International Journal of Engineering Research & Technology (IJERT)
ISSN: 2278-0181
Vol. 3 Issue 4, April - 2014

A Comparitive Study of Dynamic Backup Routes Routing Protocol And Dynamic Source Routing In Mobile Ad Hoc Networks

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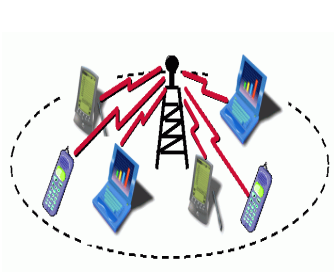
Mobile ad hoc networks (MANETs) are autonomously self organizing and self configurable where mobile nodes are constructed dynamically without the use of any existing network infrastructure or centralized administration. In this paper we present a routing protocol such as Dynamic Source Routing and Dynamic Backup Routes Routing Protocol as an on-demand routing protocol for delivery of packets as and when desirable. Our paper shows that DBR^{2}P is a better on demand routing protocol as it provides backup links during link failure.

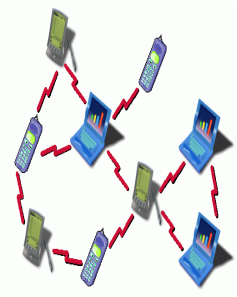
Keywords— MANETs, routing protocols, proactive, reactive, hybrid, DSR, DBR^{2}P

1. INTRODUCTION

Mobile ad hoc networks (MANETs) [1] are autonomously self organizing and self configurable where mobile nodes are constructed dynamically without the use of any existing network infrastructure or centralized administration. Wireless communication enables information transfer among a disconnected network, and often mobile, users. Popular wireless networks such as mobile networks and wireless LANs are traditionally infrastructure-based, i.e. access points and servers are deployed before the network can be used. Ad hoc networks are dynamically formed amongst a group of wireless users and require no existing infrastructure or pre-configuration.



Infrastructure-based wireless network



Ad hoc network

The key challenges in mobile adhoc network include:

a) Uni cast Routing
b) Multi cast Routing
c) Dynamic Network Topology
d) Speed
e) Scalability
f) Quality of service
g) Secure routing
h) Network Overhead
i) Energy Efficient

2. LITERATURE REVIEW

2.1 MANETs

Mobile ad hoc networks (MANETs) are autonomously self organizing and self configurable where mobile nodes are constructed dynamically without the use of any existing network infrastructure or centralized administration. The wireless links in this network are highly error prone and can go down frequently due to mobility of nodes. Therefore, routing in MANET is a key task due to highly dynamic environment. The main aim behind the developing of ad hoc networking is multi-hop relaying. MANETs [2] are a kind of Wireless ad hoc network that usually has a routable networking environment on top of a Link Layer ad hoc network. The set of applications for MANETs is varied, ranging from small, static networks that are constrained by power source, to large-scale, mobile and highly dynamic networks.

2.2 ROUTING PROTOCOLS IN MANETs

a) PROACTIVE ROUTING PROTOCOLS

Proactive routing protocols are also known as TABLE DRIVEN ROUTING PROTOCOLS [2]. As the name suggests these protocols maintains up to date routes to every other node in the network. Each node is maintaining one or more route table containing information of the next hop in the network. Proactive protocols include: Destination-Sequenced Distance- Vector (DSDV) routing, Clustered Gateway Switch Routing (CGSR), Wireless Routing Protocol (WRP), Optimized Link State Routing (OLSR).

Destination-Sequenced Distance- Vector (DSDV) routing
It is a proactive protocol that is based on Bellman Ford algorithm [3] where each node maintains routing table which contains a sequence number which is generally even if the link is present else an odd number. It is used to solve the routing loop problem.

Clustered Gateway Switch Routing (CGSR)
It uses DSDV routing scheme. It is based on the concept of clusters and cluster heads in which routing is done via the cluster heads and gateways. A packet which is sent by a node is first routed to cluster head and the packet is routed from the cluster head to gateway to another cluster head of the destination node is reached.

Wireless Routing Protocol (WRP)
It avoids the count to infinity problem [3] by forcing each node to check predecessor information. It contains link cost table, distance table, routing table, message retransmission list.

