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EXTENDING LIFETIME OF ADHOC NETWORK USING DYNAMIC PATH SWITCHING TECHNIQUE

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ABSTRACT* - In wireless ad-hoc networks, the nodes themselves from the network, and they do not need fixed infrastructure, therefore each node executes routing functionalities, such as forwarding network traffic. Manet is powered by battery which is prone to decrease with time. Designing a power aware routing is a crucial challenge in communication networks as it plays a vital role in maintaining the required QOS. Routing protocols and algorithms for MANETs are classified into three main types, proactive, reactive and Hybrid. In this paper a power aware routing algorithm called Dynamic path switching is proposed, which attempt to extend the lifetime of network in MANET. It creates a new path based on the battery level of the nodes. DPS aims at preventing node failure which eventually leads to increase in lifetime of the network. The proposed technique is incorporated in Zone Routing Protocol (ZRP) and can be simulated using NS-2 simulator to obtain the QOS parameters.

***Keywords*- MANET, QOS, DPS, ZRP**

I. INTRODUCTION

1.1 GENERAL

Mobile ad-hoc network (MANET) is one of the most promising fields for research and development of wireless network. As the popularity of mobile device and wireless networks significantly increased over the past years, wireless ad-hoc networks has now become one of the most vibrant and active field of communication and networks. Mobile Ad Hoc Networks (MANETs) has become one of the most prevalent areas of research in the recent years because of the challenges it pose to the related protocols. MANET is the new emerging technology which enables users to communicate without any physical infrastructure regardless of their geographical location, that's why it is sometimes referred to as an infrastructure less‖ network. The proliferation of cheaper, small and more powerful devices make MANET a fastest growing network. An ad-hoc network is self-organizing and adaptive. Device in mobile ad hoc network should be able to detect the presence of other devices and perform necessary set up to facilitate communication and sharing of data and service. Ad hoc networking allows the devices to maintain connections to the network as well as easily adding and removing devices to and from the network. Due to nodal mobility, the network topology may change rapidly and unpredictably over time.

1.1.2 GENERAL ISSUES FOR WIRELESS AD HOC NETWORK:

Guaranteeing delivery and the capability to handle dynamic connectivity are the most important issues for routing protocols in wireless mobile ad hoc networks. Once there is a path from the source to the destination for a certain period of time, the routing protocol should be able to deliver data via that path. If the connectivity of any two nodes changes and routes are affected by this change, the routing protocol should be able to recover if an alternate path exists. There are some other issues related to routing in wireless ad hoc networks. Whether to consider them depends on the specific environment or application. For example, overhead is particularly important in a wireless network with limited bandwidth. Power consumption may also be a problem in an ad hoc network with battery-powered nodes. Quality of service may be required in an ad hoc network supporting delay sensitive applications such as video conferencing A routing protocol may need to balance traffic based on the traffic load on links Scalability of routing protocols is an important issue for large networks. The routing protocol may need to implement security to protect against attacks, such as sniffer, man-in-the-middle, or denial of service.

II. SYSTEM ANALYSIS

2.1. EXISTING SYSTEM:

STUDY ON ENERGY CONSERVATION

It deals with an energy management model, in which each node can transfer its state between power-save mode and active mode. In such model, each mobile node can be in one of two modes, i.e., active mode (AM) and power-save mode (PS). In active mode, a node is awake and may receive data at any time. In power-save mode, a node is sleeping most of the time and wakes up periodically to check for pending messages. Transitions between power-save and active mode are triggered by packet arrivals and expiration of the keep a live timer.

OPTIMIZING POWER-AWARE ROUTING

The mobile ad-hoc network (MANET) is difficult to maintain the routing path from node mobility. The device in mobile ad-hoc network has limited power. It is in charge of both transmitting data packet and maintaining routing path. In consequence, the lifetime of routing path differ with the power control method This paper propose the routing model using PARO (Power- Aware Routing Optimization) and ZRP (Zone Routing Protocol) for effective power control and transmission. It presents a routing algorithm which tries to minimize the power consumed in transmitting a packet from the lifetime of the network by avoiding nodes that have a shorter lifetime remaining.

