IJESRT

INTERNATIONAL JOURNAL OF ENGINEERING SCIENCES & RESEARCH TECHNOLOGY

A Review of Comparative study of DSR and AODV Routing Protocols for Mobile AD-Hoc Network (MANET)

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Abstract

MANET stands for Mobile Ad hoc Network. It is a decentralized autonomous wireless system which consists of free nodes. MANET sometimes called mobile mesh network is a self configurable wireless network. A MANET consists of mobile nodes, a router with multiple hosts and wireless communication devices. The ability of self Configuration of these nodes makes them more appropriate for urgently required network connection. For example in disaster hit areas where there is no communication infrastructure. It is wholly desired to have a swift communication infrastructure. MANET is the swift remedy for any disaster situation. A range of literature relating to the field of MANET routing was identified and reviewed, It is also reviewed literature on the topic of securing AODV and DSR based MANETs as this may be the most popular MANET protocol. The literature review identified a number of trends within research papers such as elite use of the random waypoint mobility model, excluding key metrics from simulation results and not comparing protocol performance against available alternatives.

Keywords: AODV, DSR, MANET, routing protocols.

Introduction

A mobile ad-hoc network is a collection of mobile platforms that form a dynamic infrastructure-less communication network wherever it is required.

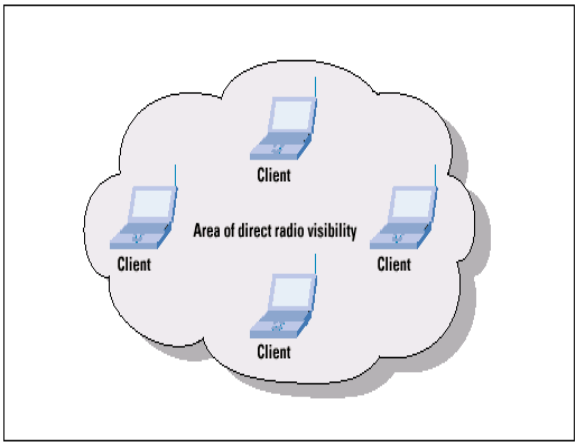

Figure 1 Infrastructure less network

The absence of a fixed infrastructure means that the communicating nodes in the network must also handle routing. swift and easy establishment of such networks make them feasible to use in military, disaster area recovery and in other environments where no infrastructure exists or it has been destroyed. Routing is a well studied feature of such networks because mobile nodes may move in various directions, which can cause existing links to break and the establishment of new routes. The mobility (i.e. how nodes move) of mobile nodes plays an important role on the performance of routing protocols. Routes between two communicating nodes may consist of multiple hops through other nodes in the network. Therefore, finding and maintaining routes in MANET is nontrivial.

There are a number of issues which affect the reliability of Ad-hoc networks and limit their viability for different scenarios; lack of centralized structure within MANET requires that each individual node must act as a router and is responsible for performing packet routing tasks; this is done using one or more common routing protocols across the MANET. Performing routing tasks requires memory and computation power, however mobile devices feature physical size and weight limitations essential for their mobility, this reduces the available memory and computational resources as well as limiting battery power.

Literature Review

Routing in the MANETs is a challenging task and has received a tremendous amount of attention from researches. This has led to development of many different routing protocols for

MANETs, and each author of each proposed protocol argues that the strategy proposed provides an improvement over a number of different strategies considered in the literature for a given network scenario. Therefore, it is pretty difficult to determine which protocols may perform best under a number of different network scenarios, such as increasing node density and traffic.

We have identified more than a few pieces of key literature in the field of MANET routing protocols which highlight existing protocols as well as the current thinking surrounded by the field and the directions researchers are moving in the future. An effective MANET routing protocol must be set to deal with the dynamic and unpredictable topology changes associated with mobile
nodes, even as being aware of the inadequate wireless bandwidth and device power considerations which may lead to reductions in transmission range or throughput [1].

Related Work

The comparative analysis of two on-demand routing protocols, AODV and DSR based on Packet Delivery Ratio (PDR), normalized routing overhead and end-to-end delay while varying the number of sources and pause time has been performed [2]. They observed that DSR performs better in terms of overhead and in terms of PDR when compared with AODV. A similar methodology with parameters concerning models at the physical and data link layers has also been done [3]. They observed that DSR performed best at all mobility rates and movement speeds, although its use of source routing increases the number of routing overhead bytes required by the protocol [4].

In Kumar et al. [5], a comparison of the performance of two high-flying on-demand reactive routing protocols for MANET (DSR and AODV) is presented, along with the traditional proactive DSDV protocol. In Rahman and Zukarnain [6] the performance comparison between three routing protocols, namely AODV, DSDV and an improvement of DSDV, is presented. The authors use three network metrics, namely packet delivery ration, end-to-end delay, and routing overhead.
This paper is concentrated on the study, survey and comparison of most popular routing protocols AODV & DSR. The next section describes the DSR and AODV routing protocols.