Optimized Link State Routing (OLSR)
This protocol performs hop by hop routing in which each node in the network uses its most recent information to route a packet [4].

b) REACTIVE ROUTING PROTOCOLS

Reactive routing protocols are also known as ON DEMAND ROUTING PROTOCOLS [4]. As the name suggests it creates routes only when demanded. When a route is requires by the destination it creates a route discovery process within the network. This process is completed once the entire route are founded and examined. Once it is discovered and established it is maintained by the route maintenance procedure until either destination is in accessible or route is no longer required. Representative reactive routing protocols include: Dynamic Source Routing (DSR), Ad hoc On Demand Distance Vector (AODV) routing, Temporally Ordered Routing Algorithm (TORA) and Associatively Based Routing (ABR).

Dynamic Source Routing (DSR)
It is a reactive protocol that creates a route on demand using source routing protocol i.e. it require a full series of paths to be established between source and destination nodes to transmit packets and each packet follows the same path.

Ad hoc On Demand Distance Vector (AODV) routing
This protocol keeps track of the neighbor nodes only and it does not establish a series of paths to reach the destination.

Temporally Ordered Routing Algorithm (TORA)
TORA is an on demand routing protocol with some proactive enhancements where a link between nodes is established creating a Directed Acyclic Graph (DAG) [4] of the route from the source node to the destination.

Associatively Based Routing (ABR)
In this on demand routing protocol, a route is selected based on the degree of association stability of mobile nodes.

C) HYBRID ROUTING PROTOCOLS

Hybrid routing protocols are the combination of both proactive and reactive routing protocols. The routing is firstly established with some proactively prospected routes and then serves the demand from additionally activated nodes through reactive flooding. Representative hybrid routing protocols include: Zone Routing Protocol (ZRP) and Zone-based Hierarchal Link state routing protocol (ZHLS).

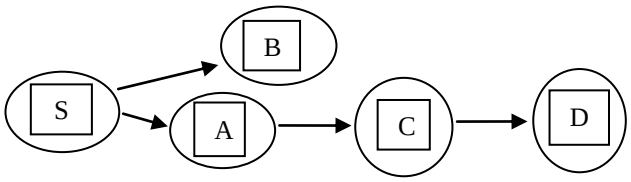
Zone Routing Protocol (ZRP)
In this protocol network is divided into routing zones according to the distances between nodes and the routing zone defines a range that each node is required to maintain network connectivity proactively [5]. The proactive part of the protocol is limited to a small neighborhood of a node and the reactive part is used for routing across the network. This reduces the latency in route discovery and reduces the number of control messages as well.

Zone based Hierarchal Link state routing protocol (ZHLS)
In this protocol network is divided into non overlapping zones. In ZHLS [5] there are two level zone level and node level. A zone level tells how zones are connected together. A node level tells how nodes of a zone are connected to each other physically. The ZHLS uses proactive routing inside the zone and reactive routing is used outside the zone.

3. DYNAMIC SOURCE ROUTING

Dynamic Source Routing (DSR) [6] is a reactive or on demand routing protocol developed at CMU in 1996.DSR uses caches to store routes. It also supports unidirectional links. This protocol is composed of two essential parts of route discovery and route maintenance.
Route maintenance contains route error packets and acknowledgements where as route discovery contains route request and route reply packets.

3.1Route Discovery In DSR



When the node S wants to send a packet to node D, but does not know a route to D, node S initiates a route discovery.
Source node S floods Route Request (RREQ) [7].
Each RREQ has a sender's address, destination's address, and a unique Request ID determined by the sender.
When Node A receives packet it has no route to D so it rebroadcasts packet after adding its address to source route. Similarly Node C receives RREQ and it has no route to D. Now Node D receives RREQ and uncast RREP to C. Route

Reply can be sent by reversing the route in Route Request (RREQ) only if the links are guaranteed to be bi directional.

3.2 Route Maintenance In DSR

Considering the above example the link [7] between C and D fails. Then C sends a route error message to S along route C-A-S when it is attempt to forward the data packet S on J-D fails. Nodes hearing RERR [8] update their route cache to remove link C-D.

