INTERNATIONAL JOURNAL FOR ADVANCE RESEARCH IN ENGINEERING AND TECHNOLOGY
WINGS TO YOUR THOUGHTS.....

Energy Saving in ZRP with Anycast Routing using NS2

Shaveta[1], Er. Navdeep Kumar[2]

[1]Research Scholar (CSE)
Haryana Engineering College
shavetagupta0@gmail.com

[2]Associate Professor (CSE)
Haryana Engineering College
navdeepkumar17@gmail.com

Abstract- *The Zone Routing Protocol is based on the zone's concept. A routing zone is defined for each node and also defined for the zones of neighboring node overlap. Energy management in network deals with the process to manage energy resources such as controlling the battery, scheduling of power sources and adjusting the transmission power so as to increase the lifetime of the node. Now we proposed a new protocol that is Zone Routing Protocol with Anycast Routing using NS2. NS-2 is a discrete event simulator. This simulator works at packet level. NS2 is simply an event driven simulation tool that has useful in studying the dynamic nature of communication networks.*

Keywords- *Zone Routing Protocol (ZRP), Routing Algorithms, Routing Protocols, IntrA Zone Routing Protocol (IARP), IntEr Zone Routing Protocol (IERP).*

1. INTRODUCTION

A mobile ad hoc network (MANET) consists of mobile hosts that can communicate to each other using wireless links. A route between two hosts may consist of hops through one or more nodes in the MANET [1]. A routing algorithm has the general characteristics of any routing protocol and also has the specific characteristics of a mobile environment, specially - bandwidth, energy limitations and mobility. Routing algorithms and protocols need to save both bandwidth and energy and must take into account the low capacity and limited processing power of wireless devices [15].

1.1Characteristics of Mobile Ad hoc Network

- **Infrastructure less:** Network is not depending on any fix infrastructure for its operation. MANET does not depend on any established infrastructure or centralized administration. Each node operates in distributed peer-to-peer mode, acts as an independent router and generates independent data. Not any mediator networking device is required for communications. Each node is work as a DTE (Data Terminal Equipment) and DCE Data Communication Equipment)
- **Dynamic topologies:** Nodes are free to move arbitrarily with different speed; thus the networks topology may change randomly & unpredictable times. Each node may work as intelligent node.
- **Energy constrained operation:** Some or all of the nodes in an adhoc network may rely on batteries or other exhaustible means for their energy for these nodes, the most important system design optimization criteria may be energy consumption.
- **Limited bandwidth:** Wireless links continue to have significantly lower capacity than infrastructure networks. In addition the realized throughput of wireless communications after accounting for the effects of multiple accesses, finding noise, and interfaces condition etc.
- **Security threats:** Most wireless networks are generally more prone to physical security threats than fixed cable networks. The increased possibility of eavesdropping, spoofing and minimization of denial of service types attack should be carefully considered.

1.2 Protocols used in Ad hoc network

Protocols are classified as: proactive such as OSLR, reactive such as AODV and hybrid such as ZRP.

A. OSLR:

The Optimized Link State Routing Protocol is a routing protocol which can be used on wireless ad hoc networks. It is a proactive routing protocol, which uses topology control (TC) messages to discover every hop and then disseminate link state information [2]. It is also known as table driven routing protocol in which every node maintains a routing table consisting of information

INTERNATIONAL JOURNAL FOR ADVANCE RESEARCH IN ENGINEERING AND TECHNOLOGY

WINGS TO YOUR THOUGHTS.....

of the network topology. The routing table contents changes with time due to the topology change as a result of node mobility. The table size is large as it contains information of all the nodes in the network.

B. AODV:

Ad-hoc On-Demand Distance Vector routing is a reactive routing protocol for MANETs and other wireless ad hoc networks. In this, the network is idle until a connection is needed. The network node broadcasts a request for connection if required. Reactive/on demand routing protocol dynamically initiates the route discovery process when needed. It is a lazy approach and its main aim is to reduce the size and maintenance overhead of the routing table [3].

C. ZRP:

Zone Routing Protocol or ZRP is a hybrid Wireless Networking routing protocol that uses both proactive and reactive routing protocols when sending information over the network [10]. ZRP was designed to speed up delivery and reduce processing overhead by selecting the most efficient type of protocol to use throughout the route [4].

