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REVIEW ARTICLE

A New Energy Efficient Approach in MANETs: A Review

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ABSTRACT

MANET is combination of mobile nodes which uses multi hop transmission for communication. Due to highly dynamic topology, routing in MANET is challenging task, moreover presence of malicious nodes make the overall network very insecure. We study both the availability and the duration probability of arouting path that is subject to link failures caused by node mobility. In this paper we describe the most prominent aspect related to the MANET and proposed routing protocol for an energy efficient clustering based algorithm that considers the node mobility and its battery power for calculating its node weight. In this algorithm, we will find that node which has highest weight and make it as cluster head node for base station and best efficient path.

Keywords—MANET, Clustering, Mobility, Efficiency, Stability, Routing Protocols, Cluster Head.

INTRODUCTION

Ad hoc networks consist of hosts interconnected by routers without a fixed infrastructure and can be arranged dynamically [1]. Considerable work has been done in the development of routing protocols in different types of ad hoc networks like MANETs, WMNs, WSNs, and VANETS etc. In recent years, the interest in ad hoc networks has grown due to the availability of wireless communication devices that work in the ISM bands [2]. While designing an ad hoc network in particular we are concerned with the capabilities and limitations that the physical layer imposes on the network performance. Since in wireless networks the radio communication links are unreliable so it is desirable to come up with an integrated design comprising of physical, MAC and network layers. Mobile ad hoc network (MANET) is a type of ad hoc network that can change locations and configure itself on the fly. Because MANETS are 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. In Latin, ad hoc means "for this," further meaning "for this purpose only." They can be set up anywhere without any need for external infrastructure [3].Clustering is the technique that is exercised to supervise enormous ad hoc network. In clustering nodes are organized in groups and every group is known as cluster. A node with high energy is elected as head node that can direct all the member nodes of same cluster and it aids to make the network more manageable. Figure1 show the architecture of MANET.

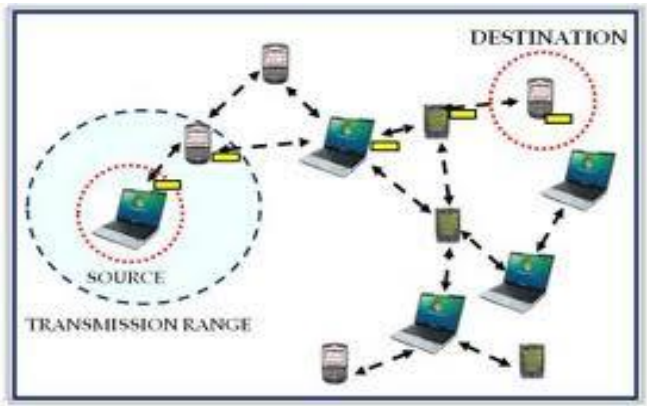

Figure 1: MANET

ROUTING PROTOCOLS

A routing protocol specifies how routers communicate with each other, disseminating information that enables them to select routes between any two nodes on a computer network. Routing algorithms determine the specific choice of route. Each router has a priori knowledge only of networks attached to it directly [4-7]. A routing protocol shares this information first among immediate neighbors, and then throughout the network. This way, routers gain knowledge of the

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topology of the network. An ad hoc routing protocol is a convention, or standard, that controls how nodes decide which way to route packets between computing devices in a mobile ad hoc network. In ad hoc networks, nodes are not familiar with the topology of their networks. Instead, they have to discover it: typically, a new node announces its presence listens for announcements broadcast by its neighbors. Each node learns about others nearby and how to reach them, and may announce that it too can reach them. We also describe the particular parameters that we choose when implementing each protocol. But before that the basic differences in these protocol implementation lies in the mechanisms they followed according to routing strategy based classification as reactive and proactive protocols [8]. In Reactive or on-demand routing routes are only discovered when they are actually needed. Hence, a node that wants to send a packet to another node, the reactive protocols searches for the route in an on-demand basis and establishes a connection to transmit and receive a packet. The route discovery typically consists of network wide flooding of request message. In contrast, in proactive routing each node continuously maintain route between pair of nodes. Hence, route creation and maintenance is accomplished through some combination of periodic and event-triggered routing updates derived from distance-vector or link-state method. Routing protocols in MANET [9] [10] are divided into four categories: proactive, reactive and hybrid routing protocols. The most popular ones are AODV, DSR (reactive), OLSR (proactive) and GRP (hybrid). This section describes the main features of three protocols AODV (AdHoc On-Demand Distance Vector Protocol), OLSR (Optimized Link State Routing) and GRP (Gathering-based Routing Protocol) deeply studied using OPNET14.5. An ad-hoc routing protocol is a convention, or standard, that it improves the scalability of wireless networks compared to infrastructure based wireless networks because of its decentralized nature. Ad-hoc networks are best suited due to minimal configuration and quick operation.

