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RESEARCH ARTICLE

ENERGY EFFICIENT ROUTING IN MANET WITH ZRP AND ANYCAST

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Abstract— The Adhoc network is a wireless network without a fixed infrastructure, and this usually established on a temporary basis for a particular purpose like emergency rescue or military communication. And energy management in adhoc networks deal with the process of managing energy resources that means the controlling of battery discharge, modifying the transmission power, and scheduling the power sources for the increasing of lifetime of the nodes in an adhoc network. In adhoc network all mobile nodes are powered by energy constraint battery, it could be difficult for a mobile node to sustain for a long time if it send and receive data more often. To solve this problem we describe the energy efficient routing in mobile adhoc network using Zone Routing Protocol (ZRP) and anycast addressing and we also simulate using NS2 simulator. The zone routing protocol behave as hybrid routing, proactive (table driven) and reactive (on demand) methodology to provide scalable routing in the ad-hoc network.

Key Terms: - MANET; ZRP; ANYCAST; HYBRID PROTCOL; ENERGY EFFICIENT

I. INTRODUCTION

A mobile adhoc network (MANET) is a self-configuring infrastructure less network of group of mobile devices that's communicating via wireless. Each device in a MANET is free to move independently in any direction, and will therefore change its links to other devices frequently. A mobile ad hoc network (MANET) is a collection of wireless mobile nodes which have the ability to communicate with each other without having fixed network infrastructure or any central base station. Since mobile nodes are not controlled by any other controlling entity, they have unrestricted mobility and connectivity to others. Routing and network management are done cooperatively by each other nodes. Due to its dynamic nature MANET has larger security issues than conventional networks. A MANET is a type of ad hoc network that can change locations and configure itself on the fly. Because MANET is mobile, they use wireless connections to connect to various networks. This can be a standard Wi-Fi connection, or another medium, such as a cellular or satellite transmission.

1.1. Difference between MANET and WLAN

Manets are animatedly created and maintained by the individual nodes comprising the network. They do not need a pre-existing architecture for communication purposes and do not depend on any type of wired infrastructure; in an ad hoc network all communicating medium is wireless.

Manet contains a special subset of wireless networks since they do not require the existence of a centralized message-passing device, but in WLAN is a wireless network that's require existence of access points or static base stations, which are responsible for routing messages to and from mobile nodes within the specified transmission area.

1.2. Routing protocol in MANET

Routing protocol in MANET divided in three categories.

Proactive or table-driven routing protocols: proactive or table [4] driven routing protocols attempt to maintain consistent, up-to-date routing information between every pair of nodes in the network by propagating, proactively, route updates at fixed intervals.

Reactive or on demand routing protocols: reactive protocols, unlike table-driven ones, establish a route to a destination when there is a need for it, usually initiated by the source node through discovery process within the network. [4] Reactive protocols, unlike table-driven ones, establish a route to a destination when there is a demand for it, usually initiated by the source node through discovery process within the network.

Hybrid routing protocols: hybrid routing protocols [2] [6] [43] is the combination of the proactive and reactive protocol because pure proactive or pure reactive protocols perform well in a limited region of network setting. However, the diverse applications of adhoc networks across a wide range of operational conditions and network configuration pose a challenge for a single protocol to operate efficiently. Researcher's advocate that the issue of efficient operation over a wide range of conditions can be addressed best match these operational conditions.

Zone routing protocol: this protocol uses both the proactive and reactive schemes [3][43][47]. 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. The zone routing protocol can be used in various network environments by setting proper zone radius.

Intra zone routing protocol

The nodes within the zone use proactive routing. Here, each node within the zone records the routing information to the destination node DN in the routing table. When there is a routing request the path to the DN is determined by referring to the routing table. This is called intra zone routing protocol (IARP). This protocol is illustrated using an example described below:

• Node s generates the IARP packet periodically with a hop count (HC) and sends it to X, Y, and Z, which are its neighbouring nodes (in figure 1.6 referred by the black solid arrow).

• Nodes which receive the IARP packet record the route information (HC=1, DN=S in the own routing table by referring to the IARP packet information. The HC is incremented and the relay node (RN) is added. E.g. Source Node (SN)=S, HC=2, the RN=X. The relay node sends the IARP packet to its neighbour nodes.

