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Research Article

AN EFFICIENT ROUTING ALGORITHM FOR MANET

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ABSTRACT
The Ad hoc networks are non-infrastructure networks consisting of mobile nodes. Battery power being limited, extending the lifetime of batteries is an important issue, especially for Mobile Ad Hoc Networks (MANETs). To reduce the energy consumption in mobile devices, there have been efforts in physical and data link layers as well as in the network layer related to the routing protocol. Mobile ad hoc network (MANET) is an autonomous system of mobile nodes connected by wireless links. Each node operates not only as an end system, but also as a routerto forward packets. The nodes are free to move about and organize themselves into a network. These nodes change position frequently. The power-aware routing protocols should consider energy consumption from the viewpoints of both, the network and the node level. From the network point of view, the best route is one that minimizes the total transmission power. On the other hand, from the viewpoint of a node, it is one that avoids the nodes with lower power. Minimizing the total energy consumption tends to favour minimum hop (min-hop) routes. Our proposed a novel on- demand power aware routing algorithm, DEEAR (Distributed Energy efficient AODV Routing) protocol. By using DEEAR also improves network throughput as well as improvement in data packet delivery ratio:

***Keywords**: Manet, AODV Introduction*

One critical issue for all kinds of mobile nodes supported by battery powers is power saving. Without power, any mobile node will become useless. The purpose of power-aware routing protocols is to maximize the network lifetime. The network lifetime is defined as the time when a node runs out of its own battery power for the first time. If a node stops its operation, it can result innetwork partitioning and there is an interrupt in ongoing communication. The power-aware routing protocols should consider energy consumption from the viewpoints of both, the network and the node level. From the network point of view, the best route is one that minimizes the total transmission power. On the other hand, from the viewpoint of a node, it is one that avoids the nodes with lower power. It is difficult to achieve these two objectives simultaneously. Minimizing the total energy consumption tends to favor minimum hop (min-hop) routes. However, if the min-hop routes repeatedly include the same node, then node will exhaust its energy much earlier than the other nodes and the network lifetime will decrease. Classification of routing protocols in MANETs can be done in many ways. Mostly this is done depending on routing strategy and network structure. Routing strategy categorizes protocols as table-driven and on demand or source initiated, while depending on the network structure these are classified as flat routing, hierarchical routing and geographic position assisted routing. There are two approaches in providing ad hoc network connectivity: flat routed network architecture and hierarchical network architectures. In flat routed network architecture, all the nodes are equal and packet routing is done based on peer- to- peer connections. However in hierarchical network architecture, at least one node in each lower layer is designated to serve as a gateway or coordinator to higher layers . Both, the table-driven and on demand protocols come under Flat routing. The on demand routing protocol, Ad hoc On-demand Distance Vector Routing (AODV)protocol performs routing based on the metric of least number of hops. In this paper, we propose an improvement of AODV protocol of node energy awareness. In Route request (RREQ) and Route reply (RREP) formats, P and N fields are added to the packet header. P is the average residual battery power of the nodes on the path and N is the number of hopsthat the RREQ packet has passed. Our proposed routing protocol can achieve increased number of alive nodes and lessenergy consumption resulting in longer network lifetime.

LITERATURE SURVEY

Mobile ad hoc networks (MANETs) are envisionedto become key components in the 4G architecture, and ad hoc networking capabilities are expected to become an important part of overall next-generation wireless network functionalities.

In general, mobile ad hoc networks are formed dynamically by an autonomous system of mobile nodes that are connected via wireless links without using an existing network infrastructure or centralized administration. The nodes are free to move randomly and organize themselves arbitrarily; thus, the network's wireless topology may change rapidly and unpredictably. Such a network may operate in a standalone fashion, or may be connected to the larger Internet. Mobile ad hoc networks are infra structure less networks since they do not require any fixed infrastructure such as a base station for their operation. In general, routes between nodes in an ad hoc network may include multiple hops and, hence, itis appropriate to call such networks multi hop wireless ad hoc networks. The mobile ad hoc networks infrastructure less network. Mobile nodes can change from one place to some other place.

AD HOC On-Demand Distance vector Routing Protocol

Ad hoc On-Demand Distance Vector (AODV) Routing is a routing protocol for mobile ad hocnetworks (MANETs) and other wireless ad-hoc networks. It is a reactive routing protocol, meaning that it establishes a route to a destination only on demand. In contrast, the most common routing protocols of the Internet are proactive, meaning they find routing paths independently of the usage of the paths. AODV is, as the name indicates, a distance-vector routing protocol. AODV avoids the counting-to-infinity problem of other distance-vector protocols by using sequence numbers on route updates, a technique pioneered by DSDV. AODV is capable of both unicast and multicast routing.