AD HOC Routing Protocols

A number of routing protocols for Ad Hoc networks exist and generally they can be classified as proactive and reactive protocols [7]. This work focuses on reactive protocols. Reactive MANET Protocols are well-matched for nodes with high mobility or nodes that transmit data rarely. There are some reactive routing protocols which we will consider here. These reactive routing protocols include AODV and DSR.

AD-HOC ON-Demand Distance Vector Routing Protocol (AODV)

AODV is an on-demand routing protocol. The AODV algorithm gives an straightforward way to get change in the link situation. For example if a link fails notifications are sent only to the affected nodes in the network. This notification cancels all the routes through this affected node. It builds uncast routes from source to destination and that's why the network usage is least. Since the routes are build on demand so the network traffic is bare minimum. AODV does not allow keeping extra routing which is not in use.

If two nodes wish to establish a connection in an ad hoc network then AODV is responsible to enable them to build a multihop route. AODV uses Destination Sequence Numbers (DSN) to avoid counting to infinity that is why it is loop free. This is the characteristic of this algorithm.

Dynamic Source Routing Protocol (DSR)

The DSR network is totally self organizing and self configuring. The protocol is just making up of two mechanisms i.e. route discovery and route maintenance.

The DSR regularly updates its route cache for the sake of new available easy routes. If some new available routes were bring into being the node will directs the packet to that route. The packet has to know about the route direction. So the information about the route was put in the packet to reach its destination from its sender. This information was kept in the packet to avoid periodic findings it has the capability to find out its route by this way.

Comparative Study

This section provides comparative study between AODV and DSR MANETs routing protocols. The Internet Engineering Task Force MANET working group suggests two different types of metrics for evaluating the performance of routing protocols of MANETs. In accordance with RFC 2501, routing protocols should be evaluated in terms of both quantitative metrics and qualitative metrics. These metrics should be independent of any given routing protocol.

A. Quantitative Metrics [8]

The following is a list of quantitative metrics that can be used to review the performance of any routing protocol.

a. Packet Delivery Ratio: The packet delivery fraction is defined as the ratio of number of data packets received at the destinations over the number of data packets sent by the sources. In other words, fraction of successfully received packets, which survive while finding their destination, is called as packet delivery ratio.

b. Average End-to-End Delay: This is the average time involved in delivery of data packets from the source node to the destination node. In other words, it is the average quantity of time taken by a packet to go from source to destination. The end-to-end delay includes all possible delays in the network caused by route discovery latency, retransmission by the intermediate nodes, processing delay, queuing delay and propagation delay. To compute the average end-to-end delay, add every delay for each successful data packet delivery and divide that sum by the number of successfully received data packets.

c. Packet Loss: Packet loss occurs when one or more packets being transmitted transversely the network fails to arrive at the destination. It may be due to path breaks caused by the mobility of nodes and node failure due to a drained battery. It is defined as the number of packets dropped by the routers during transmission.

d. Normalized Routing Load: The normalized routing load is defined as the fraction of all routing control packets sent by all nodes over the number of received data packets at the destination nodes. In other words, it is the ratio between the total numbers of routing packets sent over the network to the total number of data packets received.

B. Qualitative Metrics [8]

The following is a list of desirable qualitative properties of MANET routing protocols:

a. Loop Freedom: This refers mainly, but not only, to all protocols that calculate routing information based on the Bellman-Ford algorithm. In a wireless environment with limited bandwidth, interference from neighboring nodes' transmissions and a high probability of packet collisions, it is essential to thwart a packet from "looping" in the network and thus consuming both processing time and bandwidth.

b. On-Demand Routing Behavior:

Due to bandwidth limitations in the wireless network, on-demand, or reactive-based, routing minimizes the dissemination of control packets in the network, increases the accessible bandwidth for user data, and conserves the energy resources of the mobile nodes. Reactive routing protocols introduce a medium to high latency.

c. Proactive Behavior: Proactive behavior is preferable when low latency is the main concern and where bandwidth and energy resources permit such behavior. Mobile nodes in vehicular platforms do not face energy limitations.

d. Security: The wireless environments, along with the nature of the routing protocols in MANETs, which require each node to participate actively in the routing process, introduce many security vulnerabilities. Therefore, routing protocols should efficiently support security mechanisms to address these vulnerabilities.

e. Unidirectional Link Support: Nodes in the wireless environment may be able to communicate only through unidirectional links. It is preferable that routing protocols be able to support both unidirectional and bidirectional links.

f. Sleep mode: In general, nodes in a MANET use batteries for their energy source. The protocol should be able to operate, even though some nodes are in "sleep mode" for short periods, without any adverse consequences in the protocol's performance.

Conclusions

In this paper, an effort has been made to contemplate on the proportional study of AODV & DSR. Since a single routing protocol is not best in all kind of situations. So we must prefer a protocol as per the requirements of the specific application and the environment. The routing protocols: AODV and DSR are evaluated for qualitative measures like loop freedom, multi route, multicasting etc. and performance metrics like packet delivery ratio, end-to-end delay, and throughput and routing overhead.

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