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Comparison of Proactive, Reactive and Hybrid Routing Protocol in MANET

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Abstract: An ad hoc network is Latin words are for this purpose. It is refers to a network connection established for a single period and does not require a router or a wireless base station. A Mobile ad hoc network is a one type of network that can change locations and configure itself on the fly. But MANETS are uses mobile with wireless connections to connect to various networks. Another medium, such as a cellular or satellite transmission. The protocol is set of rules and convention of communication between the networks. A routing protocol specifies how routers communicate with each other; propagate information that enables them to select routes between any two nodes on a computer network. This paper describes three types of routing protocols and its structure and formation. Proactive routing protocol is used for updating information in the network. Reactive protocol is determining the structure of networks. Hybrid routing protocol is combination of proactive and reactive protocols. This paper also compares Common parameter of proactive, reactive and hybrid routing protocol.

Keywords: Ad hoc network, routing protocol, proactive routing protocols, reactive routing protocols, hybrid routing protocols, comparison.

I. INTRODUCTION

A mobile ad hoc network (MANET) is a continuously self-configuring, infrastructure-less network of mobile devices connected wirelessly. Each device in a MANET is free to move independently in any direction, and will therefore change its links to other devices frequently.

Each must forward traffic unrelated to its own use, and therefore be a router. The primary challenge in building a MANET is equipping each device to continuously maintain the information required to properly route traffic, such networks may operate by them or may be connected to the larger Internet.

They may contain one or multiple and different transceivers between nodes. This results in a highly dynamic, autonomous topology. In proactive routing protocol, every node maintains one or more tables representing the entire topology of the network. These tables are updated regularly in order to maintain up-to-date routing information from each node to every other node. Reactive Routing Protocol is a bandwidth efficient on-demand routing protocol for Mobile Ad-Hoc Networks.

The protocol comprises of two main functions of Route Discovery and Route Maintenance. Hybrid Routing, commonly referred to as balanced-hybrid routing, is a combination of distance-vector routing, which works by sharing its knowledge of the entire network with its neighbors and link-state routing which works by having the routers tell every router on the network about its closest neighbors.

II. CLASSIFICATION OF ADHOCNETWORK

Ad hoc networks are useful when you need to share files or other data directly with another computer but do not have access to a Wi-Fi network .You can also use Internet connection sharing with ad hoc mode to share your computer's Internet connection with other users.

Another feature of ad hoc networks is that more than one laptop can be connected to the ad hoc network, as long as all of the adapter cards are configured for ad hoc mode and connect to the same SSID (Service State Identifier). The computers need to be within 100 meters of each other.

i. VANET & In VANETs

Vehicular Adhoc Network (VANET) are used for communication between vehicles and roadside equipment. Intelligent vehicular Ad hoc Networks (In VANETs) are a kind of artificial intelligence that helps vehicles to behave in intelligent manners during vehicle-to-vehicle collisions, accidents.

ii. SPAN

Smart Phone Ad hoc Networks (SPANs) leverage the existing hardware (primarily Bluetooth and Wi-Fi) in commercially available smart phones to create peer-to-peer networks without relying on cellular carrier networks, wireless access points, or traditional network infrastructure. SPANs differ from traditional hub and spoke networks, such as Wi-Fi Direct, in that they support multi-hop relays and there is no notion of a group leader so peers can join and leave at will without destroying the network.

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iii. IMANETs
Internet based Mobile Ad hoc Networks (IMANETs) are ad hoc networks that link mobile nodes and fixed Internet-gateway nodes. For example, multiple sub-MANETs may be connected in a classic Hub-Spoke VPN to create a geographically distributed MANET

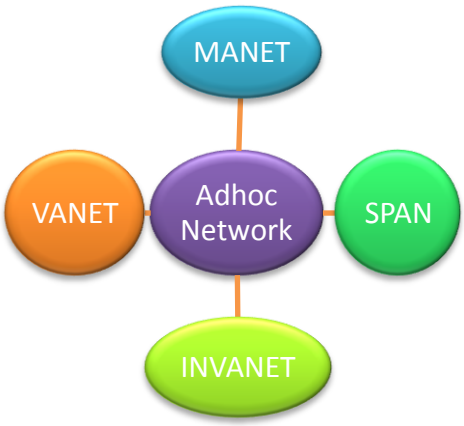

Figure 1: Types of adhoc network

III. ROUTING PROTOCOL

A routing protocol uses software and routing algorithms to determine optimal network data transfer and communication paths between network nodes. Routing protocols facilitate router communication and overall network topology understanding. A routing protocol is also known as a routing policy. Routing protocol is classified into three types of routing protocols.