POWER-AWARE ROUTING BASED ON THE ENERGY DRAIN RATE

Mobile ad hoc networks (MANETs) inherent power limitation makes power-awareness a critical requirement for MANET protocols. This paper proposes a new routing metric, the drain rate, which predicts the lifetime of a node as a function of current traffic conditions. The paper describe the minimum drain rate (MDR) mechanism which uses a combination of the drain rate with remaining battery capacity to establish routes.

MAXIMUM BATTERY LIFE ROUTING

Most ad hoc mobile devices today operate on batteries. Hence, power consumption becomes an important issue. To maximize the lifetime of ad hoc mobile networks, the power consumption rate of each node must be evenly distributed, and the overall transmission power for each connection request must be minimized. These two objectives cannot be satisfied simultaneously by employing routing algorithms. This paper presents a new power-aware routing protocol to satisfy these two constraints simultaneously.

ENERGY-AWARE ROUTING IN MANET

In this paper, it presents a thorough energy-based performance study of power-aware routing protocols for wireless mobile ad hoc networks. The energy consumption model is based on a detailed implementation of the IEEE 802.11 physical layer convergence protocol (PLCP) and medium access control (MAC) sub layers. To our best knowledge, this is the first such detailed performance study. Moreover, it some novel enhancements to routing in wireless ad hoc networks that enables the admission of flows without jeopardizing the limited energy of the wireless station.

2.1.1. ROUTING PROTOCOLS:

AD hoc routing protocols can be divided in two major categories. They may be either table driven (i.e. proactive) or on-demand-driven (i.e. reactive). In addition to this categorization there are some other generic properties and characteristics for these protocols as explained in section 2.Protocols using proactive approach maintain consistent routing information from each node to every other node. The nodes keep routing information up to date by propagating route updates throughout the network. Protocols using reactive approach are source initiated.

2.1.1 PROACTIVE ROUTING PROTOCOLS:

A Proactive Routing Protocol is also called "table driven" routing protocol. Using a proactive routing protocol, nodes in a mobile ad hoc network continuously evaluate routes to all reachable nodes and attempt to maintain consistent, up-to-date routing information. Therefore, a source node can get a routing path immediately if it needs one. In proactive routing protocols, all nodes need to maintain a consistent view of the network topology. When a network topology change occurs, respective updates must be propagated throughout the network to notify the change. Most proactive routing protocols proposed for mobile ad hoc networks have inherited properties from algorithms used in wired networks. To adapt to the dynamic features of mobile ad hoc networks, necessary modifications have been made on traditional wired network routing protocols. Using proactive routing algorithms, mobile nodes proactively update network state and maintain a route regardless of whether data traffic exists or not, the overhead to maintain up-to-date network topology information is high.

2.2. PROPOSED SYSTEM:

DYNAMIC PATH SWITCHING: Dynamic path switching is aimed at preserving each node alive as long as possible, more so as the node approaches the end of its battery life. Our main goal is to allow nodes to preserve battery during long in terms of time forwarding. We present a novel protocol that appreciates overloaded nodes and moves them to a sleep state if some conditions are respected.

In addition, to keep existing connections alive, nodes are able to select alternative paths dynamically, though still avoiding sleeping nodes. On a real scenario, when a node acting as forwarder realizes that it is consuming too much energy to honor its task, it would request to quit the forwarding state to save its remaining energy for other tasks. However, the node can quit forwarding only if others can take over its role. Otherwise its request will not be accepted. This is crucial because a node cannot decide arbitrarily to leave its role and create connectivity problems.

III. SOFTWARE DESCRIPTION

3.1 Ns-2

NS-2 is an object oriented simulator, written in C++, with an OTcl interpreter as a front end. The simulator supports a class hierarchy in C++ (also called the compiled hierarchy in this document), and a similar class hierarchy within the OTcl interpreter (also called the interpreted hierarchy in this document). The root of this hierarchy is the class TclObject. Users create new simulator objects through the interpreter; these objects are instantiated within the interpreter, and are closely mirrored by a corresponding object in the compiled hierarchy.

