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A Survey of Mobile Ad hoc Routing Protocols

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ABSTRACT
Mobile Ad-hoc Networks (MANET) are self organizing network which exchange Data among themselves through single hope or multi hope. Data transfer happens in single hope whenever the destination is available within the transmission region of source, multi hope is used when destination is not available within the transmission region of source. Designing a routing protocol is a crucial issue in MANET because of dynamic topology. Active research works has been carried in the area of Ad-hoc routing protocols to address this issue. In this paper first we focus about the design challenges for routing protocols followed by a survey of various routing protocols for Ad-hoc network.

Introduction

Mobile Ad-hoc networks are infrastructure less self organizing networks. Nodes can exchange the data among themselves through single hope or through multi hope. During this scenario the intermediate node can act as a router by forwarding the packet. MANET Topology is highly dynamic due to high mobility; transmission region is very small since they operate with battery power. Due to high mobility and low operating power they need effective routing protocols. Hence this routing protocol should capable of maintaining connectivity even in such highly dynamic network.

Routing Protocols in WSNs

Routing protocols can be divided into flat-based, location based and Hierarchical based routing

Flat based

All nodes in the network are considered as equal functionality nodes.

Location based routing

Position or Location of the sensor node information is used to transfer data form source to destination

Hierarchical routing

The nodes which are in different levels of hierarchy play different roles. Based on protocol operations they are classified into Query based, Multipath-based, Qos-based, negotiation-based, Content-centric, coherent-based routing.

Further routing protocols are classified into proactive, reactive, and hybrid protocol.

Proactive protocols/ Table driven

Each and every node will maintain a routing table with help of this table route can be found between any source and destination in other words we can say the routes are found before they needed.

Reactive Protocols/On-demand routing

When ever there is a demand for the route it will be computed, that's why it is called On-demand routing protocol.

Hybrid protocols

It is a combination of Proactive, reactive protocols. Mobility is less or the nodes are static use Proactive Protocols, or it will use reactive protocols.

Cooperative routing protocols

There will be a centralized coordinator; nodes sent data to central coordinator for processing, so less overheads.

Effective Flooding

All the above mentioned protocols uses flooding to find the path from source to destination, it will increase the number of control packets. So effective flooding mechanisms where introduce to

Minimize the number of packets, such a mechanism where introduced in Optimized Link state Routing (OLSR), Preferred Link Based Routing (PBLR), Qos In OLSR.

Proactive routing protocols

The Wireless Routing Protocol (WRP)

Improved Bellman-Ford Distance Vector routing algorithm is used in WRP. Each mobile node maintains distance table, routing table, link-cost table and Message Retransmission List (MRL)

Routing table contains

- Distance to destination node
- Predecessor and successor of a node
- State information identification using Tag

Counting-to-infinite problem can be avoided by avoiding loops; loops are avoided by Storing predecessor and successor in the routing table. This is a main disadvantage of the DVR (Distance Vector Routing) algorithm. Link-cost table for a node contains cost of the link for each of it neighbor, and number of timeouts; to check when the node received an error-free message from its neighbor.

Routing table information is updated periodically or when there is a change in state with the help of update message. Update message will be retransmitted if it is not acknowledged by its neighbor.

Main disadvantage of WRP, it needs large memory space to maintain those tables and it is not suitable for large networks.

DSDV routing protocol

Destination Sequence Distance Vector (DSDV) is also based on Bellman-Ford distance vector algorithm. DSDV Routing table consist the following things

Next hope information

Tele:
E-mail addresses: ialagiri@vit.ac.in

 Cost
 Destination sequence number

Sequence numbers are used to avoid loops. Routing table is updated either periodically (time-driven) or when there is a change (event –driven) manner. Routing table updating can be done by either "full dump" or "incremental update"

• Full dump-Update message carries full routing table.
• Incremental update-Update message contains only the changes.

The Fisheye State Routing (FSR)

FSR routing protocol behaves like a fish eye. Fish can catch more information about a near by object and less information when the object is so far way from it. Similarly FSR maintains accurate information about the single hop nodes and less information when the number of hope increases.

Link state information updating can happen only with neighbor nodes, to maintain up-to-date topology information in each and every node. Like other protocols link state information can be updated periodically.

Size of the link state message is too large. This can be improved by using different update period for different metric in the routing table. Topology information in inversely proportional to the distance, so FSR will have fewer overheads when compare to other link state protocols. Since Link state information is updated frequently with nearby nodes and that frequency is less in far way nodes.

Comparison of WRP, DSDV and FSR

WRP, DSDV, FSR even though they are belonging to same category their approach is different in updating the routing information and forming the route to destination. WRP and DSDV routing information is flooded through the entire network, in FSR this information is exchanged between the neighboring nodes.

Loop identification:

• WPR uses predecessor and successor information to avoid loops, but number of over head is high.
• DSDV uses destination sequence number to avoid route loops.
• FSR inherits loop-free property from Link State routing algorithm.

Complexity Analysis:

Time Complexity:

• WRP, DSDV and FSR have same time complexity.

Space complexity:

• WRP uses large space to maintain the number tables when compare to DSDV
• FSR has high storage complexity when compare to other link state protocols, but it support multiple-path routing and QoS routing.

Reactive routing Protocol

Dynamic Source Routing (DSR)

Route from source to destination is established in two phases

• Route discovery Phase
• Route maintenance Phase

Route discovery Phase:

A node want to send packet, first it checks its Cache. If the route is available it adds the routing information inside the packet and send it, otherwise it initiates Route discover process by broadcasting route request packet.

Route request packet consist of

• Source and destination address
• Unique identification number

-It is used to identify the uniqueness of the route request

Nodes process the root request only when

• If it is not having any route to the particular destination.
• Root request if not form same source node.

Once the route request packet reaches a Receiver the receive node check its cache, if it is not having any route information it will append its address and forward the packet. If the route request packet reaches the destination or an intermediate node which is having route to destination generates route replay packet.

Route Replay packet

• It consist of all the address of the node that are visited by route request

In DSR when there is a link failure ROUTE_ERROR packet is send to the source. ROUTE_ERROR packet reaches the source it starts route discovery process once again.

AODV protocol

Ad Hoc on-demand Distance Vector Routing (AODV) protocol is a reactive routing protocol. It uses destination sequence number to identify the recent paths.

In AODV the every node will have next-hop routing table. It is used to identify the destination for which it currently has a rout. Routing table information is not valid, if it is not updated with in a time limit.

Route discovery:

A node wants to send packets to destination but it is not having any routing information to destination it enables route discover process.

• Source node broadcast route request(RREQ)
• RREQ consist of address of source and destination along with broadcast ID
• Broadcast id is used to ensure loop free routes.
• Packet overhead is reducing, since a node discards the RREQ when the request came from same node through multiple links.

Route replay:

An intermediate node (not the destination) may also send a Route Reply (RREP) provided that it

Knows a more recent path than the one previously known to sender S

To determine whether the path known to an intermediate node is more recent, destination sequence numbers are used

The likelihood that an intermediate node will send a Route Reply when using AODV not as high as DSR (Later)

A new Route Request by node S for a destination is assigned a higher destination sequence number. An intermediate node which knows a route, but with a smaller sequence number, cannot send Route Reply

Conclusion

This Survey attempts to evaluate table driven, on-demand and exposes their characteristics and trade-offs.

The field of ad-hoc mobile networks is rapidly growing and dynamic changing and while it is not clear that any particular algorithm or class of algorithm is the best for all environment , each protocol has definite advantages and disadvantages , and is well suited for certain situations

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