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Implementation of DSR on Manet using NS2

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Abstract - *This paper presents a new Ad hoc Dynamic Source Routing (DSR) protocol based on mobility prediction, named as MDSR. Dynamic Source Routing protocol (DSR) has been accepted itself as one of the distinguished and dominant routing protocols for Mobile Ad Hoc Networks (MANETs). From various performance analysis and results, it is shown that DSR has been an outstanding routing protocol that outperforms consistently than any other routing protocol. The algorithm controls route discovery, route keeping and route switching according to the distance and mobility estimation of the neighbor nodes. We have implemented this protocol using a NS2.*

Key Words: **DSR, MANET, Wireless Route, NS2, C++.**

1. INTRODUCTION

MANET provides a possibility of creating a network in situations where creating the infrastructure would be impossible or prohibitively expensive. Unlike a network with fixed infrastructure, mobile nodes in ad hoc networks do not communicate through the fixed structures. Each mobile node acts as a host when requesting/providing information from/to other nodes in the network, and acts as router when discovering and maintaining routes for other nodes in the network. The routing protocols for adhoc networks are Proactive routing protocol and Reactive routing protocol. The proactive routing protocols are Table driven. A routing table is maintained by each node in the network. The table contains the routing entries for all the possible nodes in the MANET. The reactive routing protocols are on demand routing protocols. The routes are propagated only on demand. Dynamic Source Routing (DSR) and AODV are on demand routing protocols. DSDV is a table driven routing protocol. These are the commonly used protocols in MANETs.

To find a route between the end-points is a major problem in mobile multi hop ad-hoc networks. The problem is further aggravated because of the nodes mobility. Many different approaches are reported to handle this problem in recent years, but it is very difficult to decide which one is best routing algorithm. It is also reported in the performance analysis of different routing protocols in literature. Other aspects of ad-hoc networks are also subject to current research, especially the dynamic changing network topology of nodes.

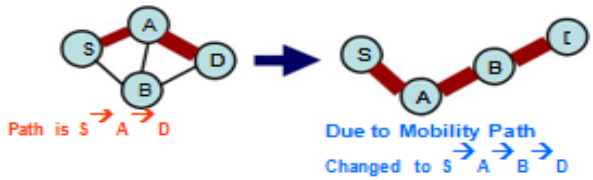

Figure 1: The dynamic scenario of network topology with mobility

1.1 Infrastructure

Wireless mobile networks have traditionally been based on the cellular concept and relied on good infrastructure support, in which mobile devices communicate with access points like base stations connected to the fixed network infrastructure. Typical examples of this kind of wireless networks are GSM, WLL, WLAN, etc.

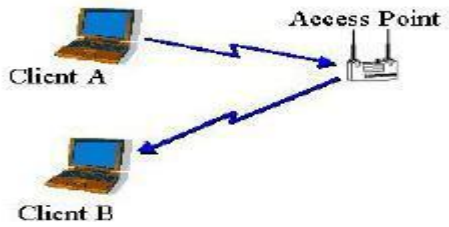

Figure 2: Infrastructure base network

1.2 Infrastructure Less

In infrastructure less approach, the mobile wireless network is commonly known as a mobile ad hoc network (MANET). A MANET is a collection of wireless nodes that can dynamically form a network to exchange information without using any pre-existing fixed network infrastructure. This is very important part of communication technology that supports truly pervasive computing, because in many contexts information exchange between mobile units cannot rely on any fixed network infrastructure, but on rapid configuration of wireless connections on the fly. Wireless ad

hoc networks themselves are an independent, wide area of research and applications, instead of being only just a complement of the cellular system.

Figure 3: Infrastructure less Adhoc network

2. Literature Review

Baisakh et al: Dynamic Source Routing protocol (DSR) has been accepted itself as one of the distinguished and dominant routing protocols for Mobile Ad Hoc Networks (MANETs). From various performance analysis and results, it is shown that DSR has been an outstanding routing protocol that outperforms consistently than any other routing protocols. But it could not pervade the same place when the performance was considered in term of energy consumption at each node, energy consumption of the networks, energy consumption per successful packet transmission, and energy consumption of node due to different overhead. Because, DSR protocol does not take energy as a parameter into account at all. And as MANET is highly sensible towards the power related issues and energy consumption as it is operated by the battery with the limited sources, needed to be used efficiently, so that the lie time o the network can be prolonged and performance can be enhanced. This paper presents a comprehensive summery of different energy efficient protocols that are based on the basic Mechanism of DSR and enlightens the effort and commitment that has been made since last 10 year to turn the traditional DSR as energy efficient routing protocol.