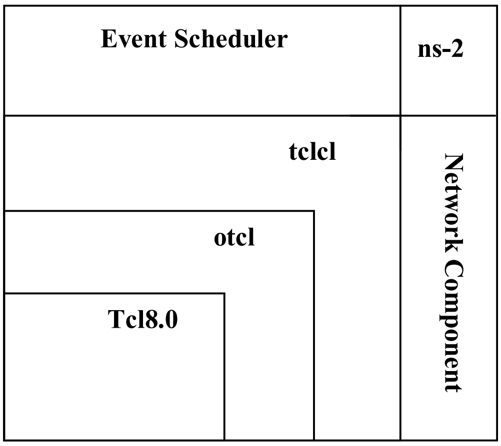

Figure 3.1 NS2 with interpreter

The interpreted class hierarchy is automatically established through methods defined in the class TclClass. User instantiated objects are mirrored through methods defined in the class TclObject. There are other hierarchies in the C++ code and OTcl scripts; these other hierarchies are not mirrored in the manner of TclObject.NS-2 uses two languages because simulator has two different kinds of things it needs to do. On one hand, detailed simulations of protocols require a systems programming language which can efficiently manipulate bytes, packet headers, and implement algorithms that run over large data sets. For these tasks run-time speed is important and turn-around time (run simulation, find bug, fix bug, recompile, re-run) is less important. On the other hand, a large part of network research involves slightly varying parameters or configurations, or quickly exploring a number of scenarios. In these cases, iteration time (change the model and re-run) is more important. Since configuration runs once (at the beginning of the simulation), run-time of this part of the task is less important. ns meets both of these needs with two languages, C++ and OTcl. C++ is fast to run but slower to change, making it suitable for detailed protocol implementation. OTcl runs much slower but can be changed very quickly (and interactively), making it ideal for simulation configuration. ns (via tclcl) provides glue to make objects and variables appear on both languages.

IV.PROJECT DESCRIPTION

4.1 ZONE ROUTING PROTOCOL:

The Zone Routing Protocol (ZRP) combines the advantages of the proactive and reactive approaches by maintaining an up-to-date topological map of a zone centered on each node. Within the zone, routes are immediately available. For destinations outside the zone, ZRP employs a route discovery procedure, which can benefit from the local routing information of the zones. As seen, proactive routing uses excess bandwidth to maintain routing information, while reactive routing involves long route request delays. Reactive routing also inefficiently floods the entire network for route determination. The Zone Routing Protocol (ZRP) aims to address the problems by combining the best properties of both approaches. ZRP can be classed as a hybrid reactive/proactive routing protocol. In an ad-hoc network, it can be assumed that the largest part of the traffic is directed to nearby nodes. Therefore, ZRP reduces the proactive scope to a zone centered on each node. In a limited zone, the maintenance of routing information is easier. Further, the amount of routing information that is never used is minimized. Still, nodes farther away can be reached with reactive routing. Since all nodes proactively store local routing information, route requests can be more efficiently performed without querying all the network nodes. Despite the use of zones, ZRP has a flat view over the network. In this way, the organizational overhead related to hierarchical protocols can be avoided.

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Hierarchical routing protocols depend on the strategic assignment of gateways or landmarks, so that every node can access all levels, especially the top level. Nodes belonging to different subnets must send their communication to a Subnet that is common to both nodes. This may congest parts of the network. ZRP can be categorized as a flat protocol because the zones overlap. Hence, optimal routes can be detected and network congestion can be reduced. Further, the behavior of ZRP is adaptive. The behavior depends on the current configuration of the network and the behavior of the users.

