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A PROPORTIONAL STUDY OF SOURCE INITIATED ROUTING PROTOCOLS IN MOBILE AD HOC NETWORKS

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Abstract:Mobile Ad hoc networks (MANET) represent complex distributed systems that comprise wireless mobile nodes that can freely and dynamically self organize into arbitrary and temporary ad hoc network topologies, allowing people and devices to seamlessly internet work in areas with no preexisting communication infrastructure e.g., disaster recovery environments. An ad hoc network is not a new one, having been around in various forms for over 20 years. The goal of the routing protocol is to have an efficient route establishment between a pair of nodes. Routing protocols used in wired network cannot be used for mobile ad-hoc networks because of node mobility .Many routing protocols such as proactive, reactive and hybrid. Reactive routing protocols have been found to be user friendly and efficient when compared to other routing protocols. The main boon of routing protocols when compared with proactive and Hybrid routing protocols is the relatively unconditional low storage requirements, higher mobility and the availability of routes when needed. There are a variety of reactive routing protocols suchasAODV,DSR,LAR1,LMR,ABR,SSI,TORA, RDMAR,MSR,AOMDV,MRAODV,ARA.Howeve r there is no study done over the efficiency of any reactive routing protocols. In this study a comparison and performance evaluation of two reactive routing protocols AODV and DSR are done using NS-2 simulator to identify the protocol that is best suited for MANET'S.

KEYWORDS: MANET, Routing protocols, AODV, DSR

I.INTRODUCTION:

Technology has advanced by leaps and bounds in the last few years. This is evident from the recent developments in various fields such as Medicine, Computer science and information technology, if no other field has these developments been more evident than in field of wireless technology. In recent times that wireless systems have started to make inroads into all aspects of human life. Mobile Ad hoc Network (MANETs) are advanced wireless communication networks. Mobile Ad hoc Network is an autonomous system of mobile nodes connected by wireless links. Each node operates as an end system and a router for all other nodes in the network. A mobile ad hoc network is a self configuring network of mobile routers connected by wireless links-the union of which forms an arbitrary topology. An ad hoc network is often defined as an: infrastructure less" network means that a network without the usual routing infrastructure, link fixed routers and routing backbones.

Properties of Mobile Ad hoc Network

Wireless Ad hoc Networks are formed by a group of mobile users or devices spread over a certain geographical area. The user or devices forming network "nodes". The service area of the ad hoc network is the whole geographical area where nodes are distributed. As Mobile Ad hoc Networks are self organized networks communication in ad hoc

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networks can generate data for any other node in the networks. The multi hop support makes communication between nodes outside the direct range of each other possible.

Salient Features of MANET

Nodes are free to move arbitrarily; thus network topology which is typically multi-hop may change randomly and rapidly at unpredictable times. Wireless links will continue to have significantly lower capacity than their hard-wired counterparts. Congestion is typically the norm rather than the exception; i.e., aggregate application demand is likely to exceed network capacity frequently. some or all the nodes in a MANET rely on batteries for their energy. Thus, for these nodes, the most important design criteria may prone to physical security threats than fixed, hard-wired networks.

Application & Challenges

Akin to packet radio networks, ad hoc networks have an important role to play in military applications. Soldiers equipped with multimode mobile communicators can now communicate in an ad hoc manner without the need for fixed wireless base stations. In addition, small vehicular devices equipped with audio sensors and cameras can be deployed at targeted regions to collect important location and environmental information which will be communicated back to a processing node via ad hoc mobile communications. Commercial scenarios for ad hoc wireless networks include:

- Conferences/meetings/lecture
- Emergency services
- Military environment
- Personal Area Networking

People today attend meetings and conferences with their laptops, palmtops, and notebooks. It is therefore attractive to have instant network formation. In addition to file and information sharing without the presence of fixed base stations and systems administrators. Ad hoc mobile communication is particularly useful in relaying information (status, situationawreness, etc.) via data, video, and/or voice from one rescue team member to another over a small handled or wearable wireless device. Current challenges for ad hoc wireless networks include:

- Multicast
- QOS support
- Power aware routing
- Location-aided routing

As mentioned above , multicast is desirable to support multiparty wireless communications. Since the multicast tree is no longer static (i.e., its topology is subject to change over time), the multicast routing protocol must be able to cope with mobility, including multicast membership Dynamics (e.g., leave and join).Another important is the limited factor supply in handled devices, which can seriously prohibit packet forwarding in an ad hoc mobile environment. Hence, routing traffic based on nodes' power metrics is one way to distinguish routes that are more long lived than others. Finally, instead of using beaconing or broadcast search, location-aided routing uses positioning information to define associated regions so that the routing is spatially oriented and limited.