Chris Karlof and David Wagner et al: They examine routing security in wireless sensor networks. Many sensor network routing protocols have been suggested, but none of them have been designed with security as an objective. They recommend security aims for routing in sensor networks, show how attacks against ad-hoc and peer-to-peer networks can be adapted into powerful attacks against sensor networks, suggest two classes of novel attacks against sensor networks––sinkholes and HELLO floods, and investigate the security of all the major sensor network routing protocols. They explains crippling attacks against all of them and demonstrates countermeasures and design considerations. This is the first such investigation of protective routing in sensor networks.

David B. Johnson et al: An ad hoc network is a collection of wireless mobile hosts forming a temporary network without the aid of any established infrastructure or centralized administration. In such an environment, it may be necessary for one mobile host to enlist the aid of other hosts in forwarding a packet to its destination, due to the limited range of each mobile host's wireless transmissions. This paper presents a protocol for routing in ad hoc networks that uses dynamic source routing. The protocol adapts quickly to routing changes when host movement is frequent, yet requires little or no overhead during periods in which hosts move less frequently. Based on results from a packet-level simulation of mobile hosts operating in an ad hoc network, the protocol performs well over a variety of environmental conditions such as host density and movement rates. For all but the highest rates of host movement simulated, the overhead of the protocol is quite low, falling to just 1% of total data packets transmitted for moderate movement rates in a network of 24 mobile hosts. In all cases, the difference in length between the routes used and the optimal route lengths is negligible, and in most cases, route lengths are on average within a factor.

Jae-Hwan Chang et al: Auhtor develop the routing problem as a linear programming issue, where the aim is to increase the network lifetime, which is identical to the time until the network partition anticipated to battery outage. Two distinct models are examined for the information-production processes. One supposed persistent rates and the other presume an arbitrary process. A shortest cost path routing algorithm is present which uses link costs that reflect both the communication energy consumption rates and the residual energy levels at the two end nodes. The algorithm is flexible to distributed implementation. Simulation outcome with both information-generation process models show that the presented algorithm can attain network life time that is very close to the optimal network lifetime gained by solving the linear programming issues.

3. DESCRIPTION OF THE PROTOCOLS

This section briefly describe the key features of DSDV, DSR and AODV protocols that being studied in this paper.

3.1 Destination-Sequenced Distance Vector (DSDV)

The Destination Sequenced Distance Vector Protocol (DSDV) is a proactive, distance vector protocol which uses the Bellmann -Ford algorithm. DSDV is a hop-by hop distance vector routing protocol, wherein each node maintains a routing table listing the "next hop" and "number of hops" for each reachable destination. This protocol requires each mobile station to advertise, to each of its current neighbors, its own routing table (for instance, by broadcasting its entries). The entries in this list may change fairly dynamically over time, so the advertisement must be made often enough to ensure that every mobile computer can almost always locate every other mobile computer of the collection. In addition, each mobile computer agrees to relay data packets to other computers upon request. This agreement places a premium on the ability to determine the shortest number of hops for a route to a destination we would like to avoid unnecessarily disturbing mobile hosts if they are in sleep mode. In this way a mobile computer may exchange data with any other mobile computer in the group even if the target of the data is not within range for direct communication.

3.2 Dynamic Source Routing (DSR)

The Dynamic Source Routing (DSR) protocol is an on demand routing protocol based on source routing. DSR Protocol is composed by two "on-demand" mechanisms, which are requested only when two nodes want to communicate with each other. Route Discovery and Route Maintenance are built to behave according to changes in the routes in use, adjusting them-selves when needed. Along with those mechanisms, DSR allows multiple routes to any destination, thus can lead easily to load balancing or increase robustness .In the source routing technique, a sender determines the exact sequence of nodes through which to propagate a packet. The list of intermediate nodes for routing is explicitly contained in the packet's header. In DSR, every mobile node in the network needs to maintain a route cache where it caches source routes that it has learned. When a host wants to send a packet to some other host, it first checks its route cache for a source route to the destination. In the case a route is found, the sender uses this route to propagate the packet. Otherwise the source node initiates the route discovery process.

