Survey on Comparative Study of Protocols in Mobile Adhoc Network

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Abstract : **Mobile Ad hoc Network (MANET) is a collection of wireless mobile nodes that dynamically form a network on temporary basis without any support of central administration called infrastructureless network. Every node in MANET moves randomly to make multi-hop network topology that changes at unpredictable times. There are various routing protocols like DSDV, AODV, DSR which have been proposed for providing communication among the nodes in the network. This paper presents a survey on performance comparison of AODV and DSR based on metrics such as throughput, packet delivery ratio and average end-to-end delay and routing overhead.It also presents the various application areas of MANET along with its vulnerabilities.**

Keywords: **MANET, AODV, DSDV, DSR, Throughput, Packet Delivery Ratio, Average End-to-End delay, Routing Overhead, NS2**.

I. INTRODUCTION

A mobile ad hoc network, (MANET) is a infrastructureless network, that dynamically establish their own network on the fly, without having any central controller. MANET is a collection of independent mobile nodes that can communicate to each other via radio channels. The mobile nodes that are in radio range can directly communicate, whereas others needs the intermediate nodes to route their packets. Each of the node has a wireless interface to communicate with each other. Figure 1 shows a simple ad-hoc network with 3 nodes. Node 1 and node 3 are not within range of each other, however the node 2 can be used to forward packets between node 1and node 2. The node 2 will act as a router and these three nodes together form an ad-hoc network.[1]
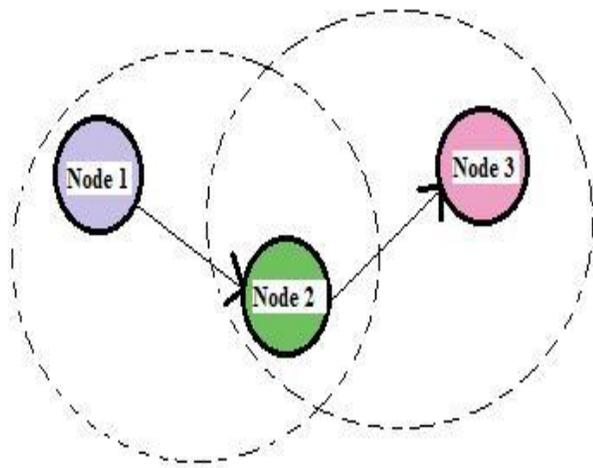

Fig1. MANET network with three nodes

A. History of MANETs

The mobile ad hoc network is classified into three types-first, second and third generation. Present ad hoc network are considered the third generation network. The first generation of ad hoc network goes back to 1970's. The first generation are called Packet Radio Network (PRNET) . The Defence Advanced Research Project Agency (DARPA) provide communication between computer and PRNET. The 2nd generation of ad hoc network is evolved in the 1980's.The PRNET is then evolved into the (SURAN) Survivable Adaptive Radio Network .SURAN provides benefits by improving radio performance smaller, cheaper and power thrifty . This provided a packet-switched network to the mobile battlefield in an environment without infrastructure. The concept of commercial ad-hoc networks arrived in 1990's with note-book computers and other communications equipment. At that time, the idea of a collection of mobile nodes was proposed at several conferences. In the mid of 1990s, a lot of work has been done on ad hoc standards. With the evolution of IETF, the MANET working group was born, and it made effort to standardize routing protocols for ad hoc networks.[2] There are two types of mobile wireless networks. The 1st is known as infra-structured network. Applications of this type of wireless network include WLAN. The second type of mobile wireless network is known as infrastructureless mobile network, commonly called as MANET. MANET is usually a self configuring and self-organizing network that does not require any infrastructure. In this,all nodes are dynamically and

arbitrary located, and required to relay packets for other nodes to deliver data across the network.

B. MANETs CHARACTERISTICS

1) Distributed operation:In this the control of the network is distributed among the nodes and MANET node should communicate and cooperate with each other.

2) Multi hop routing: When a node send a message to other nodes which is not in range, the packet should be forwarded via one or more intermediate nodes.

3) Autonomous terminal: In MANET, every mobile node is an independent node, which act as both a host and a router.

4) Light-weight terminals: In MANET, nodes use less CPU capability, low power storage and small memory size.

C. ADVANTAGES OF MANET

1)*Independence:*Manet is free from central administration.Every node participates in decision making process.

2)*Self-ConfiguringNetwork:*Nodes act as routers and decide their path by own.

3)Less costly: It has been widely used and it become so popular as it costs less as compared to wired network.No infrastructure setup is required for MANETs.

4)Scalable: As many nodes can be added as required.There is no limit on the number of participating nodes,as the communication is hop to hop .

5)Flexible :It is more flexible in comparison to wired network

D. MANETS CHALLENGES

1)Limited Bandwidth: Wireless have significantly lower capacity and limited bandwidth as compare to infra-structured networks.

2) Dynamic Topology: Dynamic topology may disturb the relationship among nodes. It may also be disturbed if some nodes are detected as compromised.

3) Hidden Terminal Problem: The hidden terminal problem means collision of packets at a receiving node due to the transmission of nodes that are not in direct range of the sender.