In AODV, the network is silent until a connection is needed. At that point the network node that needs a connection broadcasts a request for connection. Other AODV nodes forward this message, and record the node that they heard it from, creating an explosion of temporaryroutes back to the needy node. When a node receives sucha message and already has a route to the desired node, it sends a message backwards through a temporary route to the requesting node. The needy node then begins using theroute that has the least number of hops through othernodes. Unused entries in the routing tables are recycled after a time.

When a link fails, a routing error is passed back to a transmitting node, and the process repeats.
Much of the complexity of the protocol is to lower the number of messages to conserve the capacity of the network. For example, each request for a route has asequence number. Nodes use this sequence number so that they do not repeat route requests that they have already passed on. Another such feature is that the route requests have a "time to live" number that limits how many times they can be retransmitted. Another such feature is that if a route request fails, another route request may not be sent until twice as much time has passed as the timeout of the previous route request. The advantage of AODV is that it creates no extra traffic for communication along existinglinks. Also, distance vector routing is simple, and doesn't require much memory or calculation. However AODV requires more time to establish a connection, and the initial communication to establish a route is heavier than some other approaches.

DYNAMIC SOURCE ROUTING

Dynamic Source Routing (DSR) is a routing protocol for wireless mesh networks. It is similar to AODV in that it forms a route on-demand when a transmitting computer requests one. However, it uses source routing instead of relying on the routing table at each intermediate device.
Determining source routes requires accumulating the address of each device between the source and destination during route discovery. The accumulated path information is cached by nodes processing the route discovery packets. The learned paths are used to route packets. To accomplish source routing, the routed packets contain the address of each device the packet will traverse. This may result in high overhead for long paths or large addresses, like IPv6. To avoid using source routing, DSR optionally defines a flow id option that allows packets to be forwarded on a hop-by-hop basis.
This protocol is truly based on source routing whereby all the routing information is maintained (continually updated) at mobile nodes. It has only two major phases, which are Route Discovery and Route Maintenance. Route Reply would only be generated if the message has reached the intended destination node (route record which is initially contained in Route Request would be inserted into the Route Reply).
To return the Route Reply, the destination node must have a route to the source node. If the route is in the Destination Node's route cache, the route would be used. Otherwise, the node will reverse the route based on the route record in the Route Reply message header (thisrequires that all links are symmetric). In the event of fatal transmission, the Route Maintenance Phase is initiated whereby the Route Error packets are generated at a node. The erroneous hop will be removed from the node's route cache; all routes containing the hop are truncated at that point. Again, the Route Discovery Phase is initiated to determine the most viable route.
Conventional routing protocols for ad hoc networks select the routes under the metric of the minimum hop count. Such min-hop routing protocols can use energyunevenly among the nodes andthus it can cause some nodes to spend their whole energy earlier. End to end throughput and delay are widely used performance metrics in wired and wireless networks. In hierarchically organized, multi hop mobile wireless networks problem of quality of service provision arises. In addition to this, since network topology is dynamically changing, bandwidth and battery power are additional important factors to be considered in wireless ad hoc networks.
Suresh Singh, Mike Woo et al. demonstrated that significant reductions in cost can be obtained by using shortest-cost routing as opposed to shortest-hop routing. Mobile ad hoc networks have additional issues like dynamic topology, asymmetric links, routing overhead and interference due to nearby transmission. Considering issue of mobility of nodes, it is desirable to have route updates in order to know the current status of the node position in the network. This feature demands table drivenprotocols. However if energy consumption is to be considered, one has to go for on demand protocol where control information transfer is limited and is not as frequently updated as in table driven protocols. In on demand protocols, flooding the route request packets throughout the networkdoes the route discovery. Our approach is to save energy consumption at the cost of reduced route updates. Ad hoc routing protocols can broadly be classified as

Table driven and on demand protocols. Table driven routing protocols attempt to maintain consistent, up to date routing information from each node to every other node in the network. These protocols require each node to maintain one or more tables to store routing information, and they respond to changes in network topology by propagating updates throughout the network in order to maintain consistent network view. On demand routing creates routes only when desired by the source node. When a node requires a route to a destination, it initiates a route discovery process within the network. The process is completed once a route is found or all possible route permutations have been examined.

Once the route has been established, some form of route maintenance procedure maintains it until the route is no longer desired. Prominent routing protocols studied under on demand category are AODV and Dynamic Source Routing (DSR).

