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ANALYSIS OF ROUTING PROTOCOLS IN MANETS

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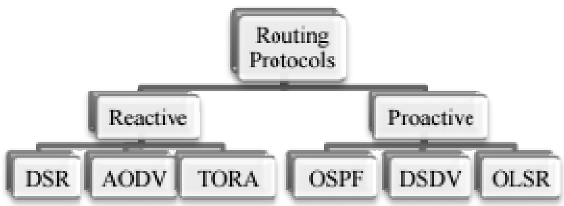
Abstract: The study of routing protocols in MANETs is one that requires a great deal of research due to the challenges it poses as a consequence of continuous mobility and lack of infrastructure. Several factors such as throughput, packet delivery ratio, end to end delay. Basically, the routing protocols of MANETs can be categorized as proactive and reactive. In this paper, our main focus has been to select a category of protocol out of two. Implemented and analysed the best protocols of these categories and compared the results, using NS2. The protocols that we have selected are OLSR and AODV from proactive and reactive categories respectively, based on their relative advantages and disadvantages in comparison to the other protocols of their category.

Keywords: MANET, NS2.

I. INTRODUCTION

Mobile Ad-hoc Network (MANET) is a collection of wireless mobile nodes and connected in dynamic manner. Nodes forming a temporary/short-lived network without any fixed infrastructure where all nodes are free to move about arbitrarily. Nodes must behave as routers, take part in discovery and maintenance of routes to other nodes in the network.[1] Wireless links in MANET are highly error prone and can go down frequently due to mobility of nodes. Stable routing is a very critical task due to highly dynamic environment in Mobile Ad-hoc Network[2].

II. ROUTING CATEGORIES



Since the advent of Defense Advanced Research Projects Agency (DARPA) packet radio networks in the early 1970s, numerous protocols have been developed for ad hoc mobile networks. Such protocols must deal with the typical limitations of these networks, which include high power consumption, low bandwidth, and high error rates [2].

Routing as such involves two basic steps. Firstly, finding the most appropriate path between the source and destination via certain intermediate nodes and secondly, the transfer of data packets using this path. Depending on the manner in which these two steps are contemplated, as mention earlier, routing has been classified as

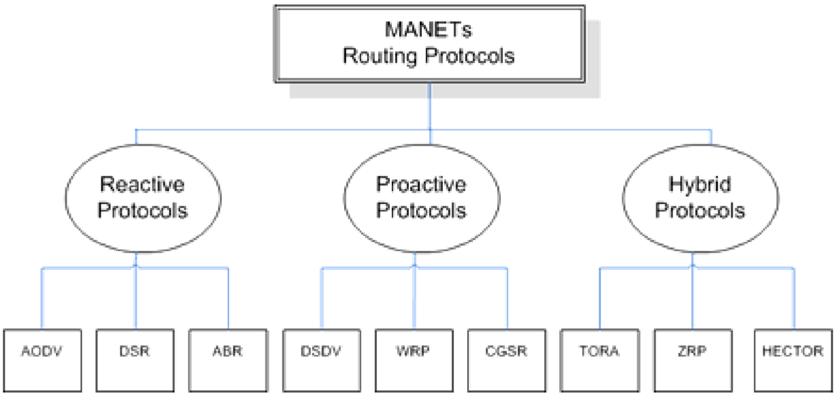
A. Proactive routing

In proactive routing fresh lists of destinations and their routes are maintained by periodically distributing routing tables throughout the network [3]. Here routing information is computed and shared and the path is set prior to the actual transfer of data packets between the source and destination.

B. Reactive routing

In reactive routing routes are found on demand by flooding the network with route request packets. Here the source initiates the data transfer process by issuing a route request, the most relevant immediate neighbor issues a route reply to this request and takes forward the data transfer process. This happens till the destination is reached and the data packet received [3].

III. ROUTING PROTOCOLS OF MANET



A routing protocol is a set of rules guiding how routers communicate with each other. As mentioned earlier our work includes the thorough study of two protocols

IV. SIMULATION SETUP

The protocols to be implemented and analyzed and the tools to be used for this implementation and analysis have been selected by a thorough study of the reference papers mentioned in the later portions of this text. We have discussed pervasively about the protocols and now we will be discussing the tools in the same way.

