Performance of OLSR in MANET using OMNETPP

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Abstract

In Today, user wants the wireless network anywhere. The wireless communication devices are transmitters, receivers and various smart antennas. These smart antennas may be any kind and the number of nodes can be fixed or mobile. The term node is referred to as nodes which can move arbitrarily in any direction. The wireless mobile nodes when collected at an instant are forming a temporary network without use of any re-existing network. The Ad-hoc routing protocols have number of types which are useful during the time of connectivity to form network. Routing protocols for mobile Ad-hoc networks have to face the challenge of changing the network topology by changing the number of mobile nodes. Scalability is an open issue in all routing protocols. In this review paper, there are observations of OLSR protocol regarding the scalability comparison of the Optimized Link State Routing (OLSR) by varying the number of nodes. The simulation is done by using OMNET++ by taking end to end delay, throughput and Packet delivery ratio as performance metrics.

Keywords: MANET, OLSR, MPR, OMNET++, Scalability

I. INTRODUCTION

Ad-hoc Network is a more developing Technology with different aspects. It takes Attention of many researchers because of its tremendous benefits for internet users. Ad-hoc network is a wireless multi-hop network, which consists of number of mobile nodes to form a connectivity. The number of nodes generates traffic which is forwarded to some other group of nodes. MANET is a spontaneous network and dealing with various wireless devices in which some of the devices are part of the network for the duration of a communication period[1]. The implementation Areas of wireless Ad-hoc networks are sensor applications, military, conferencing and emergency areas. Each of these application areas has their specific requirements in radio channel conditions for routing network protocols. Currently Ad-hoc networks are gaining popularity for their attractive features and benefits. All application areas have number of benefits and requirements for protocols in common. Ad -hoc networks have two kinds; one is static ad hoc network (SANET), and other is called mobile ad-hoc network (MANET)[4].MANET network have chosen for this study. The MANET is flexible solution and provides number of services for duration of a communication session. The following section describes MANET networks.

A. Mobile Ad-Hoc Network (MANET)

The mobile Ad-hoc network is collection of wireless mobile hosts or nodes forming a temporary network without aid of any established infrastructure. The entire collection of nodes is interconnected by number of ways. MANET can be easily deployed plug and communicate. There is more than one path from one node to another[2]. The nodes in a MANET can be of varying capabilities. In MANET, mobile nodes are interconnected by multi hop communication paths or radio links. A MANET consists of mobile platforms, known as nodes, which can move at any speed in any direction and organize themselves randomly. The nodes in the networks behave as client, routers and servers.

Mobile phones, laptop computers and military are some examples of nodes in ad-hoc networks. MANET has dynamic infrastructure and large no of applications which make them ideal to use. The MANET network is spontaneous which very suitable when natural disaster occurs. MANETS deals with wireless devices in which some of devices are part of network only for duration of a communication session. MANET devices are free to move, leave or join the network any time and exchange the information according to the requirement. The self-configuration of MANET makes it useful in Emergency Services, Commercial environments, Educational purposes and Tactical Networks.

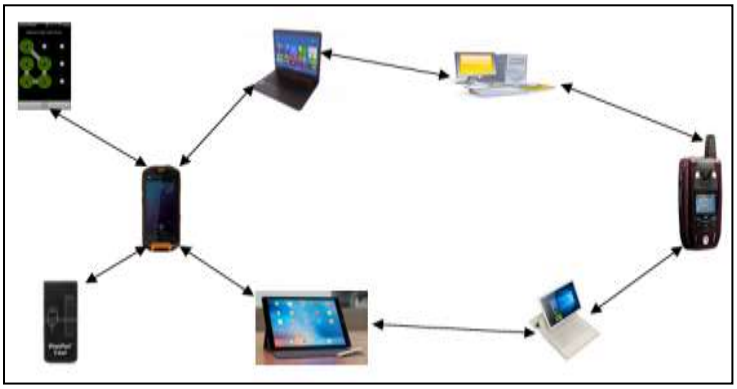

Fig. 1: A Typical Mobile Ad Hoc Network

II. ROUTING IN MANETS

This section is to explore routing in detail. MANET does not have any kind of fixed infrastructure for routing, so nodes just relay packets for each other. So, the nodes will be able to communicate only if they participate and cooperate in routing and forwarding. The Routing protocols discover routes between numbers of nodes during the time of connectivity the primary goal of Routing protocol is to establish a formalized route so the message can easily delivered [1]. The classification of routing protocols can be done in many ways, but most of them are done basing upon the network strategy and network structure. The number of mobile nodes operates on batteries, therefore to conserve energy; Routing Protocols should be able to optimize the operations. The main task of the routing protocols to route discovery and route maintains.

