Different Algorithm of Quality of Service for Lifetime Maximization in MANET

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Abstract:- The designs of routing protocols in mobile ad hoc networks (MANETs) have several challenges as the MANETs are resource constrained. The cross layer design optimization is needed to achieve the energy conservation. The cross layer optimization intends for providing the best solution form different layers in achieving the Quality of Service parameters. The traditional routing protocols were modified to consider the limitations of MANETs and developed routing protocols like DSDV, DSR and AODV to suit the needs of this dynamic network. MANETs are used for real time traffic transportation like video and audio along with data traffic and for real time traffic, providing routing with Quality of Service (QoS) is a challenging task. Although the conventional routing protocols of MANETs had been modified to provide QoS, most of the proposed protocols either concentrate on one or two QoS parameters in identifying a path. The path stability is ignored where the path break happens often due to node mobility resulting in link break or drain in node energy leading to node failure. The topology of the network can be controlled by transmission power of the node which also reduces the interference. Thus, it is possible to enhance the network performance parameters such as throughput and network lifetime. The requirement to achieve reduced end to end delay conflicts with the energy consumption. This contradictory issue and needed to be considered in the enhancement of the network lifetime. The Lifetime Enhancement Routing Protocol (LER) is proposed in MANET for selecting the efficient path to the destination which uses residual power and drain rate as cost metric. The LER protocol minimizes the node overutilization and provides load balancing.

Keywords:- mobile ad hoc networks, Routing Protocol, Quality of Service, Load Balancing

I. INTRODUCTION

Single routing protocols have limitations in highly dynamic topology with limited resources. Therefore, multipath routing allows multiple paths to the destination with the benefits of load balancing, bandwidth aggregation, fault tolerance and improvements in the quality of service. The protocol stack in MANET shown in figure 1 deals with many issues including the energy conservation, mobility management, reliable transmission and security.
The frequent changes in link characteristics due to dynamic nature of MANET makes the physical layer adjusts to the requirements. Medium Access Control (MAC) and Logical Link Control (LLC) are the sublayers of data link layer. The upper sublayer is the LLC layer responsible for flow and error control. Medium Access Control (MAC) layer avoids the collisions and offers fairness in bandwidth sharing among competing nodes. Transport layer deals with congestion caused due to interference level as a result of node transmission power. There are many challenges in the design of MAC protocols due to limited resources, time varying propagation characteristics and energy requirements of node. The hidden terminal problems may lead to collisions and exposed terminals causes low throughput. Nevertheless, the receiver blocking problem in which the receiver does not send acknowledgement (ACK) or clear to send (CTS) back to sender due to interference.