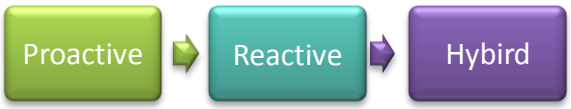

Figure 2: classification of routing protocols

IV. PROACTIVE ROUTING PROTOCOLS

In networks utilizing a proactive routing protocol, every node maintains one or more tables representing the entire topology of the network. These tables are updated regularly in order to maintain up-to-date routing information from each node to every other node. To maintain the up-to-date routing information, topology information needs to be exchanged between the nodes on a regular basis, leading to relatively high overhead on the network. One the other hand, routes will always be available on request. A proactive approach to MANET routing seeks to maintain a constantly updated topology understanding. The whole network should, in theory, be known to all nodes. This results in a constant overhead of routing traffic, but no initial delay in communication.

A. Wireless Routing Protocol (WRP)

Wireless Routing Protocol (WRP) is similar to DSDV because it provides up-to-date information of the network but it differs from DSDV only in the way that DSDV maintains only one table whereas WRP maintains a set of topology tables. WRP uses an enhanced version of the distance-vector routing protocol, which uses the Bellman-Ford algorithm to calculate paths.
The DT contains the network view of the neighbors of a node. The RT contains the up-to-date view of the network for all known destinations. The LCT contains the cost (e.g., the number of hops to reach the destination) of relaying messages through each link. The MRL contains an entry for every update message that is to be retransmitted and maintains a counter for each entry.[1][2]

B. Global State Routing (GSR)

Global State Routing (GSR) is based on link state routing protocol. In this each node exchanges link state information with its neighbor nodes. Based on link state information, a global knowledge of the network topology is maintained. GSR is similar to DSDV but it avoids flooding of routing messages. In this algorithm, each node maintains a Neighbour list, a Topology table, a Next Hop table and a Distance table.
Neighbor list of a node contains the list of its neighbors. For each destination node, the Topology table contains the link state information as reported by the destination and the timestamp of the information. For each destination, the Next Hop table contains the next hop to which the packets for this destination must be forwarded. The Distance table contains the shortest distance to each destination node.[2]

C. Fisheye State Routing Protocol (FSP)

Fisheye State Routing Protocol (FSP) is an improvement of GSR. FSR modifies the link state algorithm in the following three ways. First, link state packets are not flooded. Instead, only neighboring nodes exchange the link state information. Second, the link state exchange in only time triggered, not even-triggered. Third, instead of transmitting the entire link state information at the each iteration, it reduces the traffic of transmitting update messages. Each node has accurate information about its neighbour nodes. This is so because the transmitted update messages contain the information of the nearer nodes rather the information about all nodes in the network.[4]

D. Optimized Link State Routing Protocol (OLSR)

OLSR makes use of multipoint relays (MPRs) which act as intermediate routers in route discovery procedure. OLSR to limit the number of message retransmissions during the necessary flooding operations. OLSR works best for large and dense ad hoc networks. However, OLSR being a reactive routing protocol suffers from excessive routing overhead. OLSR performs Packet forwarding, Neighbour sensing, Topology discovery procedures. OLSR uses four messages: Hello message, Topology control, Multiple Interface Declaration (MID), Host and Network Association (HNA).[8]

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E. Destination Sequenced Distance Vector Routing (DSDV)

It is the table driven routing scheme for MANET based on Bellman-Ford Algorithm (shortest path routing algorithm to find a single path from source to destination).This algorithm solves the problem of routing loop problem. In DSDV, each node in the network maintains its own routing table. The routing table consists of destination number of hops and sequence number generated by the destination. DSDV routing protocol requires that all the nodes in the network communicate the routing table to its neighbors. The communication can be multicasting or broadcasting. With this the neighbour nodes get to know about the current status of the node i.e., any update made in the routing table due to the movement of node. The routing tables are sent to the neighbors through full dump or incremental way. In full dump way the whole table is sent whereas in incremental way only the entries that require changes are sent.

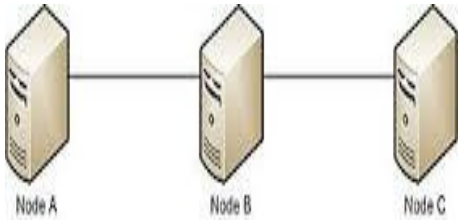


Figure 3: Node b distance between node a and node c

V. REACTIVE ROUTING PROTOCOLS

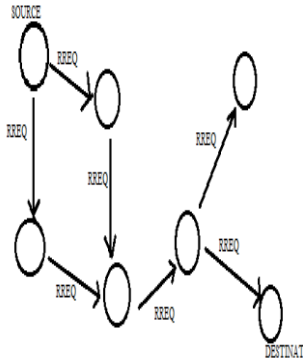
Reactive routing protocols follow a route determination procedure. If a source node has to send a packet to destination node, firstly the route to the destination node is determined and then a connection is established between these nodes. For route determination procedure, route request packets are flooded throughout the network. Flooding is a reliable method of disseminating information over the network, however it uses bandwidth and creates network overhead, reactive routing broadcasts routing requests whenever a packet needs routing, this can cause delays in packet transmission as routes are calculated, but features very little control traffic overhead and has typically lower memory usage than proactive routing protocol, this increases the scalability of the protocol.