PROPOSED SCHEME

DISTRIBUTED ENERGY EFFICIENT AD HOCROUTING PROTOCOL

Proposed a novel on-demand power aware routing algorithm, DEEAR (Distributed Energy efficient AODV Routing) protocol. DEEAR prolongs the network lifetime by compromising between minimum energy consumption and fair energy consumption without additional control packets. DEEAR also improves network throughput aswell as improvement in data packet delivery ratio. Optimum route selection in our proposed protocol will collectively consider distance of a node from source as well as remaining battery capacity of a node.

Generally in on-demand routing protocols, the source floods an RREQ packet to search for a path from source to destination. The destination node receives the RREQ packet and uni casts an RREP packet to the source to set up a path. Our proposed DEEAR being an on- demand algorithm doesn't use additional control packetsto acquire necessary information for power aware routing but utilizes RREQ packets, which are already used in on- demand routing protocols.

DEEAR only requires the average residual battery level of the entire network, which can be obtained without any additional control packets other than RREQ packets. In the proposed algorithm, intermediate nodes control the rebroadcast time of the RREQ packet, where rebroadcast time is proportional to the ratio of average residual battery power of the entire network to its own residual battery power i.e. nodes with relatively larger battery energy will rebroadcast RREQ packets earlier. Because on-demand routing protocols drop duplicate RREQ packets without rebroadcast them, DEEAR can set up the route through the nodes with relatively high battery power.

Basically the nodes use their residual battery power for the rebroadcast time of RREQ packets. If the time is determined only by the nodes' absolute residual battery power, then the retransmission time will increase as time passes by. Therefore, the relative measure needs to be used. As a relative measure, the average residual battery power of the entire network is used.

Periodic control packets can acquire exact value of this average power, but using periodic control packets is not an on-demand method and it also consumes more energy. To estimate the average energy, the proposed algorithm uses only RREQ packets that are already used in on- demand routing. P and N fields are added to the packet header, where P is the average residual battery power of the nodes on the path and N is the number of hops that the RREQ packet has passed.

OPTIMUM PATH SELECTION MECHANISM

1. The source records its own battery power to the P field, and sets the N to 1, and broadcasts the RREQ packet.
2. It is assumed that a node i has received an RREQ packet, and the node i's residual battery power is Bi and the P value of the RREQ packet is P old. Then, the average residual battery power, P new, of new route that includes the node i is given by

Pnew=[(Pold*N]+/(N+1)

Before the node i rebroadcast the packet, it updates P to P new and increases the value of N by one. This step isnot executed for duplicate RREQ packets.

3. Whenever a node i receives an RREQ packet, it calculates the average residual battery power (E new) of the network based on previous residual battery power of a network (E old) and P old as,

Enew=[(1-α)*Eold]+(α*Pold)

In this α is the weighting factor of the moving average and is set to 0.50 in our simulations. We assume random position of node i in the entire route. To consider this random hop issue we have taken α into consideration.

4. Based on estimated average power E and node's own residual battery power Bi for a node, Rebroadcast time T for a node i is given by

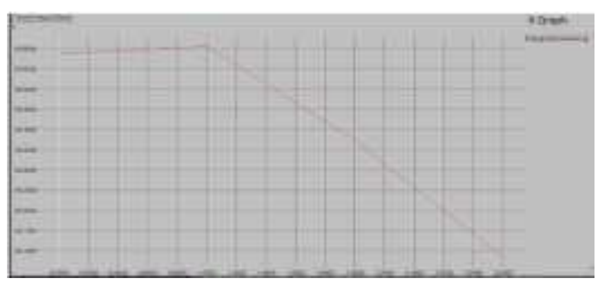
T=D*(E/Bi)

D is a constant to scale the retransmission time. According to above equation if the residual battery power Bi is smaller than the average network residual power E, then the retransmission time will be longer. If the individual battery power Bi is larger than the average, then the node i would tend to beselected as a member of the route, which results in fair energy consumption amongthe nodes. When the residual battery power variation is small, most nodes have a similar retransmission time. In that case, the route with a smaller hop count will be selected.

CONCLUSION

A new protocol is proposed which modifies AODV to improve its performances from an energy point of view. The approach is based on the reduction of energy consumption during the connection request phase, passing by phase of route discovery, as well as during the phase of data transfer and finishing by the phase of route maintenance. Our protocol DEEAR proved its effectiveness by showing better results for Number of alive nodes, its capacity to balance the consumption of energy on the totality of the network. Finally, it can be concluded that the energy consumption metric adopted in this protocol can prove more effective than the traditional metrics. DEEAR protocol a performance deteriorates as additional time is involved during the data propagation.

Parameters	AODV	DEEAR
Energy Consumption	More	Least
No of alive nodes	Less	Maximum
Packet delivery ratio	Less	Maximum
Throughput	Medium	Maximum



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