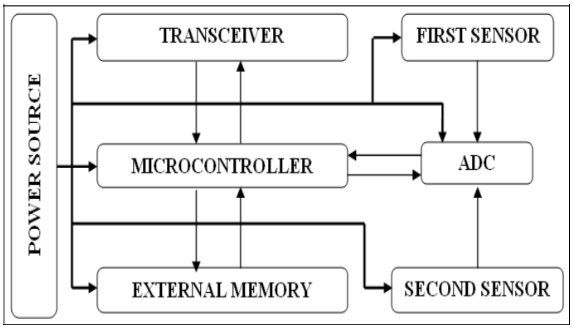

Figure 1: Network Architecture Schematic Illustration

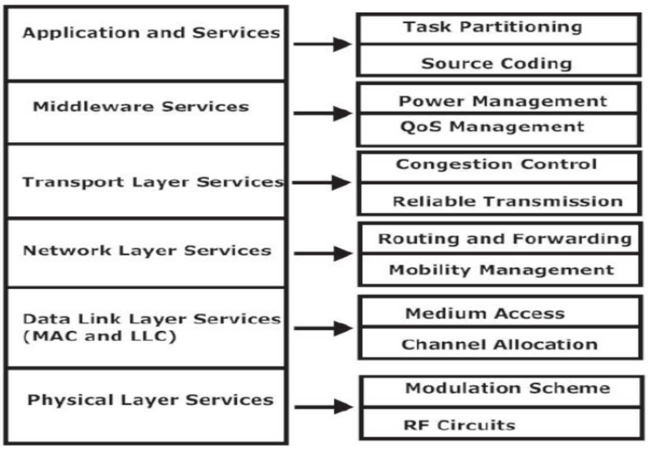

Figure 2: Layered Architecture of Wireless Sensor

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The nodes in MANET are self-configurable such that they are able to discover the network services by broadcasting their identities to the rest of the network. Thus nodes have the capabilities to form a communication to facilitate network services by sharing the technologies available at protocol stacks of different layers. This is achieved through cross layer design in Multicast is a communication method, which allows one source node transmit information to multiple destination nodes at one time. Hence, there is a requirement to find the multicast tree between source and group of destinations and information is sent in parallel mode. There are several challenges in the design of multicast routing protocols in Mobile Ad hoc Networks with respect to the following aspects.

a) Dynamic network topology structure of MANET
b) Limited bandwidth transmission
c) The limitation of mobile terminal
d) Multihop communication

Layer 1, Physical: This section of the OSI structure is responsible for the entire exchange of digital bit stream over network communications media from the physical layer of the distributing (source) device to the physical layer of the receiving (destination) gadget. Layer 1 structures include Ethernet wires and token ring networks. At the physical layer, network machines such as hubs and other repeaters, as well as wire connectors, are common. At the physical layer, data is transmitted using the physical medium's signaling: electric capacitance, frequency bands, or infrared or normal light pulses.

Data Link Layer (DLL): This layer scans for mechanical transfer mistakes and bundles of data from bits ‘beams' when receiving data from the physical layer. Physical referencing systems, such as Media Access Control (MAC) addresses for Ethernet networks, are controlled by the data link layer, which controls many networking devices can accessing the physical channel. Because the data link layer is the most complicated shell in the OSI, The ‘Sublayer 'Media Access Control' and the ‘Rational Connection Control'sublayer are often separated in this model.

Network Layer: Above the data link layer, this layer incorporates the idea of pathing. As data enters the network layer, the origin and departure point attributes found within every frame are reviewed to see whether the data has arrived at its intended departure point. After the data has arrived at its departure point, layer 3 formats them into packets that are sent to the transport layer. If not, the network layer changes the departure point address and returns the structure to the outer levels. The network layer keeps track of logical addresses for computers on the network, such as Ips, in order to facilitate routing. The alignment ofthese logical addresses and physical addresses is often controlled by the network layer. The Address Resolution Protocol is used in IP networking to achieve this mapping (ARP).

Transport Layer: The transport layer is responsible for sending data between linked devices. The most popular transport layer 4 network protocol is the Transition Control Protocol (TCP). Here optional functionality such as error detection, flow management, and packet transmission support can be provided by various communication protocol.

Layer of the Application: This layer manages of making network facilities available to users’ communication services which are widely used to define processes that interact with client data. For instance, in a secure web application, the application layer interface Hyper Text Transfer Protocol (HTTP) combines the data needed to transmit and reclaim web page content. The presentation layer collects input from such a layer 7. (and collects data also).

II. ENERGY MANAGEMENT IN MANET

In Mobile Ad Hoc Networks, the nodes are operated with inadequate battery supply. The depletion of battery leads to network partition and also affects network lifetime. The energy management techniques aim at increasing the network lifetime while maintaining the network connectivity due to dynamic nature of MANET. The energy conservation can be achieved by the following approaches.