We begin with simulation for which we use the second version of Network Simulator (NS2) [4]. The simulation process involves the creation of a Tool Command Language (TCL) [6] file that makes a setup of the scenario, meaning to say it specifies in it the required features of the network such as number of nodes, kind of agents working on the nodes and so on. After creating such a file, it needs to be run. This marks the generation of the desired network. NS2 is an open source software and extremely user friendly and so the most appropriate tool in our context.

Simulation is followed by a display of the working of the network with the protocols. This is done by using Network Animator (NAM). NAM is a TCL/TK based animation tool for viewing network simulation traces and real world packet traces. It supports topology layout, packet level animation and various other data inspection tools.

Finally for analysis we need to run some AWK (Aho Weinberger Kernighan – family names of its authors) scripts that lead to xgraphs. The AWK utility is a data extraction and reporting tool that uses a data-driven scripting language consisting of a set of actions to be taken against textual data (either in files or data streams) for the purpose of producing formatted reports. The language used by awk extensively uses the string data type, associative arrays (that is, arrays indexed by key strings), and regular expressions. The xgraphs so produced for the performance parameters for the two protocols are compared and conclusions are made.

These simulations are using AODV, OLSR that will be tested on Random Waypoint Mobility Model scheme. The simulation periods for each scenario are conduct in 10 seconds and the simulated mobility network area is 800 m x 800 m rectangle with 250m transmission range.

Bound Type	**Bound Value**
Protocols	AODV ,OLSR

Simulation Time	10s
Network Load	4 Packets / sec
Environment Size	800m x 800 m
Traffic Type	Continuous Bit Rate
Number of Nodes	50
Maximum Speed	10 m / s
Network Simulator	NS 2

Table 1: Simulation Setup

V. PERFORMANCE METRICS

The conclusions have been made by taking into consideration the following performance parameters [7].

A. *End-To-End Delay (Delay)*

It refers to the time taken for a packet to be transmitted across a network from source to destination.

$$\text{Delay} = \frac{\sum i\,[\text{time when packet(i)received} - \text{time when packet(i)sent}]}{\sum i\,\text{count packet(i)}}$$

B. *Throughput (t)*

It is the average rate of successful message delivery over a communication channel. This data may be delivered over a physical or logical link, or pass through a certain network node. The throughput is usually measured in bits per second (bit/s or bps), and sometimes in data packets per second or data packets per time slot. The system throughput or aggregate throughput is the sum of the data rates that are delivered to all terminals in a network.

$$t = \frac{\sum i\ \text{Size of Packet(i) received}}{\text{simulation time}}$$

C. *Packet Delivery Ratio (PDR)*

It is the ratio of the number of delivered packets to the destinations by the total number of packets actually sent.

$$\text{PDR} = \frac{\sum i\,\text{packet(i)received}}{\sum i\,\text{packet(i)sent}}$$

The greater the value of the packet delivery ratio, the better is the performance of the protocol.

D. *Overhead (v)*

The additional costs incurred during the data packet delivery process.

$$V = \frac{\sum i\ \text{Data packet (i)received}}{\sum i\ \text{Routing packet(i)sent}}$$