4) Packet drop or losses due to transmission errors: In Ad hoc wireless networks a much higher packet loss or drop due to increased collisions or crash of the presence of hidden terminals, interference, uni-directional links, frequent path breaks due to mobility of nodes.

5) Battery Constraints: Devices used in these networks are restricted due to the power source in order to maintain portability, limits the size of application and weight of the device.

6) Security Threats: The wireless mobile ad hoc has brought new security challenges to the network design.[2] .

E.. MANETS

1)Military Battlefield:Ad-Hoc networking would allow the military to maintain an information between the soldiers and military head quarter.

2)Local Level: Ad-Hoc networks can autonomously link an quick and temporary multimedia network using notebook computers to spread and share information among members e.g. conference or classroom. Another local level application might be in home networks where devices can communicate directly to interchange information.

3)Personal Area Network and Bluetooth :MANET is used in personal area network that is short range and localized. Short-range MANET such as Bluetooth Here bluetooth stand for inter communication between various mobile devices such as a laptop, and a mobile phone.

4)Commercial Sector: MANET can be used in disaster area where infrastructure is not possible e.g. in fire, flood, or earthquake.[1]

F. MANET VULNERABILITIES

Vulnerability means weakness in security system. MANET is more vulnerable than wired network. Some of the vulnerabilities are given as below :

1) Lack of centralized management: MANET doesn't have a centralized server. Because of decentralization ,detection of attacks is difficult because it is not easy to monitor the traffic in large scale and highly dynamic ad- hoc network.

2) No predefined Boundary: In mobile ad- hoc networks there is no physical boundary of network. The nodes work in a drifting environment where they are allowed to connect and disconnect the wireless network. As soon as an rival comes in the radio range of a node it will be able to communicate with that node.

3) Cooperativeness: nodes are cooperative and non-malicious that are assumed by Routing algorithm for MANETs usually assumes that nodes are cooperative and non-malicious. As a result a malicious attacker can easily become an important routing agent and disrupt network operation.

II. ROUTING PROTOCOLS

Ad-Hoc Routing protocols are commonly classified into three main kinds: Proactive,Reactive and Hybrid protocols .
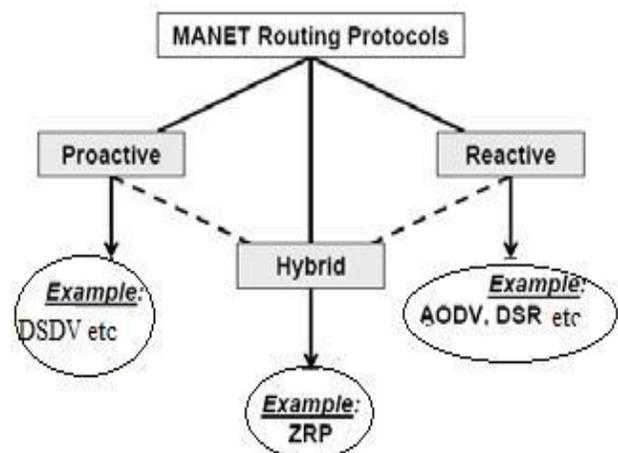

Fig 2. Types of Protocols in Manet

A.Proactive Protocols

Proactive is also known as table-driven routing protocols. In proactive routing protocol , every node maintain one or more tables representing the whole topology of the network. These tables update their information regularly in order to maintain up-to- date routing information from each node to other node. To maintain up-to-date routing information, information needs to be exchanged between the nodes on a regular basis which returns to relatively high overhead on the network. In proactive protocol, routes will always be available on request. It is its key advantage too.

B.Reactive protocols

Reactive routing is also known as on-demand routing protocol. If there is no communication between nodes then they do not maintain routing information or routing activity in network . If a node wants to send a message to another node then protocol find for route which is on-demand and establishes the connection in order to receive and transmit the message.

C. Hybrid Protocols

Hybrid protocol is the combination of both reactive and proactive routing protocols. The Zone Routing Protocol (ZRP) is a hybrid routing protocol that divides the network into zones.[4].

III. PROTOCOLS UNDER CONSIDERATION

A. Ad-Hoc On Demand Distance Vector(AODV)

AODV is a reactive protocol that act on demand. It is probably the most well-known protocol in MANET. It is a modification of DSDV.AODV is a combination of both DSR and DSDV.The demand of bandwidth is significantly less than other proactive protocols .It enables multi-hopping, self-starting and dynamic routing in MANETs. In networks with large number of mobile nodes Ad-Hoc On-demand Distance Vector Routing is very efficient as it dynamically depend on establishing route table entries at intermediate nodes. AODV never produces loops as there cannot be any loop in the routing table of any node because the concept of sequence number counter is taken from DSDV. Sequence numbers serve as time stamps and allow nodes to compare information with other nodes in the network. The main advantage of AODV is that it has less congested route .[8]

Advantages

1)Routes are not included in packet headers.
2)Nodes maintain routing tables which contain entries for routes that are in active use.
3)At most one next-hop per destination maintained at each node,DSR may maintain several routes for a single destination.
4)Sequence numbers are used to avoid old and broken routes.
5)Sequence numbers protect formation of routing loops.
6)If topology does not change,unused routes expire.