4.2 ARCHITECTURE:

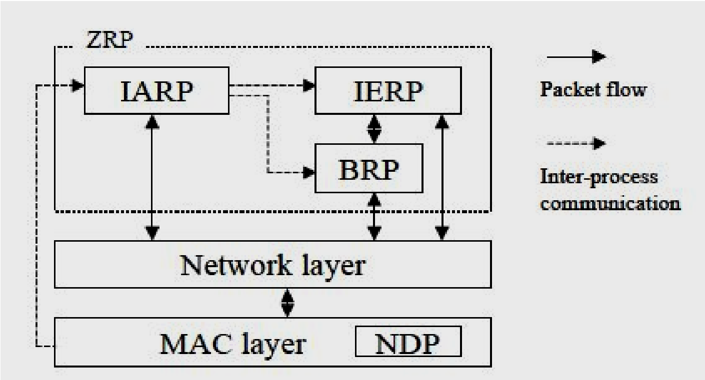

Figure 4.1 ZRP Architecture

ZRP refers to the locally proactive routing component as the Intra-zone Routing Protocol (IARP). The globally reactive routing component is named IntEr-zone Routing Protocol (IERP). IERP and IARP are not specific routing protocols. In-stead, IARP is a family of limited-depth, proactive link-state routing protocols. IARP maintains routing information for nodes that are within the routing zone of the node. Correspondingly, IERP is a family of reactive routing protocols that offer enhanced route discovery and route maintenance services based on local connectivity monitored by IARP. The fact that the topology of the local zone of each node is known can be used to reduce traffic when global route discovery is needed. Instead of broadcasting packets, ZRP uses a concept called border casting. Border casting utilizes the topology information provided by IARP to direct query request to the border of the zone. The border cast packet delivery service is provided by the Border cast Resolution Protocol (BRP). BRP uses a map of an extended routing zone to construct border cast trees for the query packets.

Alternatively, it uses source routing based on the normal routing zone. By employing query control mechanisms, route re-quests can be directed away from areas of the network that already have been covered. In order to detect new neighbor nodes and link failures, the ZRP relies on a Neighbor Discovery Protocol (NDP) provided by the Media Access Control (MAC) layer. NDP transmits “HELLO” beacons at regular intervals. Upon receiving a beacon, the neighbor table is up-dated. Neighbors, for which no beacon has been received within a specified time, are removed from the table. If the MAC layer does not include a NDP, the functionality must be provided by IARP. The relationship between the components is illustrated in Figure Route updates are triggered by NDP, which notifies IARP when the neighbor table is updated. IERP uses the routing table of IARP to respond to route queries. IERP forwards queries with BRP. BRP uses the routing table of IARP to guide route queries away from the query source.

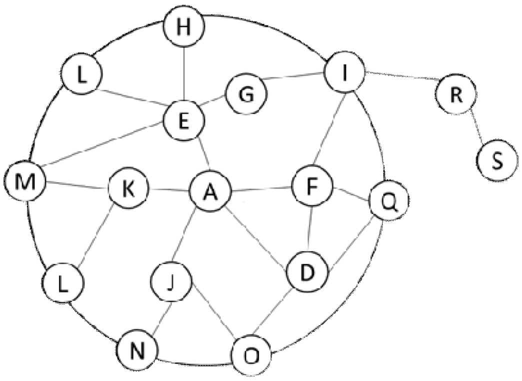

Figure 4.2 Zone routing protocol

Figure 5.2 represents zone routing protocol, were A is the source node with a radius 2. Node A transmits data to the nodes within its radius through proactive mechanism by maintaining a routing table. Nodes R and S are outside the zone of A. Data forwarding to R and S occur reactively by Border casting technique, which helps in establishing a link between nodes A and R.