- Power management
- Power control
- Topology control

Researchers have proposed several energy aware routing protocols by combining the above approaches. The protocols designed for MANET should select energy efficient path while maintaining load balance. The performance of the network is evaluated based on Quality of Service (QOS).Energy conservation at MAC layer and network layer need to be considered in the context of cross layer design optimization. The MAC protocol manages the switching energy when node switches between transmit mode and receive mode at transceiver system. The network layer is concerned with efficient routing of packets. The power approach needs link state information from the network layer. Another approach to the energy conservation is topology control approach. The transmission power control and maintaining the link connectivity in the network are the facets of topology control. A node transmits with maximum power if there is no transmission control. This results in interference in the neighboring nodes. The transmission range of all the nodes is same in homogeneous topology control mechanism. This type of topology control fails to satisfy the requirements of link connectivity and network efficiency. The other type of topology control is non homogeneous topology control in which the nodes find

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the transmission range dynamically so as to reduce the interference while keeping link connectivity. The non-homogeneous topology control methods are categorized as location based, direction based, and neighbor based. In location based methods, each node knows the location of neighbor which is used in transmission range allocation in a distributed manner. In directional based methods, nodes are provided with directional antenna. Thus, each node can estimate the direction among them. Nodes can share the information with the neighboring nodes in the neighbor based methods.

III. QUALITY OF SERVICE FOR LIFETIME

Extending the lifetime of a MANIT is problematic since nodes absorb varying quantities of energy at different periods. In a networking configuration, for instance, routers close to the sink transmit moreinformation and hence absorb further maximum energy than nodes farther apart. A new strategy for using high price mobile sensors, node mobility spinning, has been proposed to mark out differing power usage and prolong MANIT lifespan. Network rotating is a method that is used to turn nodes across high energy consumption locations. The device's sticking point is that it requires a larger amount of cluster head to be rotating in order to reconfigure packet data propagation through an increased node, resulting in lower energy levels. During the device rotating operation, a huge portion of await occurs, resulting in fewer information packet transmission.

In previous work, we introduced a modified Reciprocate-Level methodology that requires low computational from the dispatcher and less coordination across modules since nodes move self-sufficient of one another. The aim is to exchange high-level energy endpoints and low energy modules energy nodes, including distance and position information, as well as the issue of network incongruence when sharing, to achieve reliableenergy authorization across the network, resulting in higher quality.

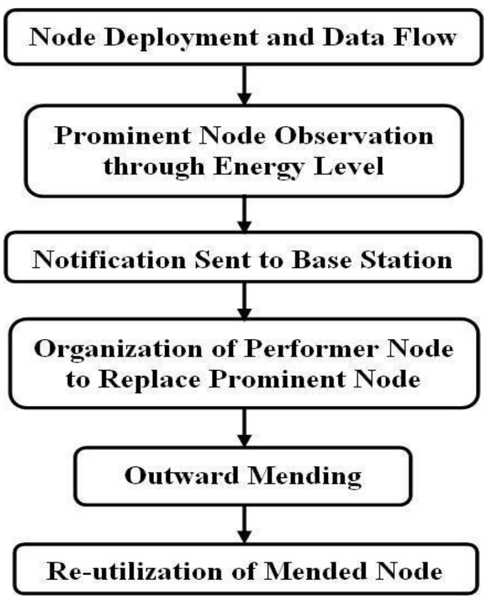

Figure 3: Methodology

The famous nodes that have an energy lesser rate than the benchmarks level will be patched up by the access point in this study using the Pre-performer link indulge in data transmission with the proposed methodology shown in Figure 3.

3.1 **Look at the Low-Level Power Node:**

The algorithm used to senses low energy nodes in MANITs that are dispensed and monitored at a local level. Lower power node attributes such as of data and emission spectra details can be identified using beam signal. A provision would also be to submit periodic intervals to verify the node's malfunction status due to network interference. If no response is received, the node is labelled as a popular node, and appropriate exchange is carried out to keep the system running smoothly.

