for Mobile Ad-hoc networks (MANET). It supports both uni cast and multicast routing and maintains a route whenever source wants to be. These routes are maintained as long as they are needed by the sources. AODV is loop-free, self-starting and uses sequence numbers to ensure the freshness of routes.

It uses a route request / route reply query cycle for establishing the route. If the route is not established between source and destination node, it broadcasts a route request (RREQ) packet across the network. Nodes receiving this packet in the network and update their information and set up backwards pointers to the source node in the route tables.

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The RREQ contains the information about source node's IP address, current sequence number, broadcast ID and update the sequence number. On receiving the RREQ, node may send a route reply (RREP) if it is either the destination or if it has a route to the destination. In this case, it uni cast a RREP back to the source otherwise it rebroadcasts the RREQ. RREP propagates back to the source and set up the route. Once the source node receives the RREP, it starts to forward the data packets to the destination. As long as the packet is transmitting from source to destination, the route is active otherwise route is deleted and nodes propagates the error message (RERR). If the source node still want the route, whole process start again. [6]

B. *IAODV Protocol*

Improved Ad-Hoc on demand distance vector routing protocol is efficient and superior of the standard AODV routing protocol in performance. It is used to balance load to avoid congestion inside novel scheme of flow control.

III. PROPOSED ALGORITHM

The AODV Routing protocol is based on on-demand approach for finding routes, a route is established only when source node want to be transmit the data packet to the destination. The Improved AODV protocol is used to enhance the stability of a network and also improve the efficiency in wireless sensor Ad-hoc network. [5]

A. *Techniques used in IAODV*

The AODV protocol is improved by creating a Cycle on a node where the congestion probability is high i.e. at near sink node to find all those nearer nodes where buffer occupancy is high. Near sink node and nodes nearer to it contains the routing table including information about its own I.P. address, I.P. address of nearer neighbour nodes, distance between the nodes, & queue length of each node as shown in Figure 3. The dynamic nature of wireless sensor network cause the topology to automatically change due to change in topology each node automatically updates its information in its own routing table & the routing table of the nearer node regarding its buffer length, its distance from other nodes, its I.P. address. Hop to hop algorithm is to be implementation to find maximum buffer occupancy of congestion affected node. This child node makes the alternate route to transmit the data, utilize its buffer space and store the data for short time interval. Hop destination algorithm is implemented by this child node to forward the packets to the destination. . The scenario for this whole process is shown in Figure 2.

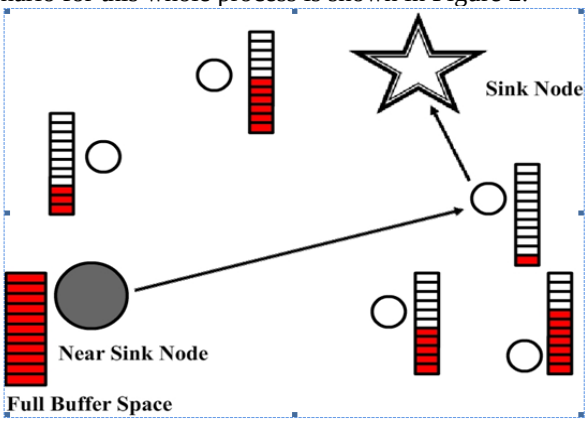

Figure2. Node's with free space transmitting packet to sink

IV. SIMULATIONS AND RESULTS

We have simulated the various parameters by Network Simulator 2 (NS2) and compared with AODV. The main objective of our simulations is to show that IAODV protocol has significant improvement as compare to AODV Protocol on the bases of utilization, energy and hop count.