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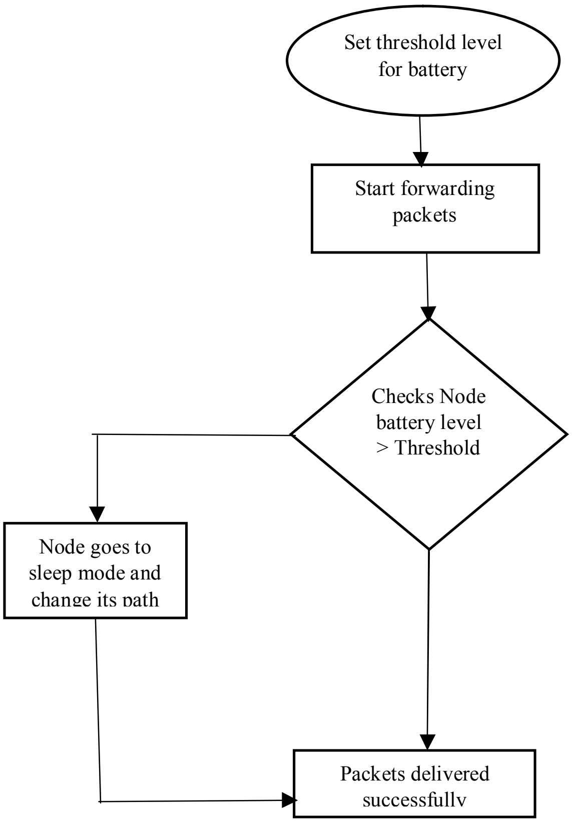

Figure 4.3 : DPS flow diagram

4.4 ZRP WITH DPS

The energy aware DPS technique is incorporated in ZRP. It operates as per the routing mechanism of ZRP protocol. It changes the path based on the conditions for changing path. If battery power of node inside the zone gets low it changes path with help of the updated routing table, which possess all the routing information. When the battery level of a node which is outside a zone gets low the DPS changes path reactively through border casting.

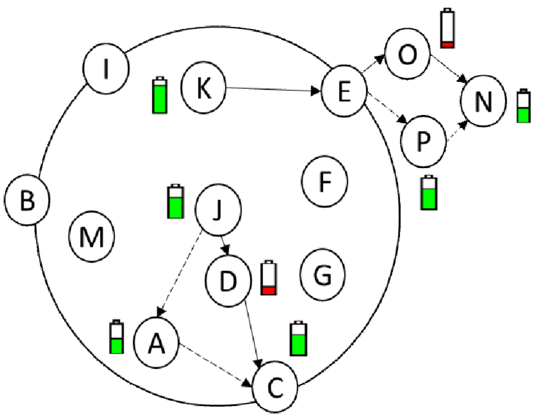

Figure 4.4 ZRP with DPS

Figure 5.5 represents incorporation of DPS in ZRP protocol. Packet forwarding is to occur between node J and node C is Transmission from node J to node C takes the path J-D-C in normal conditions. But when D's battery goes below threshold it goes to sleep mode the source changes the path to J-H-A-C which is an alternate path to reach node C. This occurs under proactive condition. Consider another scenario were packet forwarding is to occur between nodes K and N For this scenario transmission occur reactively as N is outside the zone K first reaches the peripheral nodes and then gets to destination, here the original path is K-E-O-N whereas the alternate path is K-E-P-N. The source takes an alternate path if O's battery goes below the preset threshold. The incorporation of DPS in ZRP effectively decreases the energy consumption

V. RESULTS

5.1 SIMULATION SETUP:

Simulation is done with Network simulator-2 tool. We consider all the parameters required for the simulation. Size of the simulation environment is 1000x1000 m^2.No of nodes chosen are in range 10, 20, 30, 40, 50, 60. The node density varies from 10 to 70.Routing protocol is Zone routing protocol, ZRP is a hybrid routing protocol. It is chosen since energy conservation can be done effectively the transmitting power is chosen to be 0.2 joules. The receiving power is 0.1 joules. Battery threshold is 30 joules the node changes path if battery level goes below this threshold value. The total simulation time is chosen to be 200 seconds. The packet size is set as 2000.Range of transmission is 100 meters. In these simulations the parameters compared are average energy consumed- energy consumed per node, PDR (Packet Delivery Ratio)-ratio of total packets received to packets sent, throughput and normalized overhead-the overhead used per packet received. These parameters are taken for the no. of nodes ranging from 10 to 70 in steps of 10. By fixing the topology area fixed and varying the no. of nodes alone the node density is varied and hence a correct validation of the protocol is possible.

