An Overview of Routing Protocols for Mobile Ad-Hoc Network

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Abstract— In case of ad hoc network, there is no provision for centralized control over network resources and the routing operations. Each node manages the communication links itself, updates the routing information to adopt the variations in topology. Ad hoc networks uses the shared channel and any node can transmit the data at any time over the network using shared channel but during the data transmission, any other node can also try for the data transmission which can lead to the congestion and contention over the shared channel and finally results in collision. For the better channel utilization, there are many solutions has been developed that can control the shared channel utilization in order to reduce collision and to enhance network performance. This survey paper contains a study of various kind of routing protocols used in communication systems whether it may be wired communication or may be wireless or sensor network system but still main focus is towards those routing protocols which are mostly suitable to Mobile Ad-hoc Networks.

Keywords—Ad-hoc, Centralized, Channel, Communication ,Collision, Transmission, Topology, Node, Link, performance, Routing, Utilization, etc*.*

I. INTRODUCTION

Wireless technology has become a very emerging era in the past years. The wireless communication had become a very important part of our life. Wireless technology makes us able to get rid of the wires. The wireless technology makes us able to transfer data by using air as an interface for communication. The wireless communication provides us with the ability to move from one place to another while sending the data. There are different types of the wireless networks available around us [1].

MANET were designed to work in isolation where they don't need to depend on any infrastructure network to provide communication between source and destination .There can be many intermediate nodes in between source and the destination nodes [2]. The intermediate nodes are simply called hops. If the network which we are using to communicate is using more than one intermediate node then we can call such kind of network as a multihop network. The nodes in the network are not bounded to remain in the network during the communication .When intermediate nodes move from one place to another then it might not be possible to get a path for communication [3-5]. As all the devices are mobile they are having limited range to communicate with the neighbouring nodes whenever there is a movement of the nodes the nodes need to reroute the data

by using any available node for communication. The process of re routing data after the movement of intermediate nodes is not always possible [5-6]. Due to these problems mobile ad-hoc networks are less robust as compared to infrastructure networks .As the mobility of nodes increases the performance of mobile ad hoc network drops. All the nodes have some communication interface the nodes of mobile ad hoc networks use antennas to communicate with the neighbouring nodes [7].The antennas can be unidirectional or Omni-directional. The nodes can increase the transmission and receiving power of their antennas but increased the power of the antennas can cause a issue of interference in the communication of the other nearby nodes.

II. RELATED WORK

Most of the work done related to the performance comparison of MANETs routing protocols includes either purely reactive protocols or purely proactive protocols. Some researchers have done a comparative study on reactive and proactive or reactive and hybrid protocols.

[1] In this Article author collected concept of routing methods and a comparative study of various routing methods which are used in multihop mobile Adhoc networks.

[2] In this Article author provided a scenario of rural environment for mobile Adhoc network by establishing hybrid routing protocols with their pros and cons.

[3] In this Article author tried to focus on some energy efficient routing algorithms which are suitable with MANET systems.

[4] In this Article author enlisted description of Zone routing protocol (ZRP) with its analysis in terms of various performance parameters.

[5] In this Article author provided many ways to reduce routing overheads over MANET system so that an efficient communication can be established.

[6] In this Article author produced A QoS-Oriented Distributed Routing Protocol for Hybrid Wireless Networks with MANET concepts.

[7] In this Article author told how to maintain an optimized networks. Here this research focused its goal on wireless networks.

[8] In this Article, variety of performance parameters used in Mobile Ad-hoc networks presented with their effective uses and analysis.

[9] In this Article, author provided an analytical research aspect with practical implementation about MAC protocol for MANET.

[10] In this Article, research focused on Proactive and Reactive Routing Protocols in Multihop Mobile Ad hoc Network.