1.3 Routing algorithms in Ad hoc network

A routing algorithm for ad hoc networks in which each node belongs to the two networks in a routing algorithm [15]. The first one is physical network and second one is a virtual network. Routing algorithm is based on temporary addresses. A node is required a new temporary address when physical migration occurs. The source initiates a query phase when the source wants to communicate to a node, in which the nodes that belong to the physical networks and virtual networks of source are polled about the address of the sink.

A. Proactive Routing Algorithm:

The Proactive routing algorithms aim to keep consistent and up-to-date routing information between every pair of nodes in the network by proactively propagating route updates at fixed time intervals [15]. The pro-active routing protocol learns the network topology before a request comes in for forwarding. Since the proactive routing algorithm maintains routing tables for all nodes in the network, a route is found as soon as it is requested. The advantage of these protocols is low latency in discovering new routes and minimizes the end-to-end delay [5].

B. Reactive Routing Algorithm:

Reactive routing algorithms make a route to a given target only when a node requests for route. It initiates a route discovery process. It is also called On-demand Routing Algorithm [11]. A route has been established, the node keeps it until the destination is no longer accessible. The re-active routing protocol becomes active only when a node is willing to forward a request [8]. Reactive protocols are more efficient than proactive protocols because routes are only created when needed. Some of the re-active routing protocols are Dynamic Source Routing Protocol (DSR), Ad Hoc On-Demand Distance-Vector Routing Protocol (AODV) , Temporally Ordered Routing Algorithm (TORA) , Associativity-Based Routing (ABR) and Preferred Link-Based Routing Protocol (PLBR)[2][1].

1.4 APPLICATIONS

1.4.1 Tactical Networks

Military Communication and operation automated Battle fields. Some of the essentials requirements of a combat operations include network deploy ability, network security, end to end IP, high mobile connectivity and anti jamming mechanisms. In most of the cases, military operations are often spontaneous. These operations require a communications solution which is spontaneous too. In other words, the soldiers should be able to form a network when and where it is needed.

1.4.2 Sensor Network

Sensor networks are composed of a large number of small nodes with sensing, computation, and wireless communication capabilities. In sensor networks, sensor nodes are usually scattered and the position of sensor nodes needs not be predetermined. It means that sensor network protocols and algorithms must provide self-organizing capabilities. Another feature of sensor networks is the coordination of sensor nodes to produce high-quality information about the sensing environment. The features of sensor networks provide a wide range of applications such as health, military, and home. The network applications require wireless ad-hoc networking techniques. Infact many protocols and algorithms have been proposed for traditional wireless ad-hoc networks, they are not well suited to the unique features and application requirements of sensor networks. Therefore, many routing and data

INTERNATIONAL JOURNAL FOR ADVANCE RESEARCH IN ENGINEERING AND TECHNOLOGY
WINGS TO YOUR THOUGHTS.....

dissemination protocols should be designed for sensor networks example: Remote weathers for sensors, earth activities.

1.4.3 Emergency Services

Disaster recovery, earthquakes, crowd control and commando operations Search and rescue operations, Disaster recovery, Replacement of fixed infrastructure in case of environmental disasters, fire fighting, Supporting doctors and nurses in hospitals [5].

1.4.4 Commercial and civilian

E-commerce: Electronic payments can be done anytime and anywhere environments, Business: dynamic database access, mobile offices, Vehicular services: road or accident guidance, transmission of road and weather conditions, taxi cab network, inter-vehicle networks, Sports stadiums, trade fairs, shopping malls, Networks of visitors at airports.

1.4.5 Educational Applications

Setup virtual class & conference rooms, Universities and campus settings Ad hoc communications during meetings or lectures.

1.4.6 Entertainment

Multi-user games, Robotics pets, Wireless P2P networking, Outdoor Internet access, Theme parks.

1.4.7 Location Aware Services

Automatic Call forwarding, advertise location specific services, Location–dependent travel guide.

1.4.8 Home and enterprise

Home networking is the collection of electronic products and systems, enabling remote access and control of those products and systems, and any available contents such as music, video or data. In home networks, a user wants to accomplish data communication in ways that are affordable, reliable, easy to learn, and easy to use.