Dynamic Source Routing (DSR) and Ad Hoc On-Demand Distance Vector Protocol (AODV)

DSR is a simple and efficient routing protocol designed specifically for use in multihop wireless adhoc networks of mobile nodes. It allows nodes to dynamically discover a source route across multiple network hops to any destination in the adhoc network. Each data packet sent then carries in its header the complete ordered list of nodes through which the packet must pass, allowing packet routing to be a trivially loop free and avoiding the need for up-to-date routing information in the intermediate nodes through which the packet is forwarded. With the inclusion of this source route in the header of each data packet, other nodes forwarding or overhearing any of the packets may easily cache this routing information for future use.

AODV [11] is a reactive routing protocol that minimizes the number of broadcasts by creating routes on demand. The AODV algorithm is an improvement of DSDV [12] protocol. It reduces number of broadcast by creating routes on demand basis, as against DSDV that maintains mutes to each known destination. The main advantage of AODV protocol is that routes are established on demand and destination sequence numbers are used to find the latest route to the destination. The source broadcasts a route request (RREQ) packet when it wants to find path to the destination. The neighbors in turn broadcast the packet to their neighbors until it reaches an intermediate node that has recent route information about the destination or until it reaches the destination. When a node forwards a RREQ to its neighbors, it also records in its tables the node from which the first copy of the request came. This information is used to construct the reverse path for the route reply packet (RREP). AODV uses only symmetric links because the RREP follows the reverse path of the RREQ. An important feature of AODV is the maintenance of timer based states in each node, regarding utilization of individual routing table entries. A routing table entry is expired if not used recently. Another distinguishing features of AODVis the ability to provide unicast, multicast and broadcast communication.

Destination-Sequenced Distance-Vector Routing (DSDV) and Optimized Link State Routing (OLSR)

DSDV is a hop-by-hop distance vector routing protocol requiring each node to periodically broadcast routing updates based on the idea of classical Bellman-Ford Routing algorithm. Each node maintains a routing table listing the “next hop” for each reachable destination, number of hops to reach destination and the sequence number assigned by destination node. The sequence number is used to distinguish stale routes from new ones and thus avoid loop formation. The stations periodically transmit their routing tables to their immediate neighbors. A

station also transmits its routing table if a significant change has occurred in its table from the last update sent. So, the update is both time-driven and event-driven. The routing table updates can be sent in two ways: a "full dump" or an "incremental" update.

OLSR [13] is a modular proactive hop by hop routing protocol. It is an optimization of pure link state algorithm in ad hoc network. The routes are always immediately available when needed due to its proactive nature. The key concept of the protocol is the use of "multipoint relays" (MPR). Each node selects a set of its neighbor nodes as MPR [8]. Only nodes, selected as such MPRs are responsible for generating and forwarding topology information, intended for diffusion into the entire network. The MPR nodes can be selected in the neighbor of source node. Each node in the network keeps a list of MPR nodes. This MPR selector is obtained from HELLO packets sending between in neighbor nodes. These routes are built before any source node intends to send a message to a specified destination In order to exchange the topological information; the Topology Control (TC) message is broadcasted throughout the network. Each node maintains the routing table in which routes for all available destination nodes are kept. Control traffic in OLSR is exchanged through two different types of messages: "HELLO" and "TC" messages. HELLO messages are exchanged periodically among neighbor nodes, in order to detect links to neighbors, to detect the identity of neighbors and to signal MPR selection. TC messages are periodically flooded to the entire network, in order to signal link-state information to all nodes. The best working environment for OLSR protocol is a dense network, where the most communication is concentrated between a large numbers of nodes.

Gathering-based Routing Protocol (GRP)

Gathering-based Routing Protocol [14] [15] combines the advantages of Proactive Routing Protocol (PRP) and of Reactive Routing protocol (RRP). PRP are suitable for supporting the delay sensitive data such as voice and video but it consumes a great portion of the network capacity. While RRP is not suitable for real-time communication, the advantage of this approach is it can dramatically reduce routing overhead when a network is relatively static and the active traffic is light. However, the source node has to wait until a route to the destination can be discovered, increasing the response time. The function of Gathering-based Routing Protocol (GRP) for mobile ad hoc network is to gather network information rapidly at a source node without spending a large amount of overheads. It offers an efficient framework that can simultaneously draw on the strengths of Proactive routing protocol (PRP) and reactive routing protocol (RRP) [16] collects network information at a source node at an expense of a small amount of control overheads. The source node can equip promising routes on the basis of the collected information, thereby continuously transmitting data packets even if the current route is disconnected, its results in achieving fast (packet) transfer delay without unduly compromising on (control) overhead performance.