A. *Simulation Environment*

Table 1. Paramter value of Simulation Environment

Simulator	Network Simulator 2.34
Network Size	1000m x 1000m
No. of nodes	50
Simulation Time	50Sec
MAC Type	802.11, 802.16
Bandwidth	4Mz
Traffic Sources	CBR, FTP
Traffic Agents	UDP, TCP
Interface Queue Length	50
Packet Size	512 Byte data
Max speed	10
Interval time b/w Packets	0.05
Max. Packets to be send	10000

The network simulator NS2 is a discrete event network simulator developed at UC Berkeley that focuses on the simulation of IP networks on the packet level
NS2 is based on two languages: C++ and TCL and it is using TCL/OTCL (Tool Command Language/ Object Oriented tcl) as a command & configuration interface.
There are 4 types of files of NS2:

1) .tcl or .ns, which have common subsets of commands but not exactly compatible between each other.
2) While simulator runs on .tcl or .ns file, simulation trace file (.tr) and animation file (.nam) are created during the session.
3) Network Animator (.nam) files are used to visualize the behavior of network protocols and traffic the model.

NS-2 facilitates three broad themes of network research simulations:

1) Selecting a mechanism from several options.
2) Exploring complex behavior
3) NS-2 supports: TCP family, UDP, CBR, FTP, HTTP,Pareto, Exponential protocols, wires, wireless, uni cast, multicast. Languages: Both C++ and OTcl languages. Outputs: dynamic output. NS is basically an Object-oriented Tcl (Otcl) script interpreter with network simulation object libraries. NS has a simulation event scheduler, network component object libraries and network setup module libraries.
4) NS-2 Architecture
5) The NS-2 architecture is composed of five parts:
6) Event scheduler
7) Network components
8) Tclcl
9) OTcl library
10) Tcl 8.0 scipt language

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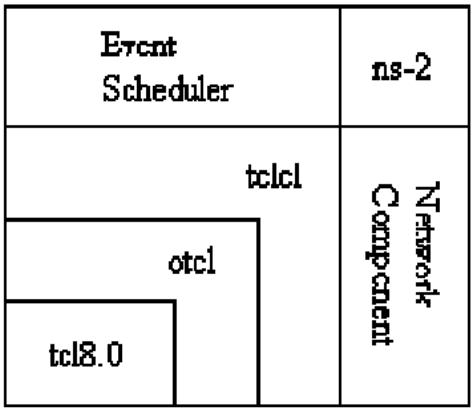

Figure 3 architecture view of NS2

The Performance analysis of proposed IAODV Protocol is done by comparing with existing AODV on the basis of the following parameters:

1. Utilization
2. Hop Count
3. Energy

A. Utilization Performance Comparison

It is the ratio of bandwidth receives into total available bandwidth for a traffic flow.

The value of Utilization should be better performance by using IAODV protocol. It can be found that the Utilization is low as compare with the AODV protocol as shown in fig. 4.

B. Performance based on Hop Count

Hop Count refer to the maximum distance to be covered, to reach the destination. It is the number of hops for a feasible path. The smaller the Hop count is, the more reliable the routing path. The route selection algorithm prefers the route that reaches the destination node first. The reason for selecting this route is that it will be less congested than the other shown in figure 5.