When a node accepts itself as an affiliated node, it generates a new low-energy module packet, notifies it of its ID, and sends this to the next detachment. This process is repeated until the packet has completed its journey from around low power and has been returned by the delegated module. Once the prominent node is been pointed, then the message will be transmitted to base station regarding the details of a prominent node which will be useful in the triggering of Pre-performer node which will be in the inactive mode at the base station to have the intense battery life.

3.2 Performer Node and Prominent Node Exchanging

Once the prominent node is been observed the notification carrying the prominent node information will be sent to base station. Once the receiver modules obtains the details of the prominent module, then the Pre-performer module which will be in the inactive mode will be shifted to active mode for the node substitution with the prominent node. Now, after aware about the location information of the prominent node, the Pre-performer node from its place will shift to the location of the Prominent nodeand the prominent node in change will be moving towards the base station for the mending process to takes place in order to reutilization of the node in the forthcoming duration.

3.3 Mending of Prominent Node

Once the Prominent node gain the base station, by through of external hardware the battery will be recharged and kept for the future use. Reasonfor not mending the node at the location of prominent node is to circumvent the gratuitous energy down and if so the recharging of the battery cannot be done promptly. Unwanted node switching will be avoided if this is accomplished.

3.4 Energy Sharing at Its Best (Optimum)

Here, Establish the CMDP method to achieve the optimum resource sharing strategy for the combined clients, given the certain pairing across mobile users, which would be demarcated by a group of devices S and k M = {s, k}, The condition and operation fields must first be described. Then measure the likelihood of a phase transition. The optimum policy is then obtained by expressing the allocating appropriate. The following is the gravity analysis of the combined consumers:

$$\Omega = \{(C_S, Ck, E_S\ E_k, As, m);\ As \in \{0, 1, Ak\} \quad (1)$$

$$Aj \in \{0, 1 \ldots Ak\}, Ej, Ej \in \{0, 1\}, m \in \{1 \ldots, 5\}\} \quad (2)$$

Were,
C_S and Ck mean the battery energy level of customers and k, respectively.
C_S and Ck are corresponding, the maximal capabilities of the batteriesof customers s and k.
Es and Ej denotes the energy intake state of users s and k, respectively.

The state's Es and Ej grades are calibrated to 0.0 to 1.0 to determine if a user expends or does not expend a specific source of power.

Energy depletion may occur as a result of data transmission or the execution of a cellular program the analysis shows that when a phone is in reserve mode, it uses the least amount of energy. Assume that in this research methodology, there are 2 types of energy depletion.

The letter ‘m' describes the level of flexibility, indicating whetherboth users should join each other rather than relocate to a charger. The input parameters below suggest that there are five possible levels.

1. Bothe the clients won’t meet their counterpart and not migrate to adapter
2. Bothe the clients won’t meet their counterpart, and client is migrating tothe adapter
3. Bothe the users won’t meet their counterpart, and client j is moving tothe adapter.
4. Both clients are moving to the adapter.
5. Both users meet not migrating to the adapter

Acutely for m = 6 because both coordinated users contact and are notmoving the adapter, they could transmit energy, build upon on the next levels.

If assumed that for m = 5, both clients are move to the adapter, there is nil energy transfer as they could acquire power directly from the adapter.

When the get together (i.e., m =6), they could accomplish an action performance to transmit energy or not transferring. Thus, the action space isdescribed as follows:

$$m = \{\{0,1,2\},,,,,,,5\} \quad (3)$$

Here,
0 denotes the state that the clients do not do anything,
1 denote that clients transfers single unit of energy to clients k,
2 denotes the performance that user k transfers single unit of energy to clients

3.5 Dynamic Matching Process

A dynamic matching method, on the other hand, can then be used to investigate user tolerance in order to arrive at secure matches. The suggested dynamic matching method as seen in Methodology 1. The equation helps theusers S and k to migrate to a pairing that generates a reduced energy loss likelihood than the existing one. A preventing pair consists of users S and k Because none of the other clients can increase their individual energy outage likelihood by improving their fitting, the algorithm ends