A. Classification of Routing Protocols

Many protocols have been proposed for MANET. These protocols can be mainly divided into two categories.

- Source- initiated /On-demand Routing Protocols (Reactive)
- Table-driven Routing Protocols(Proactive)

B. Reactive/On-demand Routing Protocols

This routing protocol is different from the above mentioned table driven routing protocol. This routing protocol creates the routes and delivered a message from the source node to the destination node only when they are desired, which means in the case if there is no communication between the nodes. In reactive or On-demand protocols, the routing information is maintained only for active routes[16]. The routes are determined and maintained instantly by a node only when it wants to send data to a particular destination. A Particular route search is needed for every unknown destination. This protocol searches for the route only when there is a demand for it (which means only when a node wants to send a packet to another node), and then it establishes the connection for transmit and receive the packet. Therefore communication overhead reduces due to route research. Some reactive protocols are Ad hoc On-Demand Distance Vector (AODV), Temporally Ordered Routing Algorithm (TORA) and Dynamic Source Routing (DSR). [16]

C. Proactive/Table-Driven Routing Protocols

These protocols maintain the routing information even before it is needed so they are called as “Proactive routing protocols”. In a network every node maintains routing information about every other node in the network. This information is usually kept in the routing tables and is always updated as soon as the topology changes in the network. Most of these routing protocols come from the link-state routing. In proactive or table-driven routing protocols, the routing tables are used. In this approach each node maintains up-to-date routing information to every other node for the network in the routing tables. Routing information is periodically updated transmitted throughout the network in order to maintain routing table consistency. However, for highly dynamic network topology, the proactive schemes require a significant amount of resources to keep routing information up-to-date and reliable. The most common used proactive routing protocols are Optimized Link State Routing (OLSR), Destination Sequenced Distance Vector (DSDV) and Wireless Routing Protocol (WRP).

III. DESCRIPTION OF OLSR

OLSR is a table- driven proactive link-state routing protocol, for mobile ad-hoc networks. Due to its proactive nature routes are immediately available when needed [2]. In the Proactive protocols, routes to all destination within the network are already maintained and known. All Routing information is kept in Routing Tables, so there is no overhead to discover a new route. The OLSR protocol is useful in high traffic areas. The key feature of OLSR is MPR(Multipoint Relay).Each node of the network selects independently its own set of Multipoint Relays from the neighbors that is called MPRs selector list.[1] Only the nodes

which are selected as MPR are responsible for route establishment as well as forwarding an MPR Selector list by Advertising other MPRs. In this way OLSR provide an efficient flooding mechanism and reducing the transmission overhead.

1) Control Traffic

The OLSR controls Traffic by exchanging through two different types of messages: HELLO and TC(Topology control). In the OLSR each node generate the HELLO messages periodically .The HELLO messages are exchanged periodically among the neighbor nodes in order to detect the link also identify the signal can forward MPRs selection. Each node in the network can learn a complete topology up to two hops. The TC messages are used for the route calculation .The Topology Control messages are flooded to the entire network through the selected MPRs. The MPRs nodes only forwarding TC message and each node in the network learn the topology to build a network or route establishment.

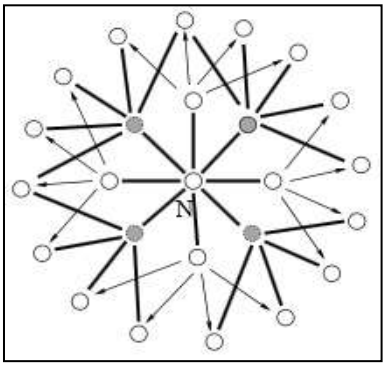

Fig. 2: Multipoint Relays (MPRs)

According to this a node updates its MPRs Selector set the information it receives in the HELLO messages and increment this sequence no on each modification. In order to build the intra-forwarding database needed for routing packets each node broadcast specific control message called topology control (TC) message. TC messages are forwarded like broadcast message in the entire network. The interval between the transmissions of two TC messages will depends upon whether the MPRs selector set is changed or not, since the last TC message is transmitted. All subsequent message will sent with normal default interval for sending TC message until MPR selector set is changed again. Each node of the network maintains a topology set, in which it records the information about the topology of the network obtained from the TC message. Each topology entry has associated with holding time, upon expiry of which is no longer valid hence removed. OLSR is to support to flexible solution large and high dense traffic loaded wireless networks. OLSR is tailored for networks where the traffic is random and large numbers of nodes in the network. It is also suitable for scenarios, where the communicating pairs change over time. This can be beneficial for situations where time critical or safety related data needs to be delivered with minimum possible delay.