5.2 RESULT

The use of Dynamic path switching has influenced the improvement of the network. The network performance parameters are compared with the performance of the ordinary ZRP. The results reveal that the new network DPSZRP is better than ZRP. The parameters which have been compared are Energy, Throughput, Packet delivery ratio, Packet loss and delay. All the parameters are found to perform better compared to the normal ZRP. The incorporation of DPS improves the overall network performance moreover the network exists for a longer duration compared to the existing one. DPS also reduces the link breakages in a network which improves the reliability of packet transmission.

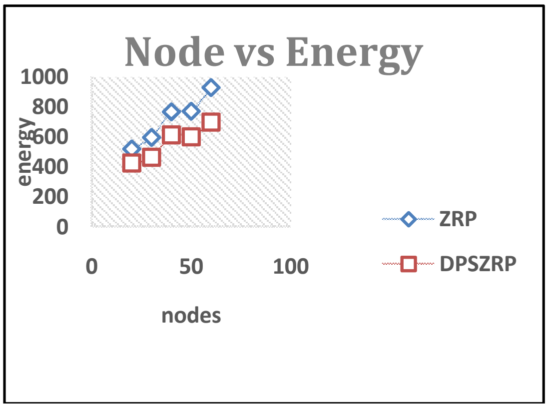

Figure 5.1: Energy consumption comparison

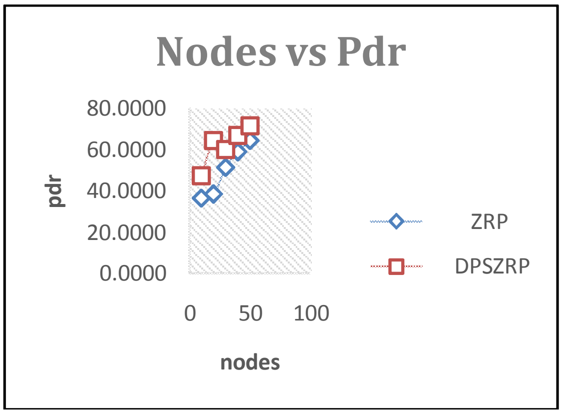

Figure 5.2 Packet delivery ratio comparisons

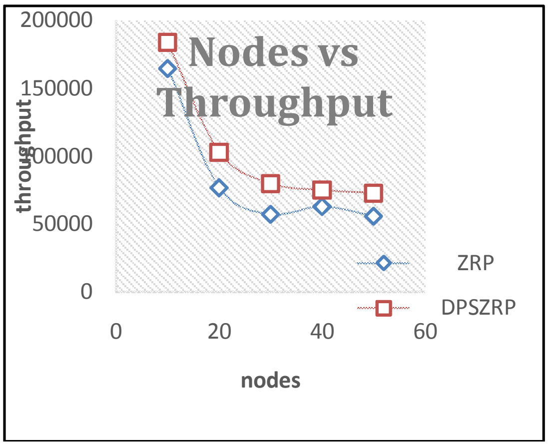

Figure 5.3 Throughput comparison

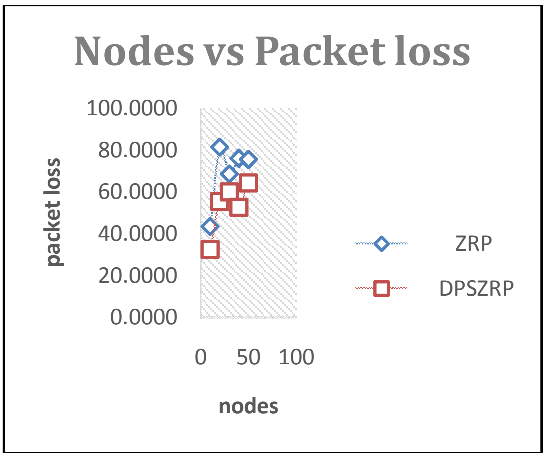

Figure 5.4 Packet loss comparisons

VI. CONCLUSION

The desired objective is obtained by implementing Dynamic path switching technique in ZRP. The modified DPSZRP technique has better overall network performance. It enhances the performance of the network by changing paths based on the battery level of a node. The DPSZRP design is found to be more efficient compared to ZRP. It makes network to exist for longer duration. The energy consumed by the proposed design is considerably low thus making the network an efficient one.

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