VI. PERFORMANCE EVALUATION

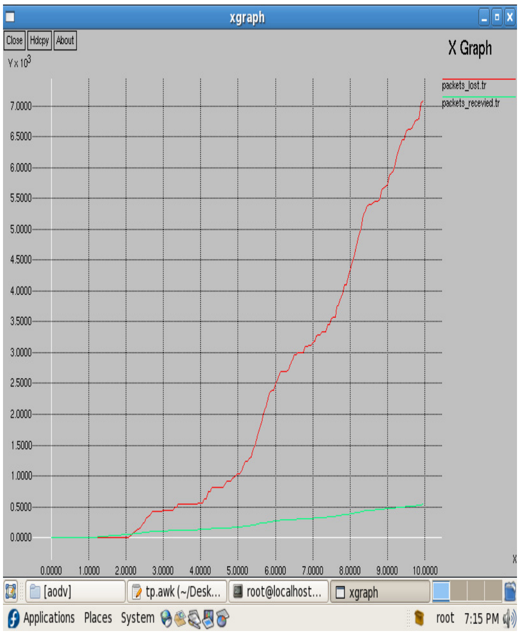


Fig 1: AODV graph comparing packets lost and packets received

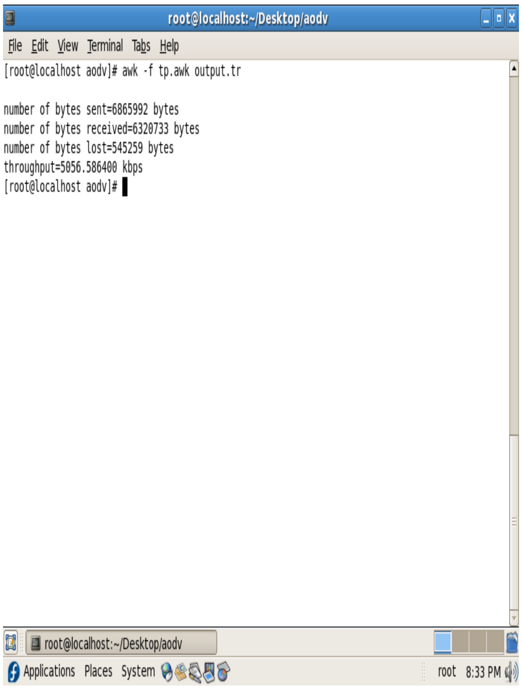


Fig 2: Throughput output of AODV

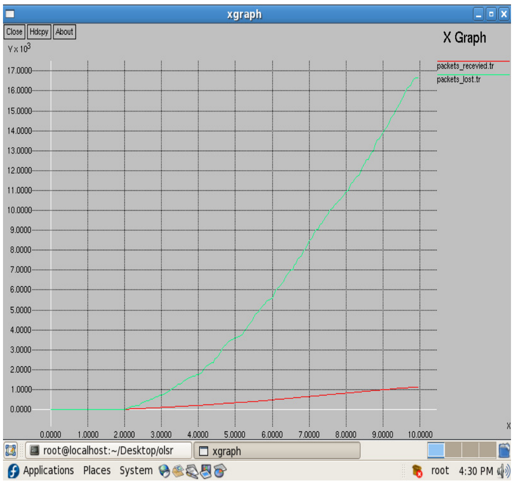


Fig 3: OLSR graph comparing packets lost and packets received

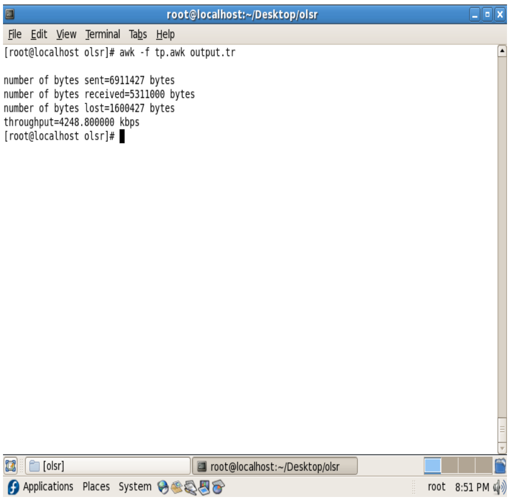


Fig 4: Throughput output of OLSR

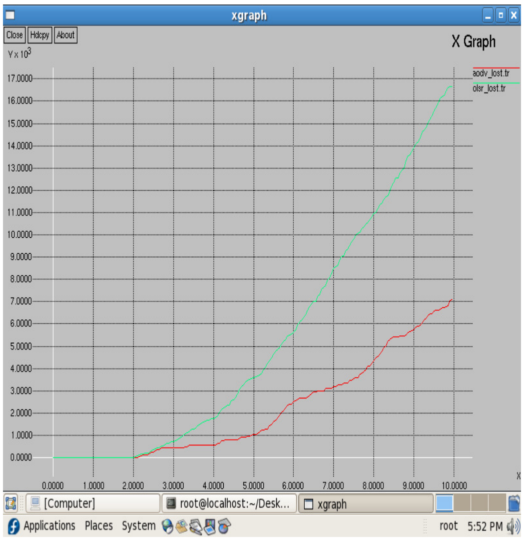


Fig 5: Comparing lost packets of AODV and OLSR

VII. RESULT

From the given xgraphs the performance parameters computed are as recorded in the table that follows:

	OLSR	AODV
throughput	120packets/sec	60packets/sec
End to end delay	10ms	9ms
Packet delivery ratio	0.067	0.075
Overhead	1.83	22.26

Table 2: Comparisons between OLSR and AODV.

VIII. CONCLUSION

Therefore, the overall performance of OLSR is better than that of AODV which indicates proactive routing protocols are more preferable than reactive routing protocols. (Yet, according to traffic patterns this may vary). And also overhead of OLSR is less compared to AODV.

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