2) Scalability

The Scalability is an open issue in all Routing protocols. It is the ability of the network to support the increase of its limiting parameters. The network is highly scalable which overcome the problem of complexity in the network The various scalability limiting parameters are -traffic rate, network size .It has been confined that as we increase the traffic size the traffic rate also increasing with it. The factors that limit the scalability of proactive routing protocols are:

- Large routing table when number of nodes in the network is large.
- Large flooding of routing information when population of network is large.
- Frequent updating when mobility is high.

Though most of the proactive protocols do not scalable with limiting network parameters due to their nature of proactively disseminating link state or distance vector information into the network. There are number of Link State (LS) routing approaches proposed in literature to make proactive approach scalable. Optimized Link-State Routing (OLSR) is a good example of link state routing which scales very well as seen in the simulation results. In OLSR the LS updates are sent along the MPR nodes which are the only nodes who retransmit them. OLSR protocol is highly scalable and best results of their simulations as we will describe in next section. OLSR overcome the problem in retransmission of a network. Certainly, this reduction on retransmission and reduces total overhead.

IV. SIMULATION SETUP

A. Simulator & Simulation

OMNET++ stands for Objective Modular Network Tested in C++. OMNET++ a discrete event simulation tool which is designed to simulate various computer networks. Its applications can be in modeling ,designing and for other systems as well. It has become a efficient network simulation tool in the scientific and computer network community as well as in industry over the years. In main feature of OLSR is that flexible module parameters and hierarchically nested modules communicate with messages through channels. To study OLSR methods the OMNET++ Simulator used for working purpose .The simulation is performed using the OMNET++ which is an object oriented modular discrete event network simulation framework. OMNET is a

discrete event network simulator that provides virtual network communication environment. OMNET++ 4.4 is chosen because it is one of the leading environments for network modeling and simulation. This tool is highly reliable, robust and efficient. The simulation study of OMNET++ focuses on the performance of routing protocol with varying the number of nodes. Therefore, three simulation scenarios consisting of different number of nodes i.e. 40, 80 and 120 are considered.

B. Performance Metrics

The various performance metrics have been chosen in order to evaluate the routing protocols for scalability. The metrics which capture the most basic overall performance of Routing protocols studied in the research work are as follows:

1) Average End-to-End Delay

Average End-to-End delay (seconds) refers time taken for a packet to be transmitted across a network as a source send a packet to the destination. It is the average time it takes a data packet to reach the destination. This includes all possible delays.

Delay= (Total Delay for all successful data packet delivery)/ Number of received data packets.

2) Throughput (Messages/Second)

Total number of delivered data packets per second of simulation time. The throughput of the protocol is analyzed in terms of number of messages delivered from source to destination according to a particular time limit. The throughput we analyzed according to per second.

Throughput= (number of delivered packets * packet size)/ total duration of simulation.

3) PDR (Packet Delivery Ratio)

It is ratio of total delivery of data packets at the destination with compared to total number of packets send by the sender .In packet delivery ratio we are check the completely delivered packet from source to send out by the sender and destination to receive the packet by receiver.

V. FUTURE WORK

This presents the observation of the scalability of the Optimized Link State Routing Protocol (OLSR). The scalability of the network change according to size or traffic. The OLSR protocol handles high traffic networks and gives best result of their performance. In This review paper we performed the scalability comparison of OLSR routing protocol. The OLSR Protocol will give the best result of their simulations as we increased the number of nodes. The results of the simulation will provide the efficient flooding mechanism in the large networks and case of high dense traffic areas. . In the research study we are working on three simulation parameters the average end to end delay, Throughput and PDR (Packet Delivery Ratio). The results and conclusion will be added to our next research paper. The OLSR gives the better results reduce overhead that a packet or node reaches to the destination in a timely delivered manner. This proposed work will be more efficient and cost effective.

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