CLUSTER BASED ROUTING PROTOCOLS (CBRP)

In cluster base routing has cluster head, which responsible for route between node and base stations. Cluster base routing reduces the routing overhead in Scalable networks. In Cluster base routing each wireless node distributes into cluster of networks with 2 hop diameter. These disjoint set or overlapping set are define as clusters. In each clusters one node is selected as Cluster Head other as member node. Cluster Head maintain the information in the cluster. Cluster base routing protocol find routes faster with minimizing flooding technique.

Terminology Used in CBRP

- Cluster: A group of nodes in which a specific node elected as head node. Each cluster has unique ID of the cluster head. Nodes belong to the cluster has recognized by their head ID.
- Cluster members: Nodes which are not participate in neither cluster gateway nor a cluster head are represented with the members of the cluster.
- Cluster Head: leader node of the cluster which play vital role for routing and data transferring.
- Cluster Gateways: Node that linkage information among two clusters.

LITERATURE REVIEW

MANET is a very active research field and many studies have addressed this issue using a variety of protocols, clustering mechanisms and mobility models. A lot of research has been done in the field of clustering in MANET.P. Ajindrajit et al. discuss about how to predict a path length from source to destination using Autoregressive Integrated Moving Average (ARIMA) and

Multilayer Perceptron (MLP) models. The routing protocols play a very critical role for ad-hoc network in communication for MANET. In MANET nodes normally operate with limited battery power supply and also have limiting in their transmission range. Path length can be determined by collecting data based on from three mobility models such as Random Way Point mobility model (RWP), Manhattan Grid Mobility Model(MHG)and) Reference Point Group Mobility Model (RPGM) [10].This paper basically Predicted forecasting accuracy for path length from source to destination for AODV in MANET using ARIMA model and MLP. We also compare the prediction capability and modelling of both ARIMA and (ANN) Artificial Neural Networks based models in terms of certain statistical performance evaluation techniques. In this it is found that neural networks model MLP based provide better results for outcomes for forecasting the path length then ARIMA models. In their experiment there is optimal number of neurons found in the MLP network to be in the range of 15–25 hidden units.

Wang et al. they have discuss and drawn attention in the research on multi-hop wireless networking which is traditionally based on stationary wireless networks. One of the reason behind it was opportunistic data forwarding is not widely utilized in MANET and have lack of efficiency , light-weight proactive routing scheme have strong source of routing capability[11].In this paper ,propose a light-weight proactive routing protocol(PSR).It can maintain more information that are based on network topology to facilities source routing. In multi-hop wireless networking, it almost always makes sense to minimize any impact on the network's communication resources for us even if there is penalty in other aspects communications. When a node should come for share its update route information with its neighbour nodes, it delays until end of cycle so that only once update its broadcast information in each node. It would trigger an explosive chain reaction and network overwhelmed then route updates, if the transmit node have any change to its routing tree .

Yuan et al. Presents in this paper elaborates ideas and evaluates several perspective data and control planes .They provide integrative analysis of zero-information opportunistic routing protocols (ORP) as in terms of number of hops as per packet. It also represents and analysis information-rich ORPs and quantitative comparison including cumulative energy efficiency and cumulative packet delivery ratio. We finally find some research smartly in directions towards lightweight routing protocol [12].There is many emerging issue remain yet first is infrastructure less or infrastructure based. ORP's mainly focus on some scenarios that have pre-deployed network structure may destroy or may not exist for all. ORP's may provide solution for transmit packets. Separating or integrating routing functions, leading to have burden to each node .Control messages are collect and diffuse by selected backbone nodes in mobile opportunistic networks and other are responsible for relay functions and data forwarding.

Liu et al. propose work on general probing-based on two-hop relay algorithm, which have limited packet redundancy. In such algorithms will works limited packet limit f and probing round τ, each transmitter is allowed to identifying of possible receiver to conduct up τ rounds of probing and each packet delivered with at f most distinct relays .To understand such working a theoretical framework was introduced to help us for different setting of τ and f. In the terms throughput capacity for per node and end-to-end packet delay, it provide benefit for us to how we can get benefit from multiple probing[13].In two-hop relay routing have advantage of mobility node and sequence of node conduct a contacts to deliver messages from end to end, become promising routing protocol for MANETs. This paper was proposed for general 2HR-(τ, f) routing algorithm which have motive to efficiently utilized wireless resources. A theoretical framework Markov chain was further developed to improve the performance for new relay algorithm, based on as per throughput and end-to-end delay for per node. Extensive theoretical study and simulation provide a framework for the 2HR-(τ, f) algorithm to perform efficiently .A new relay algorithm can provide significantly improvement for throughputs capacity as per node by enabling rounds of receiver probing more.