Quality of Service in MANET

Quality of service has been defined by the United Nations Consultative Committee for International Telephony (CCITT) recommendation E.800 as "The collective effect of service performance which determines a degree of satisfaction of a collective effect of service performance which determines a degree of satisfaction of a user of the service". The Quality of service is a rapidly growing area in both wired and mobile Ad hoc network. Many problems exist especially for MANETs [11]. The Quality of service in Mobile Ad hoc Networks depends not only on the available resources but also on the mobility rates of such resources. It means to provide a set of parameters to adapt the applications to the quality of the network while routing them through the network [12]. The Three main constraints related to the quality of service are bandwidth constraints, dynamic

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topology of MANET and the limited processing and storing capacity of mobile nodes. This has led to the development of several routing protocols which emphasizes on the implementation of effective technologies to improve Quality of service thereby significantly increasing the performance [6].

Critical Issues in MANET

An ad hoc network is a dynamic type of network with similarities and great differences to its parent fixed communication network. The properties of an ad hoc network will define its shortcomings and highlight security challenges [17][18][19][20][21][22].An ad hoc networks, is a spontaneous, self created network which cannot rely on a fixed network infrastructure, and by definition does not. A fixed entity structure such as a base station or central administration is crucial for security mechanisms. The trusted third party member who is expected in traditional networks often defines security services; the absence of such a control entity introduces new opportunities for security attacks on the network. The network instead of relying on a central administrator for network and security service, the network relies upon the nodes for these duties in a self-organized manner. Connectivity is a problem in ad hoc networks as networks are created spontaneously and nodes are mobile. Therefore connectivity between the nodes is sporadic. In ad hoc networks nodes may have no prior relationships with other nodes within the network. prior acquaintance between nodes can be seen as pre-trust relationships between nodes. It cannot be assumed that pair wise secrets exist between nodes. Physical vulnerability is a major problem in ad hoc network. Mobile node capture or compromised nodes are of higher probability in ad hoc networks than in traditional wired networks with stationary hosts. Lack of Resources is a problem with a network which has no central administrator to perform network and security tasks, and rather relies upon nodes to accomplish such services. This creates a heavy burden upon nodes to perform their own tasks as well as network tasks therefore nodes will have limited resources compared to fixed wired nodes. Threats or attacks upon the network come from entities known as adversaries, these may include insider and outsider nodes that maliciously attack or threaten the network or the secrecy of the networks content.

Objectives of the Study

The main objective of the study is to compare and analyze the performance of reactive routing protocols in mobile ad hoc network. Keeping this main objective in mind the following objectives are stated

- Study focuses on identification of reactive routing protocols which emphasizes on quality of service in mobile ad hoc networks
- To compare the performance of three reactive routing protocols which focuses on quality of service namely AODV and DSR
- To deduct the reactive routing protocol which is most efficient in enhancing quality of service and which may lead to optimal increase in performance. The remainder of this paper is organized as follows – the next section gives the details about the routing protocols and its classification. In section 3 describes in detail about reactive routing protocols and its various types and follow it with brief specifies of implementation in section 4. Section 5 consists the conclusion of the research work.

Routing protocols in MANET

Routing is the Exchange of information (in this case typical term ‘packets’) from one station of the network to the other. The major goals of routing are to find and maintain routes between nodes in a dynamic topology with possible uni-directional links, using minimum resources. A protocol is a set of standard or rules to exchange data between two devices. Routing protocols are classified into unicast routing protocols, multicast routing protocols and broadcast routing protocols. Unicast forwarding means a one-to-one communication, i.e., one source transmits data packets to a single destination. This is the largest class of routing protocols found in ad hoc networks. Multicast routing protocols come into play when a node needs to send the same message, or stream of data, to multiple destinations. Broadcast is

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the basic mode of operation over a wireless channel; each message transmitted on a wireless channel is generally received by all neighbors located within one-hop from the sender. The simplest implementation of the broadcast operation to all network nodes is by naïve flooding, but this may cause the broadcast storm problem due to redundant re-broadcast. There are several unicast protocols such as proactive, reactive and hybrid routing protocols.