• Until the HC is equal to zone radius, the second step is repeated.

• Nodes inside the zone carry out all the operation mentioned above and maintain their own routing tables. When there is a data packet sending request to the nodes within the zone radius, the packet is sent using the information in the routing table. Thus, the IARP maintains the route for each node inside the zone. In the routing table each record has a time-to-live parameter.

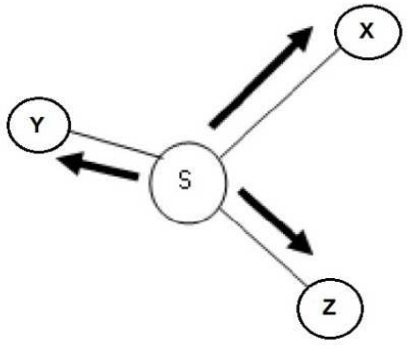

Figure 1.7 finding the node in IARP

Inter zone routing protocol

In ZRP, when the data sending is outside the zone radius of the source, it is a reactive routing and is called inter routing protocol (IERP).

• we assume that the destination node DN is node y (in figure 1.7 referred), which is located beyond the HC (assuming HC=2) and the source node X has no routing information about node y, so an ierp request packet is generated and sent to all the border nodes of the source with source node SN=X, DN=Y and number of border-cast NB=1.

• We see that the IERP request packet is sent to all the border nodes of the source called 'border-cast'. Here, the border nodes are node a, b and c.

• After the border nodes receive the IERP request packet they add one to the NB and add their own name to the relay node RN field in the IERP request packet. The information of the IERP request packet for node A is SN=X, DN=Y, RN=B and NB=2. The route to the DN node is searched by referring to their own routing tables. If the DN is not found in the routing table then the border-cast is repeated. But when the IERP request packets are sent to the SN or the RN, these packets are discarded by these nodes. If the DN is found in the routing table, then an IERP reply packet is sent to the SN in figure 1.7, as the IERP request packet has the routing information from x to y, so the node I sends the IERP reply packet to the source node s by using this information.

• The SN now knows the route to the DN=Y and hence, it sends the data packet to D via the route X-B-F-Y.

