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STUDY AND IMPLEMENTATION OF AD-HOC ROUTING PROTOCOLS

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I. ABSTRACT

Ad-hoc networks are characterized by a lack of infrastructure, and by a random and quickly changing network topology; thus the need for a robust dynamic routing protocol that can accommodate such an environment. Consequently, many routing algorithms have come in to existence to satisfy the needs of communications in such networks. This project work presents a performance comparison between two categories of routing protocols, table-driven (Proactive) and on-demand (Reactive) routing protocols, this two categories were illustrated by using two different examples of routing protocols, first example is DSDV (Destination Sequenced Distance-Vector) from the Proactive family and the second example is AODV (Ad Hoc On-Demand Distance Vector) from the Reactive family. Both protocols were simulated by using NS-2 (network simulator-2) package. Both routing protocols were compared in terms of average throughput (packets delivery ratio) and packet loss ratio, while varying number of nodes and by using the Trace file. Although DSDV perfectly scales to small networks with low node speeds, AODV is preferred due to its more efficient use of bandwidth.

I. INTRODUCTION

Mobile Ad Hoc Network (MANET) is a collection of communication devices or nodes that wish to communicate without any fixed infrastructure and predetermined organization of available links. The nodes in MANET themselves are responsible for dynamically discovering other nodes to communicate. It is a self configuring network of mobile nodes connected by wireless links the union of which forms an arbitrary topology[1]. The nodes are free to move randomly and organize themselves arbitrarily; thus, the network's wireless topology may change rapidly and unpredictably. MANETs are usually set up in situations of emergency for temporary operations or simply if there are no resources to set up elaborate networks. These types of networks operate in the absence of any fixed infrastructure, which makes them easy to deploy, at the same time however, due to the absence of any fixed infrastructure, it becomes difficult to make use of the existing routing techniques for network services, and this poses a number of challenges in ensuring the security of the communication, something that is not easily done as many of the demands of network security conflict with the demands of mobile networks, mainly due to the nature of the mobile devices (e.g. low power consumption, low processing load). [2]

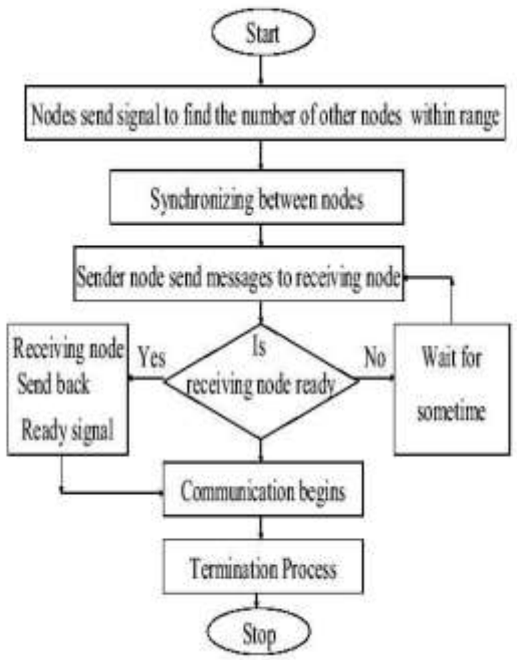

Figure 1: working of a general ad-hoc network

Ad-Hoc Routing Protocols

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A routing protocol is needed to send data from one device to another. Whenever the packet is to travel to its destination via several intermediate nodes, routing protocol is needed. This chapter aims to review strategies widely used in routing protocols. [3]Several well known routing protocols are discussed and analyzed. These routing protocols may generally be categorized as:

• Table-driven (Proactive) Routing Protocol

• On-Demand (Reactive) Routing Protocol

• Hybrid Routing Protocol

Despite being designed for the same type of underlying network, the characteristics of each of these protocols are quite distinct. In the Hybrid Routing Protocol**,** each node maintains the network topology information up to m hops, based on routing [4] information update mechanism. The following sections describe the protocols and categorize them according to their characteristics.

Ad-hoc On-Demand Distance Vector (AODV) Routing Protocol

The Ad-hoc On-Demand Distance Vector (AODV) routing protocol builds on the DSDV algorithm previously described. AODV is an improvement on DSDV because it typically minimizes the number of required broadcasts by creating routes on a demand basis, as opposed to maintaining a complete list of routes as in the DSDV algorithm. The authors of AODV classify it as a pure on-demand route acquisition system, since nodes that are not on a selected path do not maintain routing information or participate in routing table exchanges.[8] When a source node desires to send a message to some destination node and does not already have a valid route to that destination, it initiates a path discovery process to locate the other node.