3.3 Ad Hoc On-Demand Distance Vector (AODV)

AODV is a purely reactive routing protocol. In this protocol, each terminal does not need to keep a view of the whole network or a route to every other terminal. Nor does it need to periodically exchange route information with the neighbor terminals. Furthermore, only when a mobile terminal has packets to send to a destination does it need to discover and maintain a route to that destination terminal. In AODV, each terminal contains a route table for a destination. A route table stores the following information: destination address and its sequence number, active neighbors for the route, hop count to the destination, and expiration time for the table. The expiration time is updated each time the route is used. If this route has not been used for a specified period of time, it is discarded

4. SIMULATION ENVIRONMENT

4.1 Simulation Model

This section have given the emphasis for the simulation of performance of Ad Hoc routing protocols AODV,DSDV,DSR with varying the number of mobile nodes. The simulations have been performed using network simulator NS-2. The network simulator ns-2 is discrete event simulation software for network simulations which means it simulates events such as sending, receiving, forwarding and dropping packets. The latest version, ns-allinone-2.34, supports simulation for routing protocols for ad hoc wireless networks such as AODV, TORA, DSDV, and DSR. Ns-2 is written in C++ programming language and Object Tool Common Language (OTCL). Although ns-2.34 can be built on various platforms, we chose a Linux platform [FEDORA 7] for this paper, as Linux offers a number of programming development tools that can be used along with the simulation process. To run a simulation with ns-2.34, the user must write the simulation script in OTCL, get the simulation results in an output trace file. The performance metrics are graphically visualized in XGRAPH. Ns-2 also offers a visual representation of the simulated network by tracing nodes movements and events and writing them in a network animator (NAM) file. The fig.4 & 5 shows the flow chart of exact flow of data.

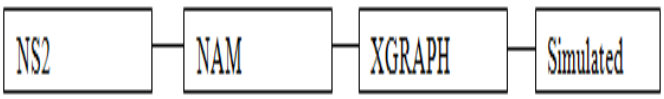

Figure 4: Product feature

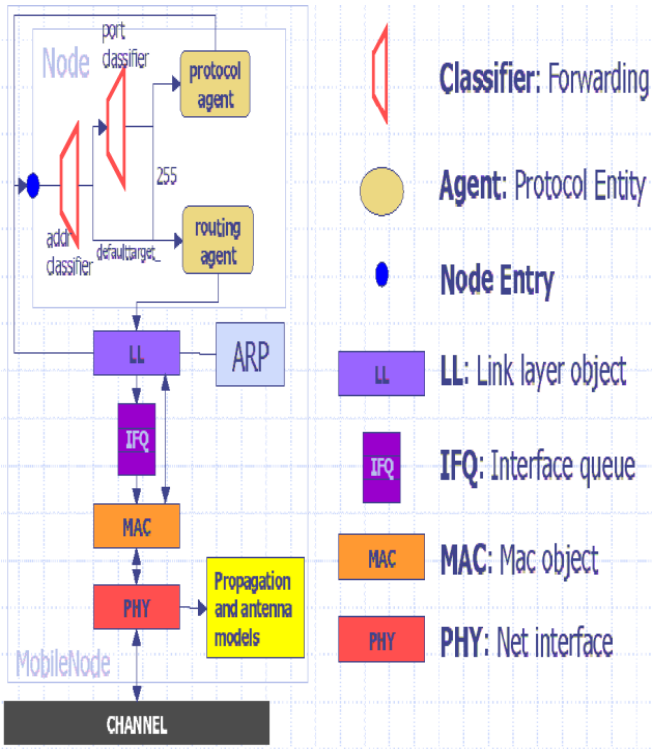

Figure 5: Product Working

4.2 SIMULATION RESULTS

- The nodes other than sink are constant, as these are connected and static with each other, So the discovery of route when the link is broken is done so fast such that only one packet is dropped whose retransmission is taken care of the upper layers.
- The packet drop is due to the DSR implementation in which when forwarding towards the destination when the node detects the link failure it drops the packet and then sends a route error to the source which originated the data packet.

Table 1: Result Scenario

Parameter	Value
Transmission range	250 m
Simulation Time	330 s
Topology Size	800m x 800m
Number of Mobile Nodes	11
Numbers of Sources	8
Number of Gateways	2
Traffic Type	Constant Bit
Packet Rate	5packets/s
Packet Size	512 Bytes
Maximum Speed	10m/s

The performance of the proposed criteria has been numerically evaluated by the estimation of the following parameters:

Percentage of Lost Packets: It is defined as the ratio between the lost data packets and the data packets generated by the sources in the MANET.

End-To-End Delay: It represents the average value of the destination from their origin. This parameter includes the time the nodes stay in the internal queues.

Normalized Overhead: It corresponds to the ratio between the total control packets and received data packets. Each hop of the control packets is computed as a new control packet.

