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Protocol Comparison Using Omni Directional Antenna with Shared Media Access in MANET

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Abstract. The field of Mobile Ad hoc Networks (MANETs) has gained an important part of the interest of researchers and become very popular in last few years. MANETs can operate without fixed infrastructure and can survive rapid changes in the network topology. Ad Hoc wireless networks have their own unique nature of distributed resources, dynamic topology and mobile device has routing capability. In the recent year variety of existing routing protocol have been tested and compare in various research paper.
In a previous comparative performance study between omnidirectional and directional antennas for DSR (on-demand routing protocol) using simulation with OPNET, by using directional antennas, substantial gain is achieved in terms of end-to- end delay, aggregate throughput average, average data packets dropped, packet delivery ratio, and routing overhead[12].
In this paper we analysis the DSDV, DSR and AODV routing protocol on the basis of shared media interface with Omni-directional antenna. by using the shared media interface we substantial gain is achieved in terms of TCP,UDP packet comparison, end to end delay , throughput, routing packets , packet delivery ratio. We use ns-2 simulator for simulation. In our simulation we generate the similar test traffic and node mobility pattern for all routing protocol.

Keywords: Destination sequence distance vector, Dynamic source routing, Adhoc on-demand distance vector, Omni directional Antenna, Direct sequence spread spectrum

1 Introduction

Ad hoc network [1] is a dynamically reconfigurable wireless network with no fixed infrastructure, whose terminal act as a router and move in an arbitrary manner, the non adjacent nodes correspond with the help of other nodes. By reason of the arbitrary mobility of every node, so the topological structure of network is changeable from time to time and routes are subject to frequent disconnections. Ad hoc network have following characteristics [2]:

- The capability of networking independently
- Acentric distribution of nodes
- Limited wireless bandwidth
- constantly changeable route
- mobility of nodes
- Dynamic topology
- Limited physical security
- Energy constrained operation

So the traditional distance vector protocol and like state routing protocol are not suitable to apply in the ad-hoc network. In order to realize reliable communication in the dynamic environment. It is of the essential to research dynamic routing protocol.

Therefore the routing protocols used in ordinary wired networks are not well suited for this kind of dynamic environment. Routing algorithms are often difficult to be formalized into mathematics they are instead tested using extensive simulation. Recently more attention has been paid to use specific network parameters when specifying routing metrics. Examples might include delay of the network, link capacity, link stability or identifying low mobility nodes. These schemes are generally based on previous work, which is then enhanced with the new metrics

Wireless networking is an emerging technology that allows users to access information and services electronically, regardless of their geographic position. Wireless networks can be infrastructure networks [5] or infrastructure less (Ad-hoc) networks. An Ad-hoc network [6] is a collection of mobile nodes which forms a temporary network without the aid of centralized administration or standard support devices regularly available in conventional networks. These nodes generally have a limited transmission range and, so, each node seeks the assistance of its neighboring nodes in forwarding packets and hence the nodes in an ad-hoc network can act as both routers and hosts, thus a node may forward packets between other nodes as well as run user applications.

2 Paper Outline

This paper is organized in to 9 sections. Section 1 cover general introduction about ad-hoc network we discussed different issues related to Ad hoc network. Section 3 gives the detail of MANET. In this section we discuss various Mobile ad hoc routing protocol, this section show the classification of routing protocol. Section 4 gives the detail description of DSDV, AODV, DSR routing protocol. Section gives outline of different radio propagation model. Section 6 gives the Shared media access techniques. Section 7 discusses the implementation methodology used. We give here description of network simulator used, our implementation parameters. Section 8 talk about performance matrices. Section 9 show different result and performance analysis. At last we discussed conclusion and future work

3 Mobile Ad-Hoc Network

MANET Stands for "Mobile Ad Hoc Network." A MANET is a type of ad hoc network that can change locations and configure itself on the fly. Because MANETS are mobile, they use wireless connections to connect to various networks. This can be a standard Wi-Fi connection, or another medium, such as a cellular or satellite transmission. Some MANETs are restricted to a local area of wireless devices (such as a group of laptop computers), while others may be connected to the Internet.

3.1 MANET Routing Protocol

MANET Routing Protocols are typically subdivided into two main categories: proactive routing protocols and reactive routing protocols [6].

Proactive routing protocol" is the constant maintaining of a route by each node to all other network nodes. The route creation and maintenance are performed through both periodic and event-driven messages. The various proactive protocols are Destination-Sequenced Distance-Vector (DSDV), Optimized Link State Routing (OLSR), and Topology Dissemination Based on Reverse Path Forwarding (TBRPF). The main advantage of proactive routing is when a source needs to send packets to a destination, the route is already available, i.e., there is no latency. The disadvantages of proactive routing are some routes may never be used and dissemination of routing information will consume a lot of the scarce wireless network bandwidth when the link state and network topology change fast. (This is especially true in a wireless Ad-hoc network.)