Proactive protocols:

Proactive protocols keep track of routes for all destinations in the ad hoc network are called proactive protocols or Table-driven protocols, the routes can be assumed to exist in the form of tables. The main advantage is that communications with arbitrary destinations experience minimal initial delay from the point of view of the application. The Disadvantages of proactive protocols is that Additional control traffic is needed to continually update stale route entries. Some of the proactive Routing Protocols are:

1. AWDS(Ad hoc Wireless Distribution Service)
2. CGSR (Cluster head Gateway Switch Routing Protocol)
3. DFR (Direction Forward Routing)
4. DBF (Distributed Bellman-Ford Routing Protocol)
5. HSR (Hierarchical State Routing protocol)
6. IZRP (Intra Zone Routing Protocol)

Reactive Protocols:

Reactive Protocols acquire routing information only when it is actually needed. The Advantage is that due to the high uncertainty in the position of the nodes, however, the reactive protocols are much suited and perform better for ad-hoc networks. The Disadvantages of reactive protocols include high latency time in route finding and excessive flooding leading to network clogging. Some of the Reactive Routing Protocols are:

1. Admission Control Enabled On Demand routing (ACOR)
2. Associativity Based Routing (ABR)
3. AODV (Ad hoc on-demand Distance Vector)
4. DSR (Dynamic Source Routing)
5. CHAMP (CacHing And Multipath Routing)
6. LAR1 (Location Aided Routing- Scheme 1)

Hybrid Protocols:

Hybrid routing are protocols in which the routing is initially established with some proactively prospected routes and then serves the demand from additionally activated nodes through reactive flooding Disadvantages of hybrid protocols is that success depends on amount of nodes activated and Reaction to traffic demand depends on gradient of traffic volume. Some of the Hybrid Routing Protocols are:

1. HRPLS (Hybrid routing Protocol for Large Scale Mobile Ad hoc Networks with Mobile Backbone)
2. HSLS (HAZY Sighted Link State Routing Protocol)
3. HWMP (Hybrid Wireless Mesh Protocol)
4. OORP (Order One Routing Protocol)
5. ZRP (Zone routing Protocol)

Reactive Routing Protocols in MANET

Reactive Routing Protocols otherwise known as on demand routing protocols take a lazy approach to routing which differs from proactive routing protocols by identifying and maintaining routes only when needed which results in reduced overhead. Routes are identified and maintained for nodes that require sending data to a known destination, this is typically done by invoking route discovery mechanisms to find path to the destination.[9]

AODV (Ad hoc On-Demand Distance Vector Routing)

AODV is a reactive protocol which is basically a combination of DSR and DSDV algorithms. It uses the advantageous feature of both these algorithm. Dynamic, self-starting and multi-hop routing is

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allowed between participating mobile nodes. The basic on demand routing mechanism of route discovery and route maintenance of DSR and the use of hop by hop routing sequencing number and periodic update packets of DSDV are both available in AODV. It employs destination sequence numbers to identify the most recent path. In AODV, the source node and the intermediate nodes store the next-hop information corresponding to each flow for data packet transmission [5] [8] [13] [14].

Advantages

The main advantage includes its adaptability to highly dynamic networks and reduced overhead. The other advantages include lower setup delay for connections and detection of latest route to the destination.

Disadvantages

It main advantage periodic updates. The distinguishing feature is the use of a destination sequence number for each route entry. If the source number is very old it leads to inconsistent routes. Unnecessary bandwidth consumption occurs in response to periodic beaconing.

DSR (Dynamic Source routing)

DSR is an on demand routing protocol in which a sender determines the exact sequence of nodes through which a packet is propagated. The packet header contains a list of intermediate nodes for routing. Route cache is maintained by each node which caches the source route that it has learned. The major components of DSR are "Route Discovery" and "route Maintenance" which work together for determining and maintaining routes to arbitrary destinations [3]. It is designed to restrict the bandwidth consumed by control packets in ad hoc wireless networks by eliminating the periodic table update messages required in the table-driven approach. A route is established by flooding Route Request packets in the network. [14].

Advantages

A route is established only when it is required. It allows the sender to select and control routes there by reducing load. Other advantages of the DSR protocol include easily guaranteed loop-free routing, support for use in networks containing unidirectional links, use of only "soft state" in routing, and very rapid recovery when routes in the network change.