Algorithm 1

- For period t = 0, an empirical pairing t is obtained (all matchingsare singletons).
- loop
- A client pairs {s, k} is arbitrary chosen
- if Os (k) <Os (Δ (s)) and Oj (k) <Ok (Δ (s)) then
- Δt+1 is matching has been revamped by clients i and j
- end if
- t ← t + 1
- end loop if No alterations to Δ

3.6 Client Matching and a Shared Energy Sharing Policy

The suggested performance analysis and optimization method is depicted in detail in Algorithm 2. The constant alignment method is the foundation of this algorithm. As a consequence, the very first step is to assess each user's different power loss likelihood through matching. The CMDP is then optimized with all possible competing configurations to determine the daily energy loss likelihood of paired users. Finally, resolve the fixed matching operation enhancement. It's worth noting that the steps for the complex matching procedure are identical.

Algorithm 2

- for s ∈ N do
- Calculate the possibility of an entire user's energy disruption without synchronization.
- terminate for
- for s ∈ N do
- for k ∈ N do
- Resolve the CMDP and acquire the specific power disruptionpossibility of the pair {s, k} of coordinated clients

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- terminate for
- terminate for

3.7 Resources of Protection

Channels constructed per the SDN design must safeguard a number of key security assets such as transparency, which ensures that data is not tampered with. Trustworthiness and accuracy of the data, authentication is nothing but only authenticated users can access the SDN components. The authentication is used to identify hijacking and to limit the consequences of stolen credentials. Resiliency is the network should have the ability to recover as autonomously as possible from an attack and availability is the network should remain operational even under the cause of an attack. Finally, performance is the Sometimes in the event of an attack, the network must be able to securea minimum connectivity and latency.

Designing routing protocols for the networks with restricted resources is a challenge due to dynamic characteristics of their network topology. Many routing protocols have been developed for the past decade for this type of network. Quality of service support is minimum in these protocols. AODV routing protocol is one of the most widely used on-demand routing protocol designed for best effort service and considers minimum number of hops or shortest path between source and destination as the main metric in determining optimum routes without considering QoS requirements. The inference from the review of research journals on various single path QoS routing protocols developed by considering Bandwidth, Delay, Number of hops, Path stability and energy have been tabulated and shown in Table 1.

Table 1: QoS based Routing protocols

Routing Techniques/ Protocol	Parameters Considered					Inference
	Link Stability	Bandwidth	End to End Delay	Hops Count	Energy	
Resource reservation	No	Yes	Yes	Yes	No	✓ High Reliability and low overhead ✓ Not Energy Efficient
Service Quality of service enabled AODV/ QoS AODV	No	Yes	Yes	Yes	No	✓ Bandwidth efficiency with reduced delay and overhead ✓ There is a tradeoff between QoS object measurement and overhead caused by frequent updates
Bandwidth Constraint QoS AODV/ QS-AODV	No	Yes	No	No	No	✓ High packet delivery ratio and low control overhead ✓ End to end delay increased at high traffic conditions
Admission control and feedback scheme	No	Yes	No	Yes	No	✓ Packet delivery ratio increased, energy dissipation decreased ✓ No impact on throughput and no predictive way to foresee a route break
Select function based delay	No	No	Yes	Yes	No	✓ Computational overhead reduced
Constrained Least cost unicast routing/ SF-DCLC	No	Yes	Yes	No	No	✓ No guarantee for throughput
Local route repair based on neighbourhood routing infromation	No	No	No	Yes	No	✓ High packet delivery ratio ✓ AODV enhanced with alternate routing path
Delay constrain AODV routing/ AODV-D	No	No	Yes	Yes	No	✓ Route discovery latency minimized ✓ Bandwidth and path stability not ensured
Fuzzy controllers based QoS routing/ FQRA	No	Yes	No	Yes	No	✓ High throughput and path success ratio with low delay ✓ Node energy and path stability not maintained
Efficient QoS routing using OLSR	No	Yes	Yes	Yes	No	✓ Minimum delay ✓ Not energy efficient
Neighbour table based routing / NQoS AODV	No	Yes	Yes	No	No	✓ Improved packet delivery ratio and reduced delay ✓ Maintenance of neighbor table incurred more overhead
Route enhanced AODV/ RE-	No	No	No	Yes	No	✓ Reduced overhead and delay