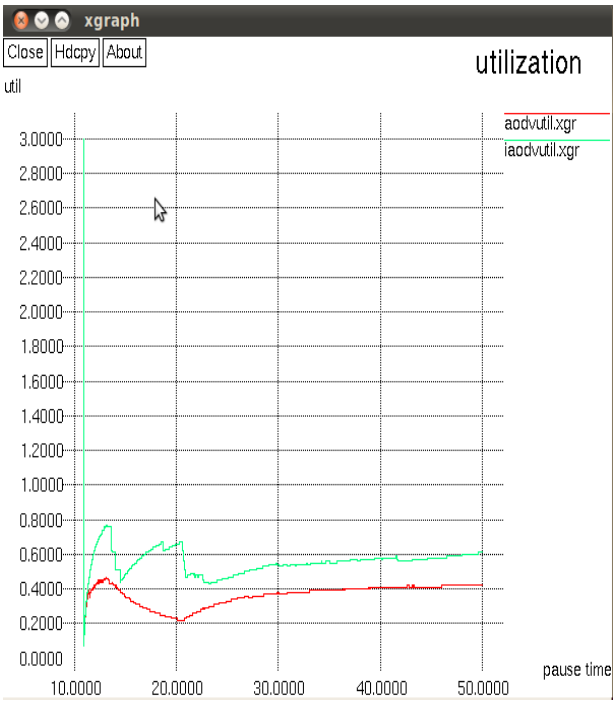

Figure 4. Performance Comparison on Utilization w.r.t. Pause Time

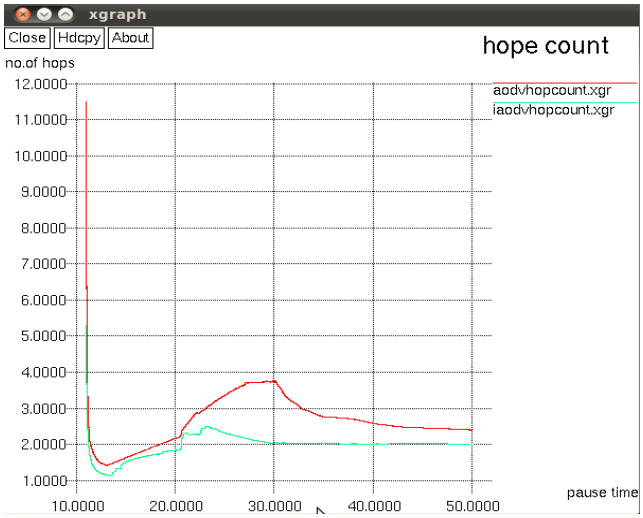

Figure 5. Performance Comparison of Hop Count w.r.t. Pause Time

C. Energy Performance Comparison

Energy is needed for sending a file or data, with the consideration of the size of packages. Practically it is not possible to replace the batteries of large number of deployed sensor in the hostile environment. Therefore there is a need to reduce the Energy consumption of the network. [3] It must be low as possible The proposed hybrid comprising AODV and DSDV shows the less energy consumption as compared to hybrid comprising AODV, WBAODV and DSDV but less than hybrid using WBAODV and DSDV protocols as shown in figure 6.

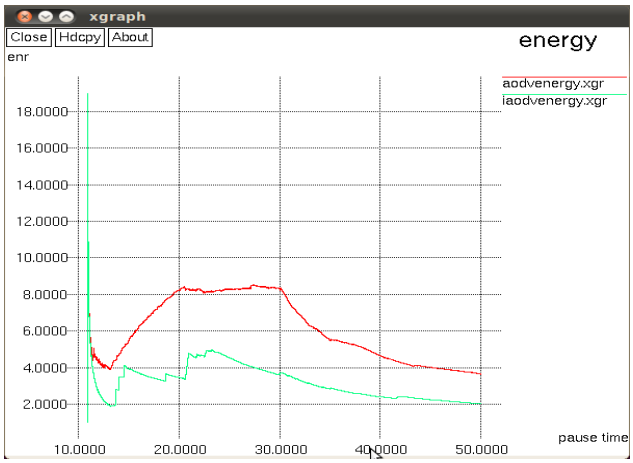

Figure 6. Performance comparison of Energy w.r.t Pause Time

Table 2. Average Value of all Parameter

Protocol / Parameter	AODV	IAODV
Hop Count	2.7429	2.0247
Utilization	0.368	0.543
Energy	6.074	3.4414

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V. DISCUSSION & RESULTS

This paper concludes that implementation of Improved AODV protocol by creating a Cycle on a node where the congestion probability is high i.e. at near sink node to find all those nearer nodes where buffer occupancy is high [5] Performance of the protocol varies according to the variation in the network parameters. In this proposed work, the results in terms of hop count are lower than AODV, utilization is higher than AODV and energy is lower than AODV. It is concluded that results of proposed protocol are better than AODV protocol.

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