

Review Performance Analysis and Challenges Wireless MANET Routing Protocols

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Abstract- This paper is concerned to develop and evaluate secure dynamic Routes discovery between a source node and a destination in the MANET if needed, and achieve high speed during route discovery, update and data maintenance, optimal bandwidth for data packet transmission and select the route which is less congestion control and less overhead is very important and challenging issue in the MANET. The inherent features of MANET such as open medium, dynamically changing network topology, lack of centralized monitoring and management point, and lack of a clear line of defense it more vulnerable to a wide range of attacks.

Aims: - Studying and investigating the current protocols of ad hoc wireless networks. Assessing the difficulties faced by other routing protocols. Designing algorithms needed to implement the idea of this proposal (Secure Subnet Gateway Routing Protocol), and achieve the following goals:

- Less congestion control, overhead control and communication cost.
- High speed during route discovery, update and data maintenance.
- Setting up a communication path which provides secure packet transmission.
- Optimum bandwidth for data packet transmission

Introduction

In recent years, mobile computing has enjoyed a tremendous rise in popularity. The continued minimization of mobile computing devices and the extraordinary rise of processing power available in mobile laptop computers combine to put more and better computer-based applications into the hands of a growing segment of the population. Therefore, the wireless mobile computers or Mobile Ad Hoc Networks (MANET) have become very necessary. A mobile ad hoc network is a collection of autonomous nodes or terminals that communicate with each other by forming a multi hop radio network and maintaining connectivity in a decentralized manner. Each node in a mobile ad hoc network acts as a host and a router both, and the control of the network is distributed among the nodes. To provide routes in such dynamic environments, many routing protocols have been proposed over the last few years. These protocols are broadly classified into three categories, namely, proactive, reactive,

and hybrid. Still, research in the area of ad hoc networking is receiving much attention from academia, industry, and government. Since these networks pose many complex issues, there are many open problems for research and opportunities for making significant contributions one of these issues is the secure communication during the route discovery.

Following Design constraints that are specific to Mobile Ad Hoc Networking are [10]:

- **Autonomous and infrastructure less:** MANET does not depend on any established infrastructure or centralized administration.
- **Multi-hop routing:** No default router available, every node acts as a router and forwards each other's packets to enable information sharing between mobile hosts.
- **Dynamically changing network topologies:** In mobile ad-hoc networks, because nodes can move arbitrarily, the network topology which is multi hop can change frequently and unpredictably resulting in route changes, frequent network partitions and possibly packet losses.
- **Variation in link and node capabilities:** Each node is equipped with one or more radio interfaces that has varying transmission/receiving capabilities and operate across different frequency bands.
- **Energy constrained operation:** Because batteries carried by each mobile node have limited power supply so the processing power is limited, which in turn limits the services and application that can be supported by each node.
- **Network scalability:** Many MANET applications involve large networks with tens of thousands of mobile nodes as found for example in sensor and tactical networks. Scalability is critical to the successful deployment of these networks.

Applications the Possible Service of Mobile Ad Hoc Networks [10]

Tactical networks - Military communication and military operations in the battlefields.

Emergency services - Search and rescue operations in the desert and in the mountain and so on and replacement of fixed infrastructure in case of environmental disasters

Coverage extension - Extending cellular network access and linking up with the Internet, intranets, and so on

Sensor networks- Inside the home: smart sensors and actuators embedded in consumer electronics.

Education- Universities and campus settings, classrooms, Ad hoc Network when they make a meetings or lectures and Wireless P2P networking

Commercial and civilian Environments-E-commerce: electronic payments anytime and anywhere and Vehicular services: road or accident guidance, Transmission of road and weather conditions, taxi cab network, inter-Vehicle networks

Classification of ad hoc routing Protocols in MANET [6][15]

These protocols can be can be classified into three main categories : proactive (or table driven), reactive (or on-demand driven) and hybrid on the basis of route discovery and routing information update mechanisms.

Proactive protocols or Table Driven Protocol

DSDV (Destination Sequence Distance Vector) [8][15][16]

The Destination Sequence Distance Vector (DSDV) is a table driven mobile ad hoc network routing protocol. DSDV is based on the improved Bellman-Ford algorithm where each node maintains a table that contains the shortest distance and the first node on the shortest path to every other node in the network

WRP (Wireless Routing Protocol) [11][16]

The Wireless Routing Protocol (WRP) is a proactive unicast routing protocol for mobile ad hoc networks. WRP inherits the properties of improved Bellman-Ford Distance Vector routing algorithm. To adapt to the dynamic features of mobile ad hoc networks, some mechanisms are introduced to ensure the reliable exchange of update messages and reduces route loops.