a. Dynamic Source Routing (DSR)

Dynamic source routing (DSR) is based on source routing method. In this the nodes maintain a route cache. Route cache is updated when a new node is known. DSR is composed of the two mechanisms of Route Discovery and Route Maintenance, which work together to allow nodes to discover and maintain source routes to arbitrary destinations in the network. DSR has a unique advantage by virtue of source routing. These two phases are Route discovery, Route maintenance. When a source node has to send a packet to the destination node, it first checks route to the destination in the route cache. If the route of the destination is present in the route cache then the source node sends the packet to the destination and if it is not present in the root cache it broadcasts a route request packet Routing Request. The address includes the destination address, source address and unique identification number.[6]

b. Ad hoc On Demand Vector Routing (AODV)

AODV is a distance vector routing protocol which determines route to the destination only on demand. It makes use of forwarding tables at each node. When a node wants to send the packet to destination, it broadcast a route request packet (RREQ) .The neighbor nodes broadcast this packet to other neighbor nodes and the process continues till it reaches the destination. While forwarding RREQ, a reverse path is established through which the destination node replies back by sending RREP packet. When a link breakage in an active route is detected, a RERR (route error) message is used to notify other nodes of the loss of the link.



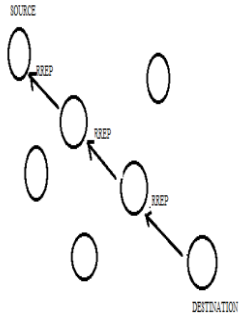


Figure 4(a): RREQ message Figure 4(b): RREP message

c. Temporally Ordered Routing Algorithms (TORA)

The key feature of TORA is its reaction to link failure. It erases invalid routes, searches for new routes and builds new routes in a single pass of the distributed algorithm.

TORA has three basic functions which are Route Creation, Route Maintenance, Route Erasure. Route Creation process converts an undirected network into a DAG (Directed Acyclic Graph) rooted at destination by assigning directions to the links.

The purpose of Route Maintenance process is to reverse some of the links if link failures occur due to which some nodes lose all paths to destinations. This process reorients the network in the state where each node has a path to destination. When the network is partitioned, the Route Erasure process erases all paths in partitions which do not have the destination. [10]

VI.HYBRID ROUTING PROTOCOL

This protocol makes use of both proactive and reactive routing protocols. It is best suited for zone routing protocol in which zone neighbors are determined by proactive routing protocols and the routes between the nodes are determined by reactive routing protocols.

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A. Zone Routing Protocol(ZRP)

In a mobile ad-hoc network, it can be assumed that most of the communication takes place between nodes close to each other. ZRP defines a zone around each node consisting of its k-neighborhood. That is, in ZRP, all nodes within k-hop distance from node belong to the routing zone of node. ZRP is formed by two sub-protocols, a proactive routing protocol Intra-zone Routing Protocol (IARP) is used inside routing zones and a reactive routing protocol: Inter-zone Routing Protocol (IERP) is used between routing zones, respectively. A route to a destination within the local zone can be established from the proactively cached routing table of the source by IARP. Therefore, if the source and destination is in the same zone, the packet can be delivered immediately. Most of the existing proactive routing algorithms can be used as the IARP for ZRP. For routes beyond the local zone route discovery happens reactively. The Zone Routing Protocol (ZRP) described in takes advantage of this fact and divides the entire network into overlapping zones of variable size.[9][11]

B. Order One Network Protocol (OORP)

The Order One MANET Routing Protocol (OORP) is an algorithm for computer communicating by digital radio in a mesh network to find each other, and send messages to each other along a reasonably efficient path. It was designed for, and promoted as working with wireless mesh networks. OORP can handle hundreds of nodes, where most other protocols handle less than a hundred. OORP uses hierarchical algorithms to minimize the total amount of transmissions needed for routing. Routing overhead is only about 1% to 5% of node to node bandwidth in any network and does not grow as the network size grows. The basic idea is that a network organizes itself into a tree. Nodes meet at the root of the tree to establish an initial route. The route then moves away from the root by cutting corners, as ant-trails do. When there are no more corners to cut, a nearly optimum route exists.[11]

VII.COMPARISON OF PROACTIVE, REACTIVE AND HYBRID ROUTING PROTOCOL

The proactive routing protocol is a routing form for flat and hierarchical but reactive is a flat only forming in the protocols. Periodic updates in the conditional of proactive but reactive protocols periodic updates in routing process will be updated. The bandwidth requirement and power management is high producing of routing protocol. The medium performance of the hybrid routing protocols.[5][7]