AODV						✓ Not energy efficient

The protocols discussed above consider one or more QoS metrics such as bandwidth, delay or Hop count to Delivery R identify the best path. On comparison of the above protocols with either AODV or DSR yields better result in terms of Packet ratio and End to End delay. In MANETs, nodes are mobile and the battery power of the node plays a vital role in discovery. To overcome this issue, Node energy has to be considered in the design of routing protocol. packet. Ignorance of Node energy in the protocol design results in node depletion causing path break lead to frequent route maintaining the established path. The Node energy decreases when it receives a packet, performs computation and sends out the The energy aware routing schemes for Ad hoc networks have been reviewed and tabulated as shown in Table 2.

Table II: Energy Aware Routing protocols

Routing Techniques/ Protocol	Parameters Considered					Inference
	Link Stability	Bandwidth	End to End Delay	Hops Count	Energy	
Routing strategy that balances the energy consumption	No	Yes	No	No	Yes	✓ Maximize network lifetime ✓ Path stability was not considered
Conditional Max-Min Battery Capacity Routing Scheme/ CMMBCR	No	No	No	Yes	Yes	✓ Increased network lifetime ✓ Delay and path stability not considered
Simulated annealing/ SA-RA	No	No	Yes	Yes	Yes	✓ High success ratio ✓ Success ratio degraded as it scales to large network
Stability based QoS AODV routing/ SQ-AODV	No	No	No	No	Yes	✓ Better packet delivery ratio, delay and overhead reduced ✓ Bandwidth and mobility of nodes not considered
Hop constrained minimum	No	No	No	Yes	Yes	✓ Energy efficient
Broadcast increment power algorithm (HC-BIP)	No	Yes	Yes	No	No	✓ Stability of the path and bandwidth efficient not ensured
QoS Power aware routing enhancing DSR routing	No	Yes	No	No	Yes	✓ Less overhead and end to end delay ✓ Path stability due to node mobility not ensured
Dijisktas algorithm	No	No	No	Yes	Yes	✓ Improved network lifetime ✓ Throughput and end to end delay not addressed
Energy Aware Routing/ EAR	No	No	No	Yes	Yes	✓ Increase network lifetime and minimum energy consumption ✓ No guarantee to throughput and delay
Energy aware routinng	No	No	No	Yes	Yes	✓ Increased network lifetime ✓ Control overhead becomes high when link breaks due to node mobility
Energy supported AODV/ EN-AODV	No	No	No	Yes	Yes	✓ Increased packet delivery ratio, decreased delay with maintained throughput ✓ Link stability not ensured
Location based energy efficient scheme/ LAR-EAODV	Yes	No	No	No	Yes	✓ High packet delivery ratio and energy saving assured ✓ End to end delay not ensured

IV. CONCLUSION

The network lifetime of Location Based Topology Control is better when compared to Location Free Topology Control protocol but doesn't meet the requirements of interference and delay constraints. In Mobile Ad hoc networks, routing algorithms choose different paths for efficient routing. This results in different end to end delay. The node mobility affects the delay. In mobile networks, the increased throughput can be obtained at the cost of high delay and low delay produces low throughputs. This constraint on throughput and delay could be satisfied by controlling mobility of the node. On the other hand increasing the transmission power of nodes along the path reduces the number of hops to the receiver and hence the delay. The high transmission range causes the interference among the neighboring nodes.

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