B.Dynamic Source Routing(DSR)

Dynamic Source Routing (DSR)is a reactive protocol which act on-demand. The main feature of DSR is source routing in which the source always know the complete route from source to destination. It frequently uses route caching and source routing. Route Maintenance and Route Discovery are two main methods used in Dynamic Source Routing. It is easy and efficient protocol. It does not depend on timer-based activities. It allows several routes to destination node and here routing is loop-free . Any broken link is notified to the source node with an bug or error message. It works well in large networks where routes change quickly and movement (mobility) of routes is higher or more. In DSR, intermediate nodes do not need to conserve the routing information. Instead the packets itself contain every routing decision. InDSR, route discovery process is used to find a route when a node tries to send a data packet to a destination for which the route is not known. A route is found by flooding the network with route requests. When a node receives this request, it transmit it again until it itself is the destination or it has way or route to the destination. This node then request to the original source. The response and request packets are source routed. Request packet creates the path of traversal. Response packet creates the reverse path to the source by traversing backwards.

Advantages

1)Routes are maintained between those nodes who need to communicate and reduces overhead of route maintenance.
2)Route caching can further reduce or decrease route discovery overhead.
3)A single route discovery may produce many routes to the destination, due to intermediate nodes replying from local caches[7].

IV. COMPARISON OF DSR AND AODV

DSR and AODV, packet delivery ratio is independent of offered traffic load, with both protocols delivering between 85% and 100% of the packets in all cases. In contrast, the lazy approach used by the on-demand protocols, AODV and DSR to build the routing information as and when they are created make them more adaptive and result in better performance (high packet delivery fraction and lower average end- to-end packet delays).

In the presence of high mobility, link failures can happen very frequently. Link failures trigger new route discoveries in AODV since it has at most one route per destination in its routing table. Thus, the frequency of route discoveries in AODV is directly proportional to the number of route breaks. The reaction of DSR to link failures in comparison is mild and causes route discovery less often. The reason is the abundance of cached routes at each node. Thus, the route discovery is delayed in DSR until all cached routes fail. But with high mobility, the chance of the caches being stale is quite high in DSR. Eventually when a route discovery is initiated, the large number of replies received in response is associated with high MAC overhead and cause increased

interference to data traffic. Hence, the cache staleness and high MAC overhead together result in significant degradation in performance for DSR in high mobility scenarios. In lower mobility scenarios, DSR often performs better than

AODV, because the chances of find the route in one of the caches is much higher. However, due to the constrained simulation environment (lesser simulation time and lesser mobility models), the better performance of DSR over AODV couldn't be observed.

DSR almost always has a lower routing load than AODV. This can be attributed to the caching strategy used by DSR. By virtue of aggressive caching, DSR is more likely to find a route in the cache, and hence resorts to route discovery less frequently than AODV.

The key distinguishing feature of DSR is the use of source routing. Dynamic DSR is a reactive protocol i.e. it doesn't use periodic advertisements. It computes the routes when necessary and then maintains them. Source routing is a routing technique in which the sender of a packet determines the complete sequence of nodes through which the packet has to pass, the sender explicitly lists this route in the packet's header, identifying each forwarding "hop" by the address of the next node to which to transmit the packet on its way to the destination host.

AODV is essentially a combination of both DSR and DSDV. It borrows the basic on-demand mechanism of Route Discovery and Route Maintenance from DSR, plus the use of hop-by-hop routing, sequence numbers, and periodic beacons from DSDV.

V. PERFORMANCE METRICS

The following four important performance metrics are considered for evaluation of these two on demand routing protocols:

A. Packet Delivery Fraction

The ratio of the data packets delivered to the destination to data send by source.

B. Average end-to-end delay of Data Packets

The difference in the time it takes for a sent packet and to reach the destination.

C. Routing Overhead

This is the ratio of routing related transmissions to data transmission in a simulation.

D. Throughput

Number of Packets send or received in per unit of time.

VI. CONCLUSION

MANET have been an area for active research over past few years due to their popularity widespread application in military and civilian commercial. Such a network is highly dependent on the cooperation of all its members to perform the networking function.

It includes a brief introduction to characteristics, advantages and vulnerabilities of MANET.This paper studies the protocols used in MANET.AODV and DSR are compared on the basis of various Performance metrics like packet delivery ratio ,delay and load. In this review paper we attempted to present an overview of two routing protocols and performance comparison of both the protocols based on Random way point model and their differences in their dynamic behaviours that can lead to performance differences.In lower mobility scenarios DSR often performs better than AODV.

VII. FUTURE SCOPE

This is a review paper on characteristics of MANET and its various protocols .In future we will try to implement and can study the effects of different protocols on the network of nodes.Implementation can be done using any network simulator e.g. NS2. NS2 is a simulation network which provides appropriate environment for checking the behaviour of MANET network under required conditions.It provides us the facility for tracing the behaviour of nodes and to represent with the help of graphs also. We can check their performance under various performance parameters.

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