With Reactive Routing [12], it reduce overhead, the route between two nodes is discovered only when it is needed. There are different types of reactive routing protocols such as Dynamic Source Routing (DSR), Ad Hoc On-Demand Distance Vector (AODV), Temporally Ordered Routing Algorithm (TORA), Associativity-Based Routing (ABR), and Signal Stability Routing (SSR).This implies that a route is built only when required. The main advantage of Reactive routing is that the precious bandwidth of wireless Ad-

hoc networks is greatly saved. The main disadvantage of Reactive routing is if the topology of networks changes rapidly, a lot of update packets will be generated and disseminated over the network which will use a lot of precious bandwidth, and furthermore, may cause too much fluctuation of routes.

4 Routing Protocols

In this paper we study those protocols we used in our paper for evaluation. This protocol is DSDV, DSR, and AODV.

4.1 Destination Sequacne Distance Vector –DSDV

DSDV [8] is a proactive unicast mobile ad hoc network routing protocol. Like WRP, DSDV is also based on the traditional Bellman-Ford algorithm. However, its mechanisms to improve routing performance in mobile ad hoc networks are quite different. In routing tables of DSDV, an entry stores the next hop toward a destination, the cost metric for the routing path to the destination, and a destination sequence number that is created by the destination. Sequence numbers are used in DSDV to distinguish stale routes from fresh ones and avoid the formation of route loops. The route updates of DSDV can be either time driven or event driven. Every node periodically transmits updates, including its routing information, to its immediate neighbors. To guarantee loop-freedom, DSDV uses a concept of sequence numbers to indicate the freshness of a route. A route T is considered more favourable than T' if T has a greater sequence number or, if the routes have the same sequence number, T has lower hop-count.

4.2 Dynamic Source Routing –DSR

The DSR Protocol [6, 8] is a simple and efficient routing protocol designed specifically for use in multi hop wireless ad hoc networks of mobile nodes. Using DSR, the network is completely self-organizing and self-configuring, requiring no existing network infrastructure or administration. Network nodes (computers) cooperate to forward packets for each other to allow communication over multiple “hops” between nodes not directly within wireless transmission range of one another. As nodes in the network move about or join or leave the network, and as wireless transmission conditions such as sources of interference change, all routing is automatically determined and maintained by the DSR Routing Protocol. In DSR, Headers of data packets carry the sequence of nodes through which the packet must pass. This means that intermediate nodes only need to keep track of their immediate neighbours in order to forward data packets. The source, on the other hand, needs to know the complete hop sequence to the destination.

4.3 AD HOC On Demand Distance Vector-AODV

The Ad hoc On-Demand Distance Vector (AODV) [11] routing protocol is intended for use by mobile nodes in an ad hoc network. It offers quick adaptation to dynamic link conditions, low processing and memory overhead, low network utilization, and determines unicast routes to destinations within the ad hoc network. It uses destination sequence numbers to ensure loop freedom at all times (even in the face of anomalous delivery of routing control messages), Avoiding problems (such as "counting to infinity") associated with classical distance vector protocols. AODV is an ‘on demand routing protocol’ with small delay. That means that routes are only established when needed to reduce traffic overhead. AODV supports Unicast, Broadcast and Multicast without any further protocols. The Count-To-Infinity and loop problem is solved with sequence numbers and the registration of the costs. In AODV every hop has the constant cost of one. The routes age very quickly in order to accommodate the movement of the mobile nodes. Link breakages can locally be repaired very efficiently. To characterize the AODV with the five criteria used by AODV is distributed, hop-by-hop, deterministic, single path and state dependent.

5 Propagation Model Used

Radio propagation model is the key factor to determine which nodes can communicate. It also influences frame collisions and errors in a simulation. Obviously to get realistic simulation results, it is essential to use a realistic radio propagation model.[7] proposed following propagation model for Mobile Ad- Hoc network.

- Two ray Ground propagation model
- Log distance path propagation model

- Intelligent Ray Tracing Model

In order to simulate our project we used two ray ground propagation models. This model is proposed by FRIIS [11]. the two ray ground model is optimistic for the short transmitter-receiver separation distances. Hence, in most applications, the two ray ground propagation model is used.

6 Shared Media Access

Various mobile nodes share the common channel or medium for transmission and reception with different frequency band it is called shared channel or media access .various type of media access is available like, SDMA, FDMA, TDMA, CDMA, DSSS. In this paper we simulate with the DSSS media access technique. Different SS techniques are available, but all have one idea in common: the key (also called code or sequence) attached to the communication channel.