CGSR (CLUSTER GATEWAY SWITCH ROUTING PROTOCOL) [11][13][16]

It is multichannel operations in the network. It facilitates the code separation among the clusters. There is some algorithm are used for electing the cluster head. When two cluster head come in contact or cluster is out of range from all other cluster heads, by using LCC (Least cluster change) can cluster heads only heads changed. If source is sending a packet to the destination then it will send the packet to first cluster head that come in route and it will send to the another cluster head until the destination node's cluster head is reached .

Reactive routing protocols or on- demand driven protocol

DSR (DynamicSource Routing) [3][8][11][16][28]

It is discover the route by sending the request (RREQ) to neighbour and neighbour send the reply (RREP) to the source and update own route cache memory because it is not table driven protocol.

AODV (Ad Hoc on Demand Distance Vector)

[8][14][15][16]

An Ad Hoc network is the co-operative engagement of a collection of mobile nodes without the required intervention of any centralized access point. Route finding is based on a route discovery cycle involving a broadcast network search and a unicast reply containing discovered paths. It maintains the route if a route is not use in lifetime than it will be expire and save the route cache space. If the route is already existing it send the packets otherwise source discovers the routes.

TORA (Temporally Ordered Routing Algorithm) [8][11][15]

The Temporally Ordered Routing Algorithm (TORA) is a reactive routing protocol based on the concept of link reversal algorithm and provides loop-free multipath routes to destination nodes. TORA improves the partial link reversal method by detecting partitions and stopping non-productive link reversals. In TORA, the network topology is regarded as a directed graph.

Hybrid routing protocols or hierarchical routing protocol

ZRP (Zone Routing Protocol) [7][14][15][18]

It is a hybrid routing protocol for MANET. It is able to proactively maintain routes within a local region of the network called as routing zone. It can improve the efficiency of a reactive route query/reply mechanism. The ZRP can be configured for a particular network through adjustment of a single parameter, the routing zone radius.

HSR (Hierarchically Segmented Routing) [15][16]

This routing is very good routing protocol. It provides many facilities. It provides a good scalability. If network is large. In this situation it gives a low overhead facility. It also gives the low end to end delays, seamless connectivity and quality of service.

CBRP (Cluster Based Routing Protocol) [1][8][9][12][15]

In the Cluster Based Routing Protocol (CBRP) nodes are divided into clusters and the clustering algorithm is performed when a node joins the network. Before joining, a node is in the "undecided" state. The "undecided" node initiates the joining operation by setting a timer and broadcasts a Hello message. If a cluster head receives the Hello message, it replies with a triggered Hello message. Receiving the triggered Hello message, the "undecided" node changes its state to "member" state. If the "undecided" node has bi-directional links to some neighbours but does not receive a message from a cluster head before the local timer generates a Timeout, it makes itself a cluster head.

Illustrates Comparison between Table Driven, Demand Driven and Hybrid [2][5][6][20]

	Table Driven	(Proactive)	Demand Driven (On-Demand)
Routing Protocols	DSDV,CGSR, WRP	AODV,DSR, TORA	ZRP,CBRP
Route acquisition delay	Low	Higher	Lower for Intra-zone; Higher for Inter-zone
Control overhead	Higher	Low	Medium
Power requirement	Higher	Low	Medium
Bandwidth requirement	Higher	Low	Medium

Shows the Table-Driven for the three kinds of protocols and comparison between them [2][15][16][20]

Table Driven	CGSR	WRP	DSDV
Routing philosophy	Hierarchical	Flat	Flat
Loop-free	Yes	Yes, but not instantaneous	Yes
Number of required tables	2	4	2
Frequency of update transmissions	Periodically	Periodically and as needed	Periodically and as needed
Updates transmitted to	Neighbours and cluster head	Neighbours	Neighbours
Utilize hello messages	No	Yes	Yes
Critical nodes	Cluster head	No	No

Shows the Demand Driven (On-Demand) with three types of protocols and comparison between them [3][5][8][11][20][28].