3.3 Advantages of DSR

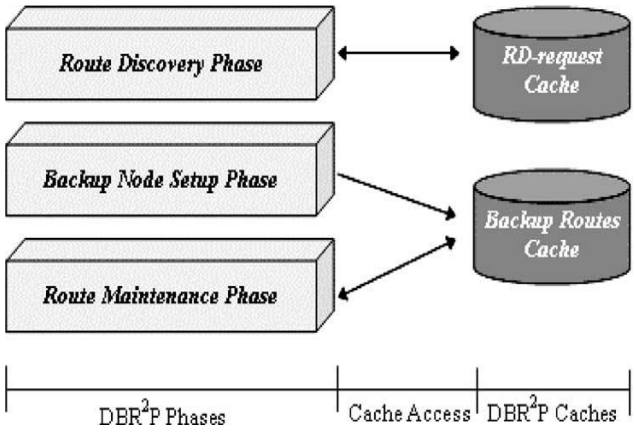
1 Route maintained only between nodes that need to communicate so it reduces the overhead of route maintenance.
2. Route caching can further reduce route discovery overhead.

3.4 Disadvantages of DSR

1. Packet header size grows with route length due to source routing.
2. Flood of route requests may potentially reach all nodes in the network.

4 DYNAMIC BACKUP ROUTE ROUTING PROTOCOL

Dynamic Backup Routes Routing Protocol (DBR^{2}P) [10], a backup node mechanism for quick reconnection during link failures. DBR^{2}P is an on-demand routing protocol that does not require any routing table. It replies a complete route from the source node to the destination node on demand and sets up many backup routes dynamically for quick reconnection when a link fails. DBR^{2}P allows intermediary nodes to receive and transmit the same request packets as obtained from the source node to gather more information to establish backup nodes.



4.2 Motivation

A new routing protocol, Dynamic Backup Route Routing protocol (DBR^{2}P), with backup route mechanisms is generated. This method focuses on the intrinsic properties of MANETs [9] and considers many factors that affect the superiority of routing. When a route is required from the source node to the destination node, quality of service is only slightly affected as long as the time spent to search for the route is within the tolerated period. That is, when the source node broadcasts the route request packets to find a route to the destination node, the route through which request initial arrives at the destination node may not be the shortest path or the most stable one. A little period wait to allow requests to be received by the destination node via some more routes will provide potential backup routes to support reconnection if a link fails. Backup route information is saved in particular on-route nodes. Once the backup routes are found, nodes can be traced back whenever a disconnection or loss of connection occurs. The destination node replies the first route as the primary route.

4.3 Workflow of Dynamic Backup Route

The dynamic route backup function is implemented as dynamic route backup groups. In a dynamic route backup, the backup link is activated when the primary link leading to the monitored network section fails. A dynamic route backup group operates as follows:-

1) The system checks for the routes to the monitored network section and monitors whether the routes to the monitored network section are updated.
2) If at least one route to the monitored network section exists, and the route is originated from an interface with the dynamic route backup function disabled, the primary link operates properly.
3) If there is no such route exists, the primary link is considered to be shut down and busy, and the backup link will be activated.
4) After the backup link is activated effectively, the data is transferred. When the primary link restores, the backup link can be turn down either immediately or after the timer expire.

5 COMPARITIVE STUDY OF DYNAMIC SOURCE ROUTING AND DYNAMIC BACKUP ROUTES ROUTING PROTOCOL

Both Dynamic Source Routing and Dynamic Backup Routes Routing Protocol are on demand routing protocol which are loop free and does not require routing table.DSR includes only two phases route maintenance and route discovery but DBR^{2}P includes three phases i.e. route maintenance, route discovery and backup node setup. DBR^{2}P and DSR can provide shortest routes during the route discovery phase. DBR^{2}P has a higher throughput than DSR. However, in DBR^{2}P, the destination node continues to receive more routes to establish backup routes. The mechanism of backup routes, that the DSR does not provide, can improve the performance effectively.

PARAMETER	DBR^{2}P	DSR
Route Establishment	On –demand	On-demand
Loop free	Yes	Yes
Routing table required	No	No
Cache required	Yes	Yes
Periodic messages	None	None
Backup routes	Yes	No

6 CONCLUSION

This paper presents a Dynamic Backup Routes Routing Protocol which could provide a backup node mechanism for quick reconnection when a link fails and sets up many routes to destination nodes as and when needed. DBR^{2}P provide reliable transfer of data for application such as mobile commerce and mobile entertainment. Improvement on the stability of routes could be considered in the future of DBR^{2}P [10]. Issues such as quality of service and multicast could be addressed to enhance the capability of DBR^{2}P in future researches. Therefore DBR^{2}P is a better routing protocol as compared to DSR.

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