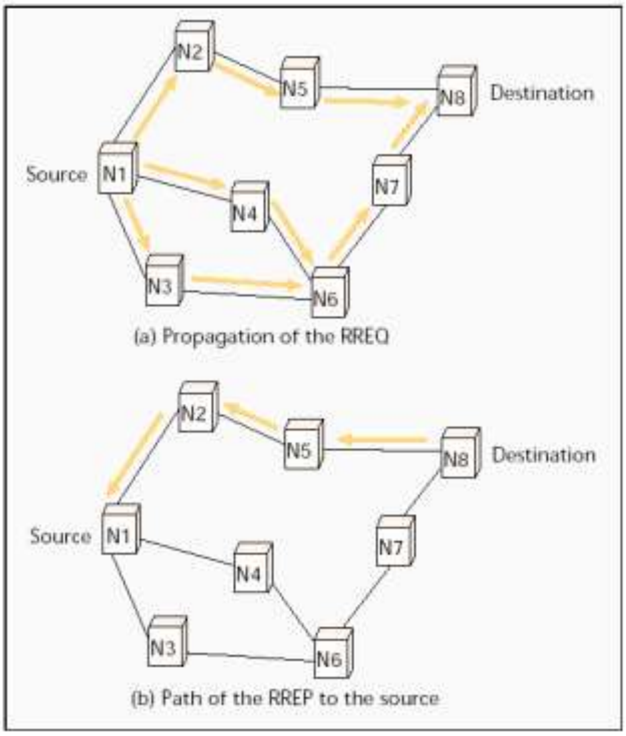

Figure 2: AODV route discoveries

Network Simulator (NS-2)

Network simulator 2 (NS-2) is an open source discrete event simulation tool used for simulating Internet protocol (IP) networks. It was developed by UC Berkeley and widely used worldwide for network simulation purposes. The NS-2 software uses TCL as a front-end interpreter and C++ as the back end network simulation engine. Network simulation scripts in TCL are used to create the network scenarios and upon the completion of the simulation, trace files that capture events occurring in the network are produced.[9] The trace files would capture information that could be used in performance study, e.g. the amount of packets

transferred from source to destination, the delay in packets, packet loss etc. However, the trace file is just a block of ASCII data in a file and quite cumbersome to access using some form of post processing technique. In order to ease the process of extracting data for performance study, the NS-2 Trace Analyzer is proposed. This software is a tool for extracting and presenting trace files for the network simulation environment of NS-2. The NS-2 Trace Analyzer software consists of three layers. The first layer is the source layer which consists of the trace file data. The second layer is the processing layer. This layer processes the data obtain from the source and convert it to meaningful format for the third layer. [10]The third layer is the presentation layer. This layer presents meaningful data in the form of graph, table and report for network performance study, i.e. throughput, end-to-end delay, packet loss.