S.Buchegger and J.Y.LeBoudec [14] in this paper author introduce a new protocol called confident to detect the misbehaviour of nodes. This protocol is depending upon the generousness and faith. Connection and decision of routing in confident protocol is built by observing the transmitting behaviour of other nodes.

P.Michiardi et al [15] this paper represents a collaborative reputation mechanism using watchdog (CORE). Core uses three different reputation mechanisms, a subjective reputation (calculated from subject's observation), an indirect

reputation (positive values) and a functional reputation (particular-function behaviour).

S. Bansal et al [16] describe a protocol called OCEAN (an Observation-based cooperation Enforcement in Ad hoc network). This protocol directly observes the behaviour of other nodes instead of using indirect reputation method. Decision of routing is taken by directly observing the behaviour of neighboring node. Simulation study is carried out by calculating average throughput with high and zero mobility of OCEAN.

Xu Li [17] proposed a Genetic Algorithm Simulated Annealing Clustering Strategy (GASA-CS). This strategy aids to reduce the cost of clustering and get equality of topology and load inside the whole network that further assist to increase the lifetime of network

Pushpita Chatterjee [18] describes a game theoretic routing model. Two mechanisms Credit and reputation are to force the nodes to work honestly. This model mainly proposed to overcome the problem of selfish behaviour of node, where the node behave idle and stop the transmission. Costs of forwarding packet for intermediate nodes are calculated using Procurement and Dutch mechanism. STACRP find selfish nodes and force them to cooperate, so that the throughput of network can be increased.

Ira Nath et al [19] in this paper author proposed a new weighted adaptive clustering algorithm. The purpose of this algorithm is to decrease the transmission overhead, total required time and increase the life time of cluster head by overcoming the limitations of previous selection methods of cluster head. WACA can accustom in usual change in topology of network.

Wonchang Choi et al [20] the author proposes a distributed weighted clustering algorithm (DWCA) in this paper. The motive of this algorithm are keep stability for the structure of cluster, reducing the overhead for the setting up and maintenance of cluster, increase the life time of node and attaining suitable end to end performance. The simulation result proved that DWCA perform better in decreasing the number of reaffiliation, reduce overhead and nodes can live longer life than WCA.

Mohamed Aissa and Abdelfettah Belghith [21] the author describes new strategy for clustering in MANET advancement in WCA in this paper. A new clustering stability scheme and a simple clustering load balancing schemes are combined to introduce new mechanism to conquer the deficiencies in WCA and other identical algorithms. This algorithm also decreases the cost of communication as the cluster head is invoked only on demand.

PRPOSED WORK

The greatest challenge manifesting itself in the design of wireless ad-hoc networks is the limited availability of the energy resources and Security. These resources are quite significantly limited in wireless networks than in wired networks. Energy-efficient communication is critical for increasing the life of power limited wireless ad hoc networks. The nodes are free to move randomly. Thus the network's wireless topology may be unpredictable and may change rapidly. The mobility model is designed to describe the movement pattern of mobile users, and how their location, velocity and acceleration change over time. The overall performance of any wireless protocol depends on the duration of interconnections between any two nodes transferring data as well on the duration of interconnections between nodes of a data path containing n-nodes. A multi-hop wireless ad hoc network is dynamically formed by a collection of mobile nodes. Each of these mobile nodes is operated by a limited-energy battery and usually it is impossible to recharge or replace the batteries during a mission. The communication between two mobile nodes can be either in a single hop transmission in which case the two nodes are within the transmission ranges of each other, or in a multi-hop transmission where the message is relayed by intermediate mobile nodes. Since wireless communications consume significant amounts of battery power, therefore, the limited battery lifetime imposes a severe constraint on the network performance. Energy efficient operations are critical to enhance the network lifetime.

The following Performance Metrics has been used for evaluating the performance of various MANET routing protocols:

Network Load: The statistic represents the total data traffic (in bits/sec) received by the entire WLAN BSS from the higher layers of the MACs that is accepted and queued for transmission

End-to-end Delay: Represents the end to end delay of all the packets received by the wireless LAN MACs of all WLAN nodes in the network and forwarded to the higher layer. This delay includes medium access delay at the source MAC, reception of all the fragments individually, and transfers of the frames via access point, if access point functionality is enabled.

Throughput: Represents the total number of bits

(in bits/sec) forwarded from wireless LAN layers to higher layers in all WLAN nodes of the network.

CONCLUSION

In this paper, we propose a method that is design routing protocol based clustering that can effectively detect good path and nodes. Energy based clustering algorithm has been proposed that uses the node mobility and its available battery power for calculating the node weights. The proposed scheme uses both wireless communications consume significant amounts of battery power, therefore, the limited battery lifetime imposes a severe constraint on the network performance.

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