4.3 Project Scope

This document includes details covering the design of all the MANET networks using DSR protocol software components currently known to project developers. This includes but is not limited to:

• Simulation interface design engineering.
• Detailed description of objects and classes to be used.
• Usability. Implementation of DSR protocol over MANET using NS2 will provide researchers detail references of challenges and usability at real time environment

5. CONCLUSION

This implementation of DSR Source routing protocol includes most of the basic facilities described in DSR–MANET IEEE draft, but some optimization measures like cached route request, and flow control are not implemented in this implementation. Packet salvaging, automatic route shortening (Gratuitous Route Reply), caching negative information, caching overhead routing information and increased spreading of route error packets are the other options available in draft which can be implemented in this implementation The DSR protocol allows multiple routes to any destination and allows each sender to select and control the routes used in routing its for example for use in load balancing or for increased robustness. 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. The DSR protocol is designed mainly for mobile ad hoc networks of up to about two hundred nodes, and is designed to work well with even very high rates of mobility.

6. EXPERIMENTAL RESULTS

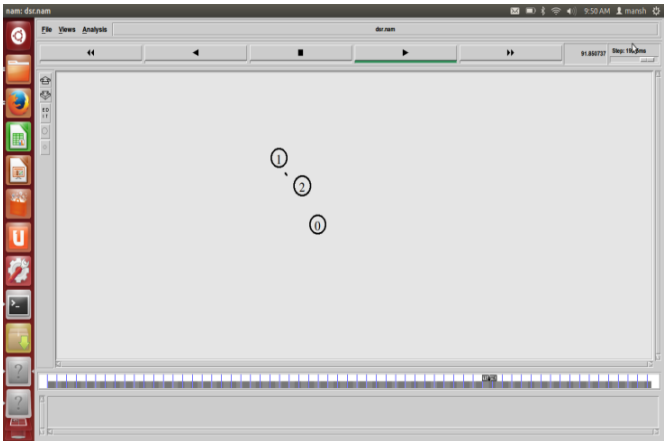

Figure 6.a: Node initialization

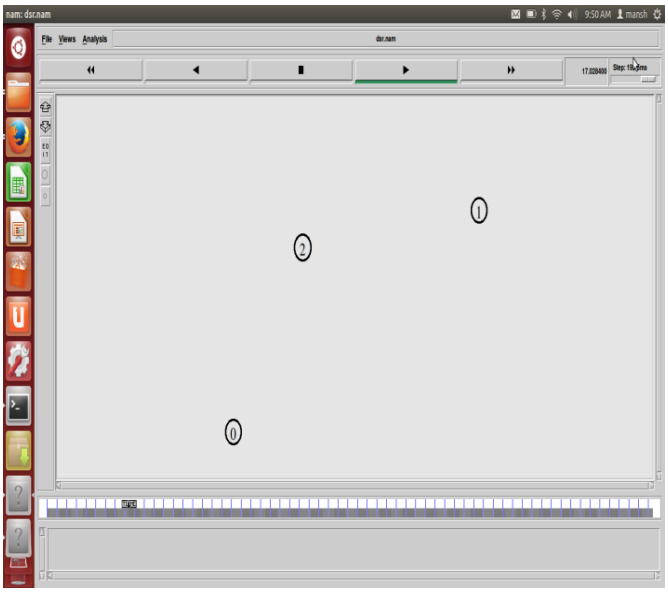

Figure 6.b: Node movements

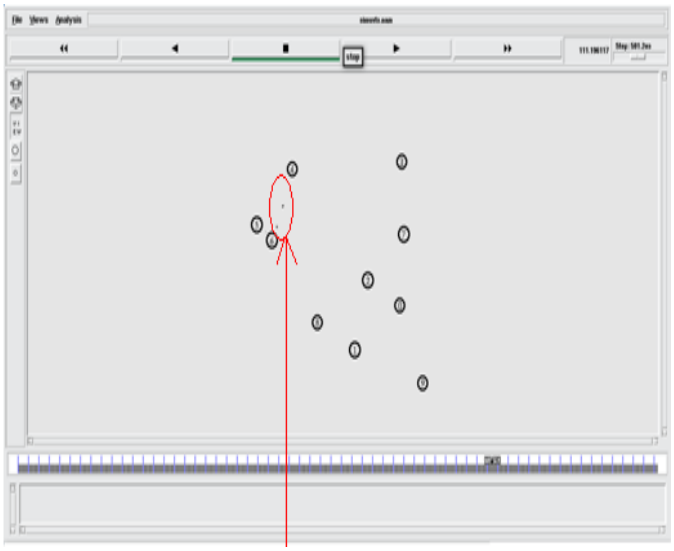

Figure 6.c: Transfer of packets

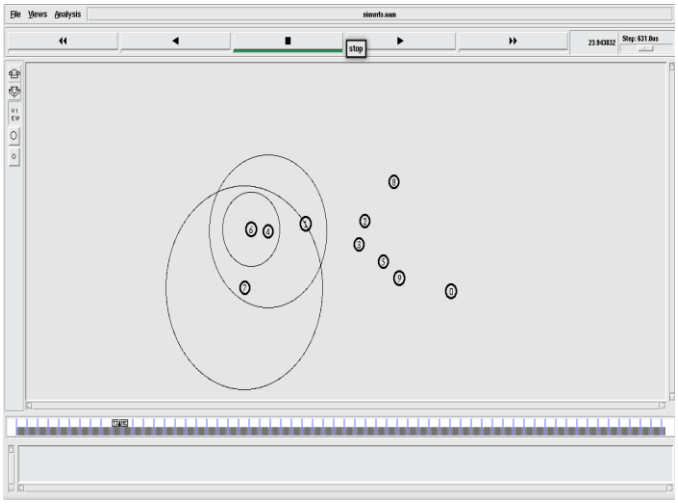

Figure 6.d: Route Discovery

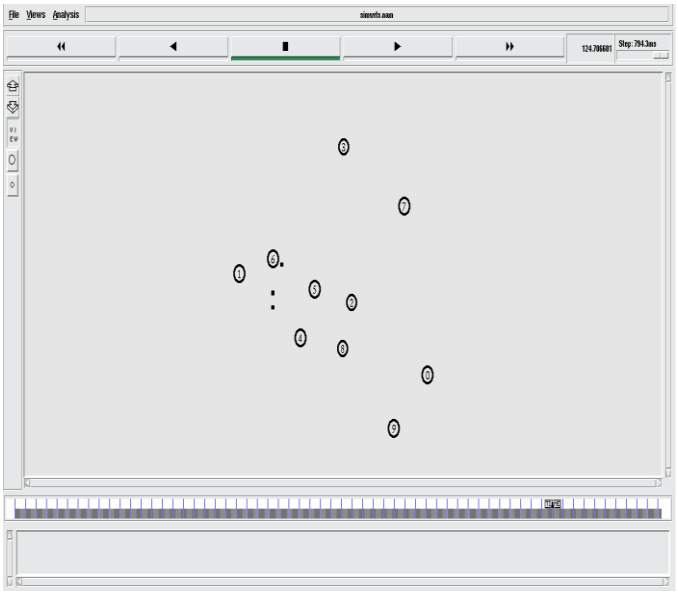

Figure 6.e: Dropping of packets

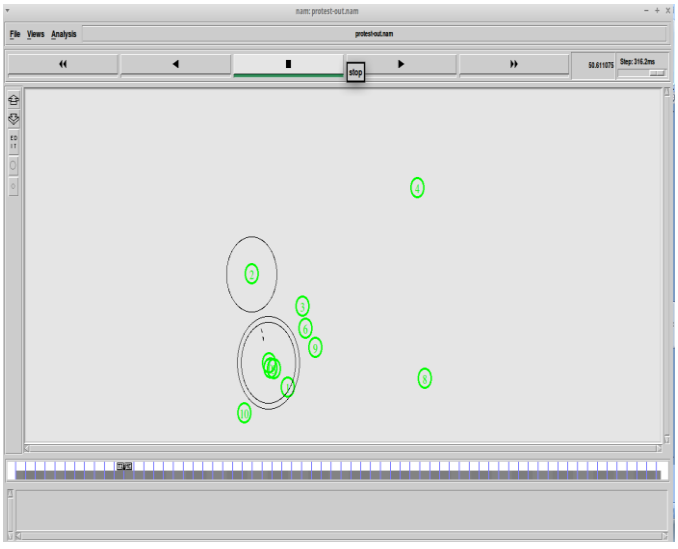

Figure 6.f: Movement of nodes

7. FUTURE WORK

Due to fundamental characteristics, routing protocols in wireless mobile ad hoc networks (MANETs) are particularly vulnerable to attack. One such attack, the "sinkhole" problem, is analyzed in the context of the dynamic source routing (DSR) protocol, and a sinkhole intrusion detection system (SIDS) is proposed for detecting it. The design and evaluation of this system is rigorously detailed, its performance is evaluated, and directions for future work are outlined. The simulation results show that SIDS is a promising methodology for this important problem.

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