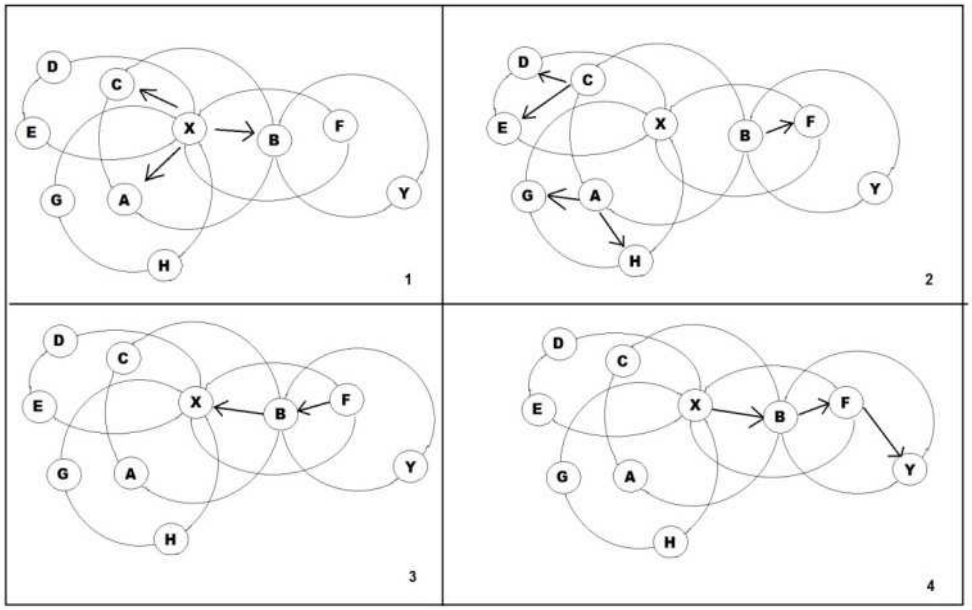

Figure 1.8 Searching DN in IERP

II. RELATED WORK

The authors in [1] have shown the development of the efficient power aware protocol is the need of today's ad-hoc networks. Although developing battery efficient systems that have low cost and complexity, remains a crucial issue. In order to facilitate communication within a mobile ad-hoc network, an efficient routing protocol is required to discover routes between mobile nodes. Power is one of the most important design criteria for ad-hoc networks as batteries provide limited working capacity to the mobile nodes. Power failure of a mobile node not only affects the node itself but also its ability to forward packets on behalf of others and hence affects the overall network lifetime. Much research efforts have been devoted to develop energy aware routing protocols. In this paper the authors proposed an efficient algorithm, which maximizes the network lifetime by minimizing the power consumption during the source to destination route establishment.

Marc R. Pearlman [5] at al present a paper and they discuss how to configure the ZRP then that's provide the best performance for a particular network at any time, and Previous work has demonstrated that an optimally configure the ZRP that operates at least as efficiently as reactive flood-search or proactive distance vector/link state routing protocols. In this paper, they also prove the effects of relative node velocity, node density, network span, and user data activity on the performance of the ZRP. Jan Schaumann [7] in 2002 analyse the ZRP in mobile Adhoc network discuss the basic of MANET and implication on routing and problems occur due to rapidly changing topology without fixed router. In paper author, also discuss the ZRP hybrid routing protocol having both proactive and reactive protocol in context to other routing protocol.

Suresh Kumar et al [32] have present a paper and they compare between the CBR in ZRP, AODV and DSR. They show different parameter with help of simulation, like total bit send, total packet send, and total through put within these routing protocols. Vincent at al [37] present a paper and they discuss about the density-based anycast routing, in this new anycast routing paradigm mostly suitable for wireless ad hoc networks. Instead of routing packets merely on proximity information to the closest member, density-based anycast routing considers the number of available anycast group members for its routing decision. And they also presented a unified

model based on potential fields that allows for instantiation of pure proximity-based, pure density-based, as well as hybrid routing strategies.

Casey Carter at al [39] presents a paper and they discuss about the result, if we compare the any casting and many casting. In this paper they used this addressing method in DSR routing protocol, and show if we use any casting in DSR then average end-to-end delay is less than the simple DSR and failure of transmission is less than other.

III. PROBLEM FORMULATION

In mobile ad hoc network all nodes are mobile and autonomous, and each node also works as host and router. Every node is powered by an energy constrained battery the size and power of battery is limited is we increases the size of battery in mobile node then problem during the mobility of node. Then we need some powerful routing scheme then consume less power and increases the lifetime of node in any network.

The major problem in making an energy efficient approach is the finding the most power consumed area in Mobile nodes. In mobile node energy management is divided in to many categories that are the transmission power management, battery energy management, processor power management, and device power management.

In the mobile node first area of consumption of power is by the radio frequency module in mobile node. The major operation of this radio frequency module is transmit, receive data packet to other nodes.

Battery energy management is aimed at extending the battery life of node by taking advantages of its chemical properties, discharge pattern, and selection of battery.

Power consumed by the processor in mobile devices is affected by the clock speed and the number of instructions executed per unit time is some of the processor parameter that affects power consumption.

The intelligent device management can reduce power consumption of a mobile node significantly. This can be done by the operating system by selectively powering down interface devices that are not used or putting different power saving mode.

IV. IMPLEMENTATION

We use NS2 (Network Simulator) for the Simulation of Zone Routing Protocol and any cast the version of NS2 is 2.33, The NS2 (network Simulator) is widely used tool that in networking research and simulate the behaviour of wired and wireless networks. NS provides extensive support for simulation of TCP, UDP, routing, and multicast, unicast protocols over wired and wireless (local and satellite) networks.

Simulator Parameter

Protocol Used	ZRP(Zone Routing Protocol)
Zone Radius	2
Simulation Time	15sec
No of Nodes	30
Type of Traffic	CBR (Constraint Bit Rate)
No of Connections	20
Addressing Method	Anycast
No of Packets	512

V. SIMULATION RESULTS

The main idea behind the calculating the energy in among nodes first we check the energy consumption areas in the node, then we found there are three areas in mobile node that consume most power, that's radio frequency module, processing unit in node, and consumed energy by device. In that's three areas we only modify in the frequency module and processing unit. If we communicate via simple ZRP then all areas work in the all node but if apply the anycast in ZRP then all nodes are not in working them we save power in that nodes.