Wireless technology is the most convenient and exciting technology for creating home networking.

- networking • Conferences, meeting rooms
- Personal area networks (PAN), Personal networks (PN)
- Networks at construction sites

1.5 ZONE ROUTING PROTOCOL:

This protocol uses both the proactive and reactive schemes. The proactive scheme is used for all the nodes within the zone radius which is the Hop Count (HC) and the reactive scheme is used for all the other nodes in the network excluding the nodes in zone radius.

1.5.1 Architecture:

The Zone Routing Protocol, as its name implies, is based on the concept of zones [9]. A routing zone is defined for each and every node separately. It is also defined for the zones of neighboring nodes which overlap. The routing zone has a radius r expressed in terms of hops. The zone includes those nodes, whose distance from the node is at most r hops.

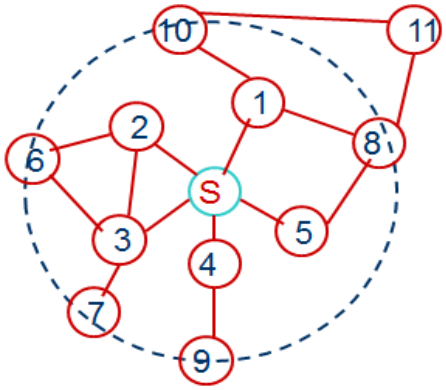

Figure 1- Routing Zone

A routing zone for node S of radius 2 is shown in above figure 1. The nodes from 1 to 10 belong to the routing zone of S, but not node 11. The nodes 6 to 10 are called peripheral nodes because hop distance from S is equal to radius of the routing zone. The information about neighbors is required to construct a routing zone of a given node. A neighbor is defined as a node for that node that communication can be established directly.
The Zone Routing Protocol can be used in various network environments by setting proper zone radius.

A. Intra Zone Routing Protocol:

The nodes within the zone use proactive routing. In this, each node within the zone records the routing information to the destination node DN in the routing table. When there is a request the path to the DN is determined by referring to the routing table. It is called Intra zone Routing Protocol (IARP) [12]. Node S generates the IARP packet periodically with a Hop

INTERNATIONAL JOURNAL FOR ADVANCE RESEARCH IN ENGINEERING AND TECHNOLOGY
WINGS TO YOUR THOUGHTS.....

Count (HC) and sends it to A, B, and C, which are its neighbouring nodes in fig 2.

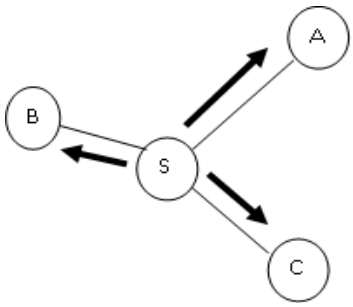

Figure 2- Transmission of IARP packets from S

B. Inter Zone Routing Protocol:

In ZRP, when the data is sending outside the zone radius of the source, it is a reactive routing and is called Inter Routing Protocol (IERP) [13]. In fig.3 the SN now knows the route to the DN=D and hence, it sends the data packet to D via the route S-C-I-D

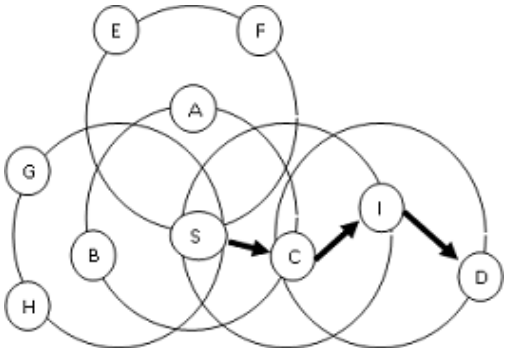

Figure 3- Transmission of IERP packets

2. RELATED WORK

Two major issues that need to be considered in ZRP are:

1. Power Management

In ZRP, the packets are forwarded with full power without considering the node's position inside the zone. According to Inverse Square Law, the power received by the receiving node is inversely proportional to square of the distance between the nodes. The node could waste power if the distance between the sender and the receiver node is less.

2. Bandwidth Utilization

As the distance between the sender and border nodes increases, the zone area will also increase, which means the radio coverage of the sender node will not be able to reach the border nodes in the zone. Due to that reason, the sender node will increase the number of broadcasts to find the border nodes in the zone, which will obviously increase the bandwidth utilization.