6.1 Direct Sequacne Spread Spreactum

In this technique, the PRN is applied directly to data entering the carrier modulator. The modulator therefore sees a much larger bit rate, which corresponds to the chip rate of the PRN sequence. The result of modulating an RF carrier with such a code sequence is to produce a direct-sequence-modulated spread spectrum with ((sin x)/x) frequency spectrum, centered at the carrier frequency. DSSS [10] phase-modulates a sine wave pseudo randomly with a continuous string of pseudo noise (PN) code symbols called chips, each of which has a much shorter duration than an information bit. That is, each information bit is modulated by a sequence of much faster chips. Therefore, the chip rate is much higher than the information signal bit rate. Direct-sequence spread-spectrum transmissions multiply the data being transmitted by a "noise" signal. This noise signal is a pseudorandom sequence of 1 and −1 values, at a frequency much higher than that of the original signal, thereby spreading the energy of the original signal into a much wider band.

7 Methodlogy Used

7.2 Network Simulator

We did our simulation on the NS 2.31 [9] Network simulator which discrete event driven simulator developed by UC Berkeley [9]. The goal of NS2 is to support research and education in networking. It is suitable for designing new protocols, comparing different protocols and traffic evaluations. NS2 is developed as a collaborative environment. It is distributed as open source software.

7.1 Simulation Methodlogy

In our simulation we generate test traffic of constant bit rate (CBR) over UDP and FTP packets over TCP. We Create 30 mobile nodes with 12 FTP connections and 4 CBR connections with 1000 bytes/sec of traffic load. Our protocol evaluations are based on the simulation of 30 wireless mobile nodes forming an ad hoc network, moving about over a rectangle (800m x 600m) flat space for 100 seconds of simulation time. The physical radio characteristics of each mobile node's network interface, such as the antenna gain, transmit power, and receiver sensitivity, were chosen to approximate the Lucent WaveLAN direct sequence spread spectrum radio. We used the following table 1.1 shows simulation parameter to simulate our project [11].

Table 1.1 simulation parameter

Parameter	value	Parameter	value
Number of nodes	30	Packet Size	1000 Bytes
Simulation Time	100sec	Max Connections	10,20
Max Speed	30 m/s	Band Width	10Bbps
Area	800*600m	Mobility model	Random way point
Traffic Source	CBR	Antenna height	1.5 mt

Pause Time (sec)	0,10,20,30,40,.....,100		

8 Performance Matrices

In order to evaluate the performances of three MANET protocols, several metrics need to consider. These metrics reflect how efficiently the data is delivered. In epidemic routing, multiple copies may be delivered to the destination. According to the literatures, some of these metrics are suggested by the MANET working group for routing protocol evaluation [11, 12, 16].

I. ***Packet Delivery Ratio:*** The ratio between the number of packets originated by the application layer CBR sources and the number of packets received by the CBR sink at the final destination.

II. ***Average End-to-end Delay:*** This includes all the possible delays caused by buffering during route discovery latency, queuing at the interface queue, retransmission delays at the MAC, and propagation and transfer times.

III. ***Packet Dropped:*** The routers might fail to deliver or drop some packets or data if they arrive when their buffer are already full. Some none, or all the packets or data might be dropped, depending on the state of the network, and it is impossible to determine what will happen in advance.

IV. ***Routing Load:*** The total number of routing packets transmitted during the simulation. For packets sent over multiple hops, each transmission of the packet or each hop counts as one transmission.

V. ***Throughput:*** The total successfully received packet to the destination. In the other words, the aggregate throughput is the sum of the data rates that are delivered to all nodes in a network

9 Performance and Results

Simulation result are shown in the form of various graph shown below.fig 1 show the total packet received ,transmit , loss for AODV protocol in CBR mode.fig 2 show UDP packet transmission ,received, loss for DSR.fig 3 shows the same result for DSDV protocol.fig 4 show comparative performance of DSDV,DSR,AODV protocol for TCP packet.fig 5 show the routing load comparison for three protocol. Throughput comparison is shown in figure 6 and last fig 7 shows the packet delivery ratio for respective protocols.