The calculation of energy in ZRP and ZRP with the anycast, first we any two default value of energy that is transmission energy and receiving energy by a node. When nodes in simple ZRP send or receive data then we calculated the total energy by all node, and energy in ZRP with anycast we use same idea calculated energy by

all node active in ZRP with anycast. The number of active nodes in ZRP with anycast is less than the simple ZRP then total average value of energy of ZRP with anycast is less than simple ZRP.

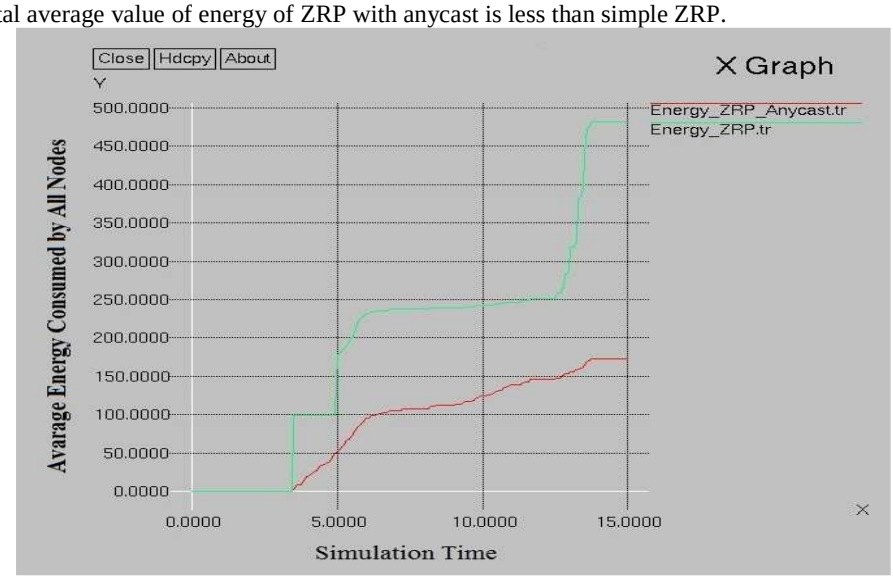

Figure 6.1 Graph between average energy consumed by all nodes and simulation time

Above graph (figure 6.1) shows the result of average energy consumed by simple ZRP and ZRP with anycast. Anycast is addressing method and routing method the main advantage of using method there is no more overhead data packet, and supposes if any link is failure then this use alternate link. When we use anycast in ZRP then total number of nodes in active state is decreases, and it uses only anycast addressed node then total number nodes is decreases then the time delay between source node and destination node is decreases.

The total time taken for transferring the data source to destination is depend upon the various objects in network like medium i.e. wired or wireless, congestion in network, how far is destination node and type of protocol used. In this proposed mechanism take wireless medium, and we use the Anycast addressing then there is no over congestion in network, and we use the hybrid protocol that is Zone Routing Protocol that take the advantage of both type of protocol.

Figure 6.2 Graph between average end-to-end time delay and simulation time

In the figure 6.2 shows the average end-to-end time delay comparison between ZRP and ZRP with Anycast shows. In this graph green line in graph shows average end-to-end time delay in simple ZRP and red line shows average end-to-end time delay in ZRP with Anycast that is lower than simple ZRP. Then we say that ZRP with Anycast transfer data faster than simple ZRP.

VI. CONCLUSION AND FUTURE WORK

In this paper we proposed an energy efficient routing scheme for mobile adhoc network with using Zone Routing Protocol and anycast addressing, and also compare with the simple ZRP. After comparison of ZRP and ZRP with anycast, then we say that if we use ZRP with anycast then energy consumption is less than simple ZRP and average end-to-end time delay is also reduce when we use ZRP with anycast. Making of a new mechanism for the improvement of the previous routing mechanism, this improvement also prove with the use of NS2 simulator.

The possible future enhancement is anycast address using in another routing protocol, and we check that is better than ZRP or not. And also check what effect on when we using different zone radius.

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