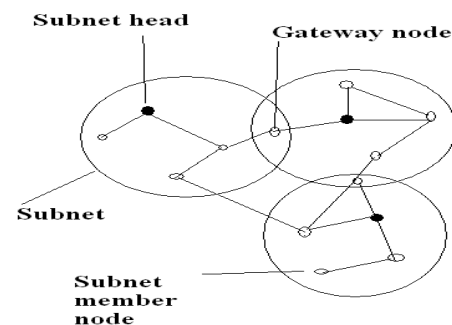
On Demand	TORA	DSR	AODV
Overall complexity	High	Medium	Medium
Overhead	Medium	Low	Medium
Routing philosophy	Flat	Flat	Flat
Loop Free	Yes	Yes	Yes
Multicast capability	No	No	Yes
Beaconing requirements	No	No	Yes
Multiple route support	Yes	Yes	No
Routes maintained in	Route table	Route cache	Route table
Route reconfiguration Methodology	Link reversal	Erase route, notify source	Erase route , notify source
Routing metric	Shortest path	Shortest path	Freshest shortest path &

Some draw backs of existing protocol

- Cluster gateways switch routing protocol frequency update periodically therefore bandwidth is wastage and higher power consumption at cluster head nodes can lead to multiple path breaks. The Proposed protocol over comes this problem, SSGRP is used to grouping the mobile nodes to sending data dynamically when need source to destination [1][4][9].
- Cluster gateway switch routing protocol do not support multi casting. [11][13].
- CGRP is not suitable for highly dynamic topology because it supports DSDV protocol which is not suitable for highly dynamic topology. During the high mobility of nodes there is a heavy overhead control and therefore not scalable in ad hoc wireless network which has limited bandwidth and is highly dynamic. [21][22][26].
- WRP it require larger memory and greater processing power from nodes in wireless
- Rout maintenance mechanism does not locally repair by DSR
- CGSR is maintaining only shortest path. While The [11][13][15].
- Cluster base protocol is not suitable for moderate size highly dynamic network. [1][4].
- CGRP is depending upon number of sources if number of source increases then performance decreases. [14][19][32].
- Short latency for finding new routes, hacking the messages can take place, when the person is not in the area of zone can't receive any information. [15].
- AODV is not proved the authentication but using [22][23][24].
- TORA may produce temporary invalid routes

Secure Subnet Gateway Routing Protocol (SSGRP)

The SSGRP is hybrid routing protocol for mobile ad hoc network which exploit the good feature.



Methodology

- In the first step the network is segmented into subnet. And using Multicast propagation technique.
- In the second step each subnet node divided into three parts on the basis of physical subnet working
 - Subnet head node in each physical subnet
 - Gateway node
 - Nodes member in the physical subnet

Working of above three nodes

- **Subnet head node**- physical subnet head selected in each physical subnet and in the physical subnet RREQ routing request packet are sent between adjacent physical subnet to form on demand routing using SAODV. It is a Reactive (on demand approach) SAODV for all other physical subnet in the network and maintaining route information to all physical subnet and broadcast the information using SAODV to the neighbour physical subnet heads via gateway nodes.
- **Gateway node**- Gateway node is responsible for communication between two or more physical subnet heads.
- **Member nodes**- In the physical subnet member nodes RREQ routing request packet are sent between adjacent member nodes in the physical subnet to form on demand routing using SAODV protocol and maintain subnet member table that maps each node to its respective physical subnet head.

SAODV using digital signature - SAODV Digital signatures are used to protect the Integrity of the non-mutable data in RREQ and RREP messages. That means that they sign everything but the Hop Count of the AODV message and the Hash from the SAODV extension. When a RREQ is received by the destination itself, it will reply with a RREP only if it fulfills the AODV's requirements to do so. This RREP will be sent with a RREP Signature Extension. When a node receives a RREP, it first verifies the signature before creating or updating a route to that host. Only if the signature is verified, will it store the route with the signature of the RREP and the lifetime.

CONCLUSION

In this article we provide description of several routing schemes proposed for ad hoc mobile networks. We also provide a classification of these schemes according to their routing strategies. We have presented a comparison of these categories of routing protocol, highlighting their features and differences, and characteristics. We have identified possible application and challenges facing ad hoc mobile wireless networks. This work can be further extended to improve this

system by implementing other parameters like end to end delay, packet delivery ratio, security issues etc. such that the overhead of selecting routing protocol can be minimized.

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