To solve these issues I used ZRP with anycast routing. My objectives are:

1. Implementation of ZRP with anycast routing using Modified Zone Routing Protocol:

In anycast routing, the packets are routed to the most nearest anycast group member. The concept of anycast is used in Modified Zone Routing Protocol assuming the destination as a member of anycast address, so the packet can be sent to any of the other member of the anycast group which is located nearer to the source node.

2. Performance Analysis of Modified ZRP:

The ZRP protocol is modified to create zones with respect to two power levels.

3. METHODOLOGY

Whenever the node forwards a packet to the intermediate or border node in the zone it uses the maximum power to reach the destination. To avoid this problem, the ZRP protocol is modified. The reason for creating a dynamically changing zone is - if a node has no border nodes elected but full of intermediate nodes elected then the intermediate nodes inside the zone will not be able to talk with its neighbouring zone nodes. According to this protocol one zone can communicate to another zone through the border nodes only [14].

In anycast routing, the packets are routed to the most nearest anycast group member [16]. The concept of anycast is used in Modified Zone Routing Protocol assuming the destination as a member of anycast address, so the packet can be sent to any of the other member of the anycast group which is located nearer to the source node.

Ns2

NS-2 stands for Network Simulator (version 2). NS-2 is a discrete event simulator. This simulator works at packet level. NS2 is an event driven simulation tool that useful in studying the dynamic nature of communication networks. NS-2 uses a TCL as scripting language. Simulation of wired and wireless network functions and protocols (e.g., routing algorithms, TCP, UDP) can be

INTERNATIONAL JOURNAL FOR ADVANCE RESEARCH IN ENGINEERING AND TECHNOLOGY
WINGS TO YOUR THOUGHTS.....

done using NS2. In general, NS2 provides users with a way of specifying such network protocols and simulating their corresponding behaviors. Due to its flexibility and modular nature, NS2 has gained constant popularity in the networking research community since its birth in 1989. Ever since, several revolutions and revisions have marked the growing maturity of the tool, thanks to substantial contributions from the players in the field. Among these are the University of California and Cornell University who developed the REAL network simulator,1 the foundation which NS is based on. Since 1995 the Defense Advanced Research Projects Agency (DARPA) supported development of NS through the Virtual Inter Network Test bed (VINT) project [9]. Currently the National Science Foundation (NSF) has joined the ride in development. Last but not the least, the group of researchers and developers in the community are constantly working to keep NS2 strong and versatile.

4. RESULTS

We work in the field of Mobile Ad hoc Network to support the better performance of the system by reducing the transmission power of the packets. The factors considered in the proposed work are:-

A. Energy:

The graph is showing energy of transmission power of packets with anycast and without anycast routing.

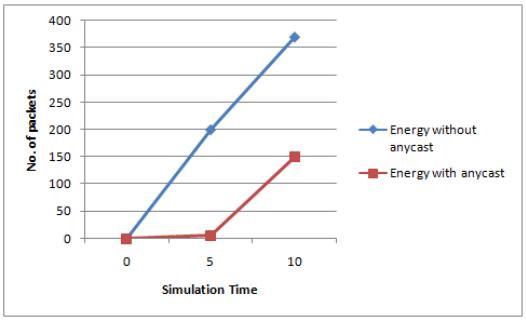

Figure 4- Energy consumed with anycast and without anycast

B. Number of packets Received/lost :

The graph is showing packets received and packets lost in ZRP.

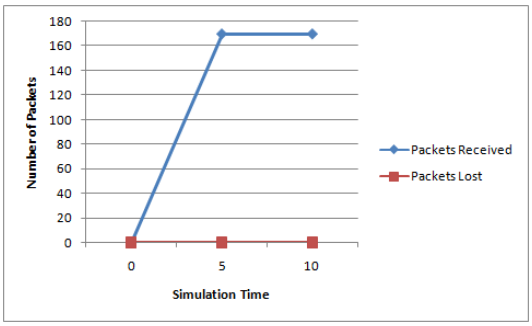

Figure 5- Packets received/lost in ZRP

5. CONCLUSION AND FUTURE SCOPE

Whenever the node forwards a packet to the intermediate or border node in the zone it uses the maximum power to reach the destination. The two main issues in existing work are power management and bandwidth utilization. Both the issues are resolved. Using ZRP with anycast routing reduces the transmission power or saves the transmission power of nodes. Hence, this reduces the energy consumption of the network.