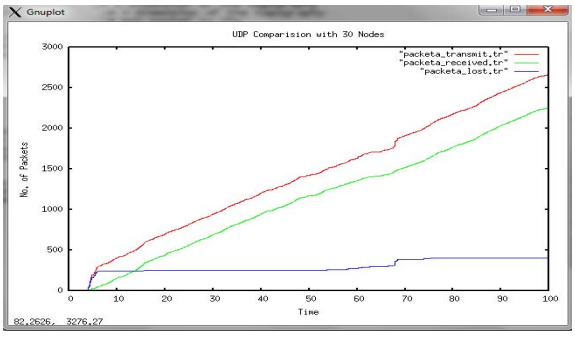

Figure 1: AODV Case

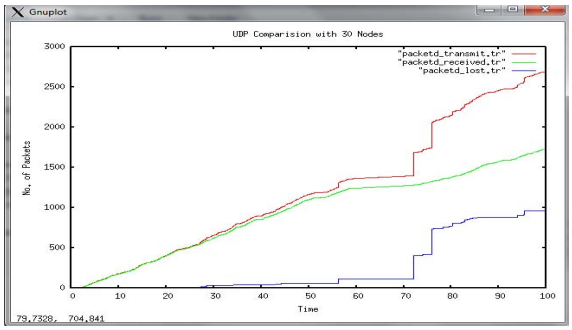

Figure 2: DSR Case

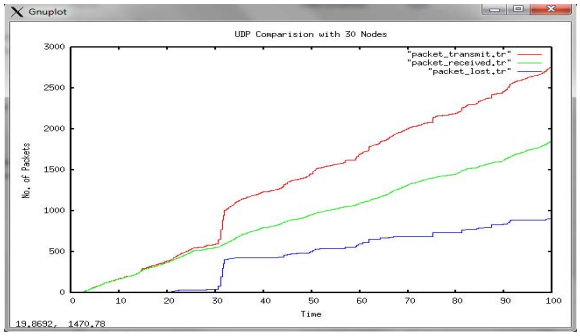

Figure 3: DSDV Case

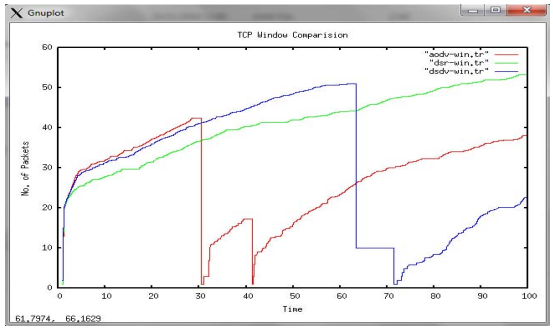

Figure 4: TCP Window

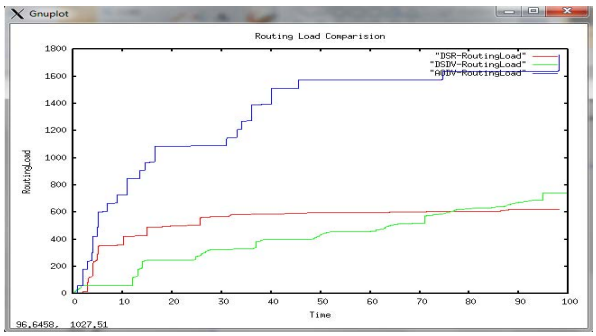

Figure 5: Routing Load comparison

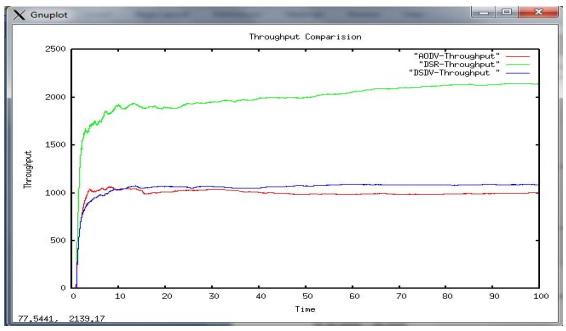

Figure 6: Throughput Comparison

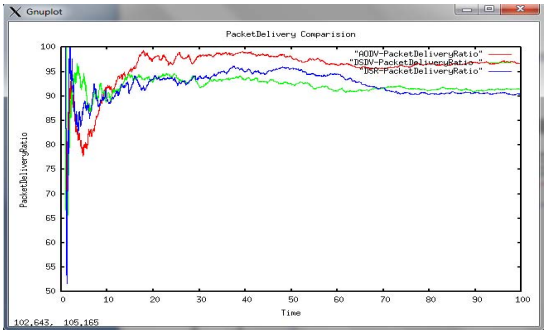

Figure 7: Packet Delivery Ratio

10 Conclusion

In our simulation we test DSDV,AODV,DSR protocol using ns-2 simulator , we used DSSS as shard media access techniques for transmission and we get result that on the basis of packet delivery ratio, end to end delay , no of packet drop , AODV give significantly good performance over other protocol ,but on the basis of routing overhead, throughput our simulation find DSR protocol good over there one.

11 Future Work

We can extent this work doing with more parameter that may give more in depth knowledge and analysis of protocols. This protocol can be tested in existing protocol for heavy traffic like MPED-4 video streaming. It is very useful to test this protocol in heavy traffic. In future work we can modified this work for 3-d space. Substantial modification is required in existing NS-2 framework.

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