III. EXISTING METHODOLOGY & TOOLS

Mobile ad hoc network (MANETs) is networks which don't have any fixed infrastructure .These networks are very useful in a scenario where there is no time to setup any infrastructure for communication. These networks use intermediate devices to communicate from source to the destination [11-14]. Here types of MANET routing has been given in Figure 1:
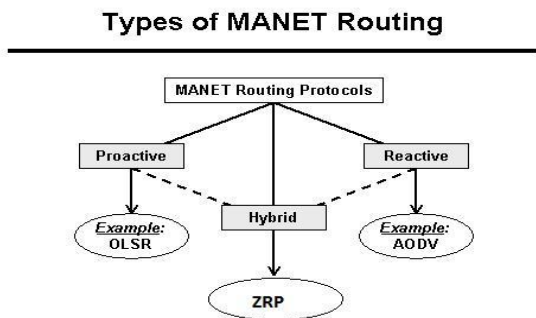
Figure 1: MANET Routing

The routing protocols which are used in mobile ad hoc network are broadly divided into the following three types:

- Proactive Protocols (also known as table-driven)
- Reactive Protocols (also known as On-demand)
- Hybrid Routing Protocols(Combination of table driven and on demand)

Proactive Routing protocols:
In it, all the nodes continuously search for routing information within a network, so that when a route is needed, the route is already known. If any node wants to send any information to another node, path is known, therefore, latency is low. However, when there is a lot of node movement then the cost of maintaining all topology information is very high [16].

Reactive Routing protocols:
Whenever there is a need of a path from any source to destination then a type of query reply dialog does the work [7, 8].Therefore, the latency is high; however, no unnecessary control messages are required.

Hybrid routing protocols:
These protocols incorporate the merits of proactive as well as reactive routing protocols. A hybrid routing protocol should use a mixture of both proactive and reactive approaches. Hence, in the recent years, several hybrid routing protocols are proposed like ZRP, ZHLS, SHARP and NAMP [13-14].

DSDV (Destination Sequence Distance Vector):
It is a proactive routing protocol and based on the distributed Bellman-Ford Algorithm. The improvement from distance vector in wired routing protocol is in the terms of avoidance of routing loops. Each node maintains a routing table which has the list of all the possible destinations and number of routing hops to reach the destination. Whenever some packet comes to node, routing table is to be consulted to find the path. DSDV uses a concept of sequence numbers to distinguish stale routes from new routes and the sequence number is generated by the destination node. To maintain consistency in routing table, DSDV sends routing updates periodically [12].

DSR (Dynamic Source Routing):
DSR is a pure reactive routing protocol which is based on the concept of source routing. DSR protocol is composed of two important phases: route discovery androute maintenance. DSR does not employ any periodic routing advertisement packets, link status sensing or neighbour detection packets [15]. Therefore, the routing packet overhead is less because of its on-demand nature. Every node maintains a route cache to store recently discovered paths. Whenever a route is required for a particular destination then that particular node will consult route cache to determine whether it has already a route to the destination or not.

AODV (Ad-hoc On-demand Distance Vector) :
AODV algorithm is pure reactive in nature and it contains the properties of both DSR and DSDV protocols. AODV algorithm is an improvement on DSDV in the sense that it minimizes the number of broadcasts. AODV borrows the concept of hop by hop routing, sequence numbers, periodic beacon messages from DSDV protocol [15]. Like DSR, it is on-demand protocol but unlike source routing.

IV. PERFORMANCE METRICS

There are several simulators available like OMNET++, Quaint, OPNET and NS2. Here, NS2 is used for simulation experiments since it is preferred by the networking research community. NS2 is an object oriented simulator, written in C++ and OTcl (Object oriented Tool command language) as the frontend. If the components have to be developed then both Tcl (Tool command language – scripting language) and C++ have to be used. In this section, we have described about the performance metrics and implementation details of all four parameters [8, 11, 13 & 16]:

Throughput:
The ratio of data packets received to the destination to those generated by source.

Average Delay:
It includes all possible delays caused by buffering during route discovery latency, queuing at the interface queue, retransmission delays at the MAC, and propagation and transfer times. It is the average amount of time taken by a packet to go from source to destination.

No. of Packets Dropped:
It is the number of packets lost by routers at the network layer due to the capacity of buffer or the packet buffering time exceeds the time limit.

Routing Overhead:
It is the number of routing packets which would be sent for route discovery and maintenance.

V. CONCLUSION AND FUTURE SCOPE

In the present study, the performance of MANET routing protocols is studied with respect to following four performance metrics namely, throughput, average delay, and number of packets dropped and routing overhead from earlier researches. DSDV is a proactive protocol, whereas, AODV and DSR falls under the category of reactive protocol and ZRP is a hybrid protocol. In terms of throughput, AODV performance is better than others whereas, DSDV performance poorly sometimes. Another disadvantage of DSDV is that the number of dropped packets is also significantly higher. ZRP throughput does not change even with a change in mobility or pause time because of its hybrid nature.

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