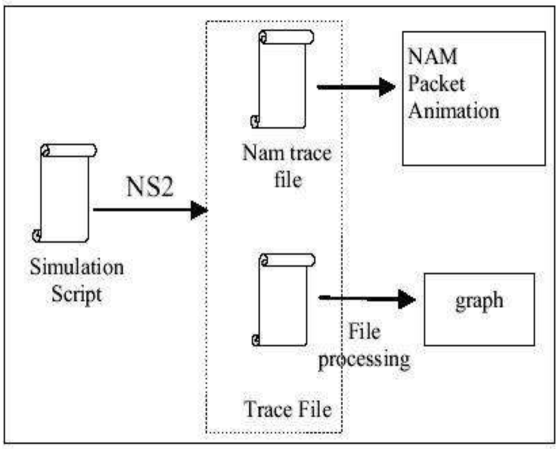

Figure 3: Ns-2 Simulation Process Flow

Simulation Scenario for DSDV Routing Protocol

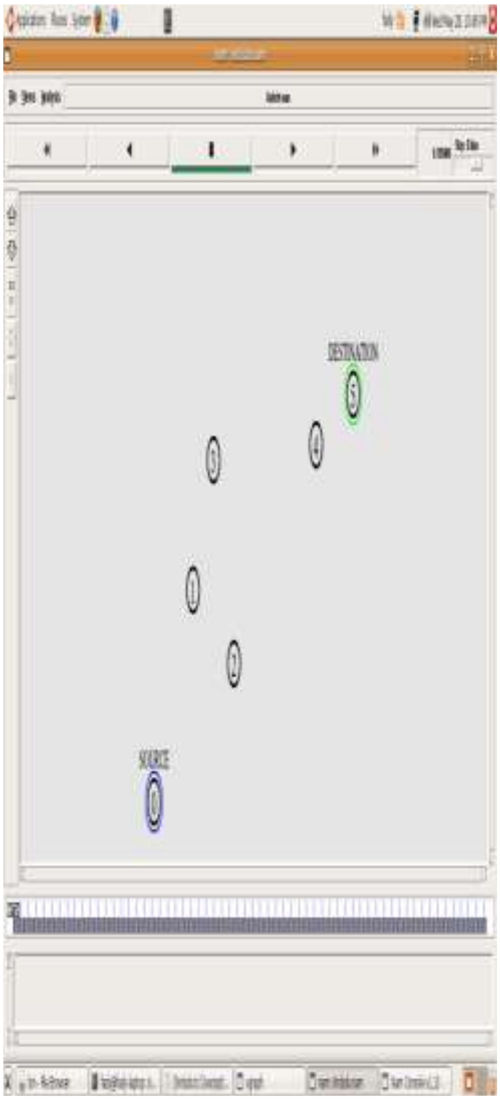

Figure 4: topology of a six nodes ad-hoc Network

Analysis of Simulation Results

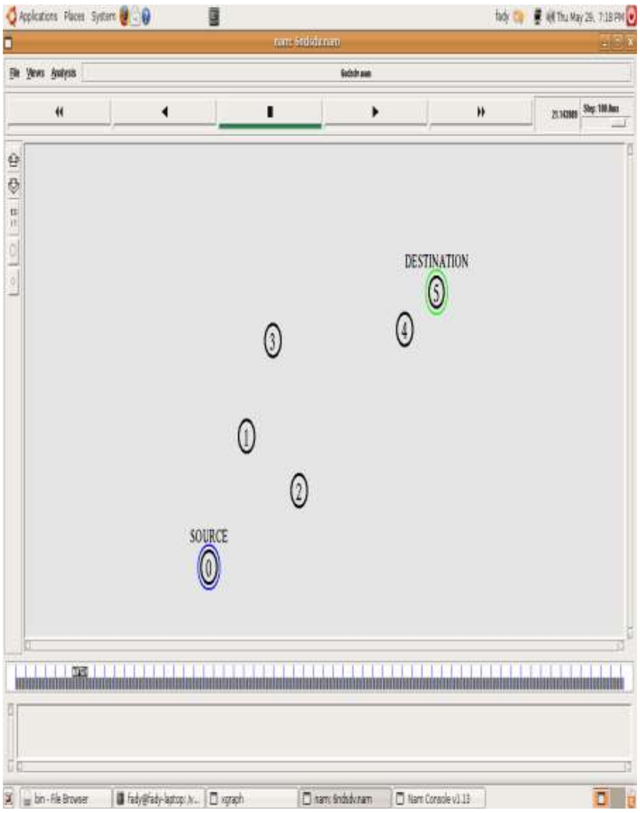

Figure 5. phase- 1 for DSDV routing protocol

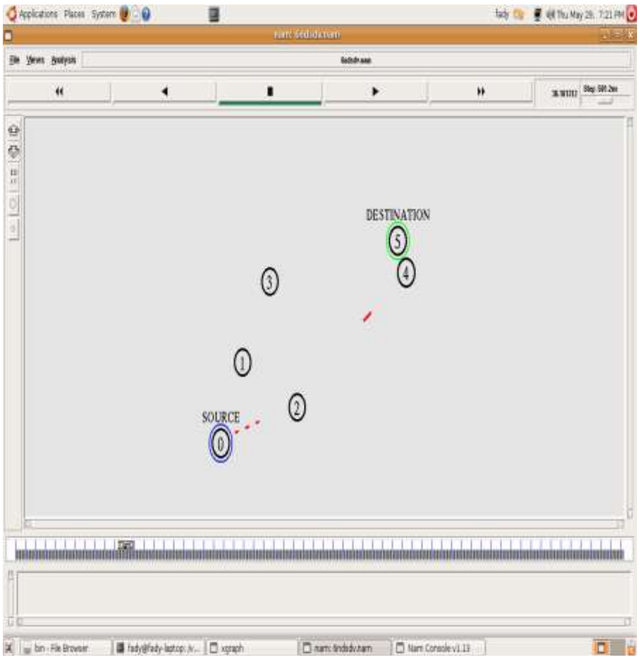

Figure 7: TCP window size in a six node scenario with DSDV routing protocol

Conclusion

We have compared the performance of DSDV (Destination Sequenced Distance-Vector) from the Proactive family with the second type is AODV (Adhoc On-Demand Distance Vector) from the Reactive family. We used a detailed simulation model to demonstrate the performance characteristics of these protocols. By simulating we can argue that if delay is our main criteria than DSDV can be our best choice but if reliability and throughput are our main parameters for selection then AODV gives better results compare to others because its throughput and packet delivery ratio is best among others. While there are many other issues that need to be considered in analyzing the performance of ad-hoc networks, we believe that our work could provide intuition for future protocol selection and analysis in ad-hoc networks. While we focus only on the network throughput, reliability and the delay, it would be interesting to consider other metrics like power consumption, the number of hops to route the packet, fault tolerance, minimizing the number of control packets etc.

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