Disadvantage

The source route has to be included with each packet causing significant overheads. The other disadvantage includes aggressive use of caching and lack of any mechanisms to detect freshness of routes which causes delay and throughput reduction. The route maintenance mechanism does not locally repair a broken link. The connection setup delay is higher than in table-driven protocols.

Experimental Setup

The study has been done to compare the efficiency of two different reactive routing protocols in Mobile Ad hoc Networks. The tool used is NS-2, Throughput, Average End to End Delay and Average Jitter. The simulation using 25, 50 and 100 nodes. The performance of all two routing protocols is carried out and results are compiled.

Results:

Table.1 Metrics Values using 25 Nodes

Protocols	Throughput	Avg. ETED*	Avg. Jitter
AODV	1720	0.18	0.13
DSR	4200	0.0098	0.00263

Table.2 Metrics Values using 50 Nodes

Protocols	Throughput	Avg. ETED*	Avg. Jitter
AODV	**1720**	**0.18**	**0.13**

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DSR	**4200**	0.0098	**0.00263**

Table.3 Metrics Values using 100 Nodes

Protocols	Throughput	Avg. ETED*	Avg. Jitter
AODV	3500	0.062	0.038
DSR	4200	0.0343	0.0092

*Avg. ETED- Average End to End Delay;

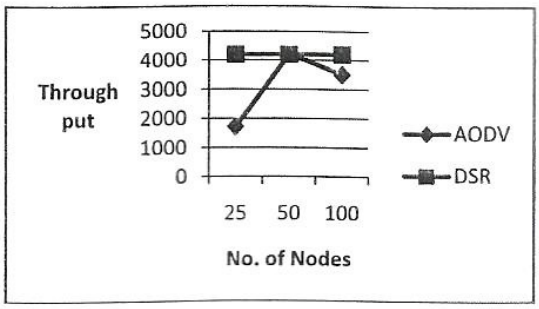

Fig.1 Comparative Chart for the Metric-Throughput

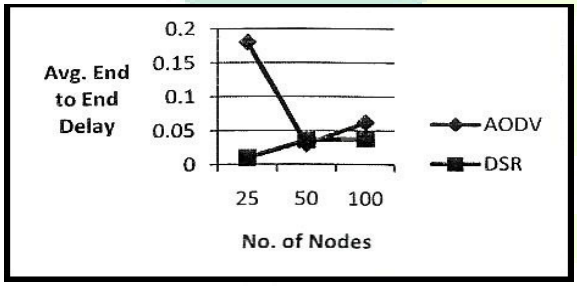

Fig.2 Comparative Chart for the Metric-Average End to End Delay

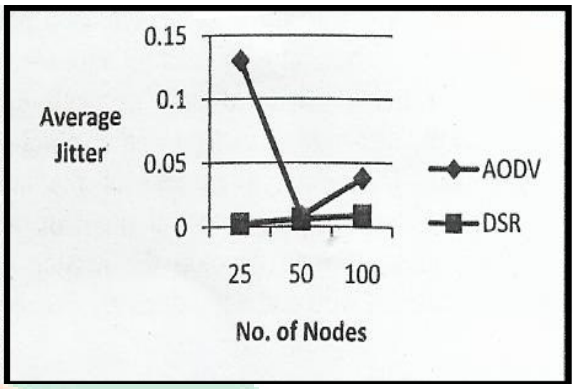

Fig.3 Comparative Chart for the Metric-Average Jitter

Conclusion:

In the recent time there has been a lot of interest in the field of wireless networks. The fast moving world demands seamless communication facilities, so former types of connectively like wired networks, radio waves are fast becoming obsolete. One of the recent developments in the world of wireless technology is the use of mobile ad hoc networks which was initially developed for military applications but now has expanded to include many commercial applications. The rapid use of MANET has resulted in the identification of several problems. MANET protocols did not focus on the quality of service but the recent applications like multimedia has impressed the importance of quality of service in MANET and this has become the area of potential interest. The study has been done by comparing two reactive routing protocols AODV and DSR. The parameters studied include average jitter, average end to end delay and throughput. The result were analyzed using simulation method and NS-2 Simulator was used for the analysis The two routing protocols, all result in improvements of the various parameters such as average jitter, average throughput and average end-to-end delay but these improvements are greater in DSR than in the AODV, therefore it can be concluded that DSR is the best routing protocols.

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