References

[1] International Journal of Emerging Technology and Advanced Engineering (ISSN 2250-2459, Volume 2, Issue 5, May 2012), "Energy Management in Zone Routing Protocol (ZRP) "by Ravilla Dilli1, Putta Chandra Shekar Reddy2.

[2] "Improved Zone Routing Protocol with Reliability and Security using QualNet Network Simulator" by Saurav Ghosh.

[3] "Minimizing Delay and Maximizing Lifetime for Wireless Sensor Networks with Anycast", Joohwan Kim, Student Member, *IEEE*, Xiaojun Lin, Member, IEEE, Ness B. Shroff, Fellow, *IEEE*, and Prasun Sinha.

[4] "Scalable Unidirectional Routing with Zone Routing Protocol (ZRP) Extensions for Mobile Ad-Hoc Networks" by Prasun Sinha.

[5] Ayyaswamy Kathirvel, and Rengaramanujam Srinivasan, "Analysis of Propagation Model using Mobile Ad Hoc Network Routing Protocols", International Journal of Research and Reviews in Computer Science (IJRRCS), vol. 1(1), 2007.

INTERNATIONAL JOURNAL FOR ADVANCE RESEARCH IN ENGINEERING AND TECHNOLOGY

WINGS TO YOUR THOUGHTS.....

[6] IEEE JOURNAL ON SELECTED AREAS IN COMMUNICATIONS, VOL. 17, NO. 8, AUGUST 1999, "Determining the Optimal Configuration for the Zone Routing Protocol" Marc R. Pearlman, Student Member, *IEEE*, and Zygmunt J. Haas, Senior Member, IEEE.

[7] International Journal of Computer and Information Engineering 3:4 2009, "Load Balancing in Genetic Zone Routing Protocol for MANETs" by P. Sateesh Kumar.

[8] Journal of Theoretical and Applied Information Technology,"GENETIC ZONE ROUTING PROTOCOL" by P. Sateesh Kumar.

[9] Marc R. Pearlman and Zygmunt J Haas, "Determing the optimal configuration for the ZRP", IEEE Journal on Selected Areas in Communications, vol. 17(8), August, 1999, DOI: 10.1109/49.779922, pp-1359-1414.

[10] Md. Saiful Azad, Mohammad Moshee Uddin, Farhat Anwar and Md. Arafatur rahman "Performance Evaluation of Wireless Routing protocols in Mobile Wimax Environment", Proceedings of the International Multiconference Of Engineers And Computer Scientists, 2008, vol. 2, IMECS 2008, March 2008, pp.19-21.

[11] P. Sateesh Kumar, and S. Ramachandram, "Performance Studies on the various routing protocols in Ad hoc Networks", Int. Jrl. Of Scientific Computing", vol.2, No.1, pp. 83-91, Jun. 2008.

[12] P. Sateesh Kumar, S. Ramachandram and C.R. Rao, "Effect of Transmission Range on the Performance of Zone Routing Protocol in MANETs", *In Proceedings of ICACC-2007*, pp. 627-630, 2007.

[13] P. Sateesh Kumar, S. Ramachandram, "Genetic Zone Routing Protocol", Journal of Theoretical and Applied Information Technology, 2008, pp. 789-794.

[14] Sree Ranga Raju et. al, "Performance Evaluation of ZRP over AODV and DSR in MANETs using Qualnet", European Journal of Scientific Research, vol. 45(4), 2010, pp 651-667.

[15] T. Ravi Nayak, Pothalaiah Sake, K Ashok Babu, "Implementation Of Adaptive Zonal Routing Protocol For Wireless Network", International Journal Of Engineering Science And Technology, vol.2 (12), 2010, pp 7273-7288.

[16] Tapaswini Dash et al. / International Journal on Computer Science and Engineering (IJCSE)(ISSN : 0975-3397 Vol. 4 No. 06 June 2012), " Zone Routing Protocol Using Anycast Addressing For Ad-Hoc Network".