Protocols	Routing structure	Periodic updates	Control Overhead	Route acquisition delay	Bandwidth requirement	Power requirement
Proactive	Both Flat and hierarchical structures	Yes, some may use Conditional	High	Low	High	High
Reactive	Mostly Flat, Except CBRP	Some nodes may require Periodic beacons.	Low	High	Low	Low
Hybrid	Flat	Yes	Medium	Lower for Intra-zone; Higher for Inter-zone	Medium	Medium

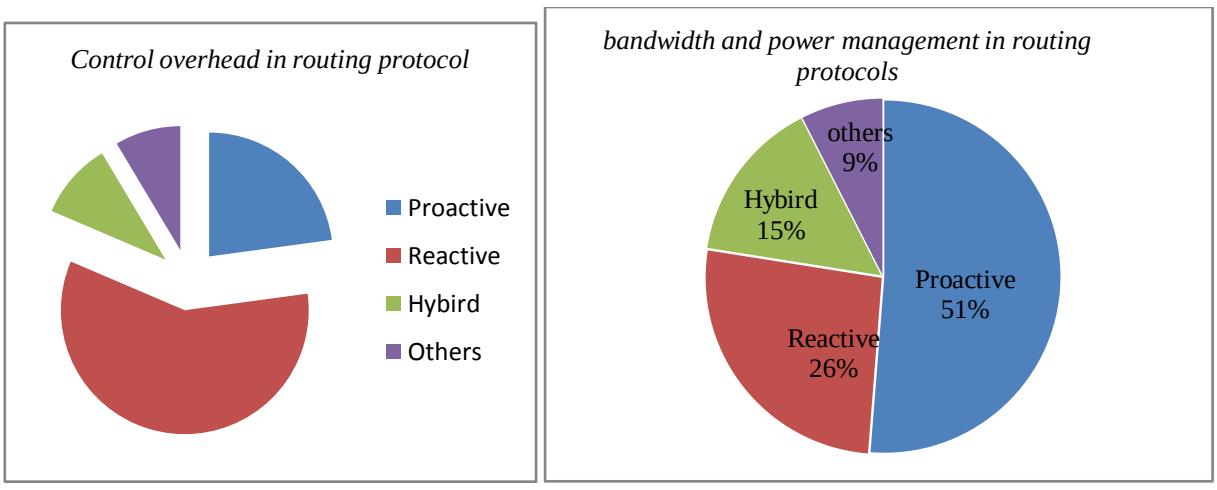

Figure 5: control overhead, bandwidth and power management is performance of routing protocol

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VIII.CONCLUSION

Vehicular adhoc network is used to identify problem in vehicle. Intelligent vehicular adhoc networks are used in artificial intelligence communication that prevents major road accidents. Mobile adhoc network is configured without wire. The proactive routing protocols are update table information in the routing.

The reactive routing protocols maintain structure and recovery of protocols. The hybrid routing protocols executes both proactive and reactive protocols. Global state routing keeps the link state information of worldwide knowledge of the network. Optimized routing protocol chooses the path which has minimum distance for the network connection.

When comparing proactive, reactive and hybrid protocols on the base of bandwidth and power management proactive protocols provide higher bandwidth and power management. But control overhead reactive protocols use more control overhead then the other two protocols.

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BIOGRAPHIES

S. Saranya received her B.SC (Computer Science) from Sree Saraswathi Thyagaraja College, Pollachi, India. She completed her Master of Computer Applications (MCA) from Sree Saraswathi Thyagaraja College, Pollachi, India. Presently, she is a Research Scholar at Department of Computer Science, NGM College, and Pollachi, India. She presented a Research Paper on national Conference. Her area of interest includes Cloud computing, Computer Network, Data Mining.

Dr R. Manicka chezian received his M.Sc. Applied Science from PSG College of Technology, Coimbatore, India in 1987. He completed his M.S. degree in Software Systems from Birla Institute of Technology and Science, Pilani, Rajasthan, India and Ph.D. degree in Computer Science from School of Computer Science and Engineering, Bharathiar University, Coimbatore. He has 25 years of Teaching experience and 17 years of Research Experience. He served as a Faculty of Maths and Computer Applications at P.S.G College of Technology, Coimbatore from 1987 to 1989. Presently, He is working as an Associate Professor of Computer Science in NGM College (Autonomous), Pollachi, India. He has published more than 120 papers in various International Journals and Conferences. He is a recipient of many awards like Desha Mithra Award and Best paper Award. He is a member of various Professional Bodies like Computer Society of India and Indian Science Congress Association. His research focuses on Network Databases, Data Mining, Data Compression, Mobile Computing and Real Time Systems, Network, Bio-Informatics, Distributed Computing.