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Comparison of Energy Consumption in MANET using DSS & S to S Key Algorithm

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Abstract: Mobile Ad Hoc Network (also called MANET) is a collection of portable devices that establish communication without the help of any infrastructure or established communication backbone MANETs are infrastructure less and can be set up anytime anywhere. One of the main design constraints in mobile Ad Hoc networks (MANETs) is that they are power constrained. Hence, every effort is to be channeled towards reducing power. Mobile Ad Hoc network are self-organizing, multi-hopping, mobile and scalable. Each node in MANET is equipped to continuously maintain the information regarding route. Topology of the ad-hoc network depends on the trans-mission power of the nodes and the location of the portable nodes, which may change from time to time. In a MANET, the energy depletion of a node does not affect the node itself only but the overall network lifetime. In this paper, the focus is on a technique for minimizing energy conservation within the routing protocols of the ad hoc network. In our proposed work we are Implementing Digital Signature Standard Scheme and then we will apply this algorithm in Mobile Ad-hoc Networks. We are also Comparing the Energy consumption of node of Digital Signature Standard with Station to Station key agreement when used in Mobile ad-hoc Networks. The Performance of the algorithms will be compared on the energy saving from one node to another. The simulation was carried out using the NS-2 network simulator.

Keywords: Digital Standard Signature (DSS), Station to station key (S to S), AODV, NS-2 Simulator

I. INTRODUCTION

Wireless communication brings fundamental changes in the field of data networking and telecommunication. One of the popular ad hoc networks is Mobile Ad-hoc Network. It is regarded as a system of wireless mobile nodes that can self organize into arbitrary and temporary network topologies freely and dynamically.

In mobile Ad-hoc network there is no fixed infrastructure or centralized administration which mean that there is no base station. Mobile nodes are free to move randomly (network topology change randomly).Each node work as router. MANET offers an independent, scalable and flexible solution for mobile and dynamic topologies. For the design of MANETs there is limited availability of energy resources. Energy saving is critical for increasing the life of power limited wireless ad hoc networks. Each of the mobile nodes is operated by a limited energy battery and it is not impossible to recharge or replace the batteries in working condition. As wireless communications consume significant amount of energy, this limited battery lifetime degrade network performance. Energy failure effects nodes ability to forward packets and overall performance of the network lifetime. A mobile node consumes its battery energy even it stays idle listening to the wireless medium for any possible communication requests from other nodes. For this, the energy-efficient routing protocols minimize the energy required to transmit and receive data packets and also energy during idle period.

To make energy and intelligent self organization in MANETs which motivate to design the energy efficient routing protocol for MANETs by integrating the principles of AODV protocol to conserve battery life of mobile nodes by comparing the outcomes through DSS algorithm and STS Algorithm.

II. LITERATURE SURVEY AND RELATED WORK

Mobile ad hoc networks are a class of temporary networks in which nodes are moving without any fixed infrastructure or centralized management. Due to the various applications that use MANETs are such as battlefield, emergency services, and disaster discovery, MANETs suggest many advantages too many organizations that need wireless roaming. There are number of routing protocols have been developed and it is hard to determine which of the protocols may complete well under a number of different network scenarios such as network size and topology etc MANETs mainly use three types of routing protocols. The reactive protocols such as Dynamic Source Routing (DSR), Ad hoc On-demand Distance Vector (AODV) and Temporally Ordered Routing Algorithm (TORA) dynamically determine the routing path as and when there is a demand to transmit some data.

- Proactive protocols- In table driven routing protocols, the protocols accepted and up to-date routing in series to all nodes is maintained at each. Nodes sometimes look for routing information within a network. The fixed cost of these protocols is possible, because it is free to the traffic profiles and has a fixed upper bound such as Destination Sequenced Distance Vector (DSDV).

- Reactive or On-demand routing protocols look for the routes and are created as and when required. When a source wants to send to a destination, it invokes the route discovery mechanisms to find the path to the destination. The on demand routing protocols, "on demand" means that it builds routes between nodes only as preferred by source nodes. It maintains these routes as long as they are required by the sources .The reactive or on-demand routing protocols describe the perfect nature of ad hoc network, which is much more dynamic than infra structured networks. For example: Ad-Hoc On-demand Distance Vector (AODV), DSR.
- Hybrid routing protocols such as Zone Routing Protocol (ZRP) are also used, which integrates the characteristics of proactive and reactive protocols, but also has demerits i.e. cannot be evaluated for unidirectional links and it can be applied only for very large networks [1].

AODV protocol supports both unicast and multicast packet transmissions even for nodes in constant movement. It also responds very quickly to the topological changes that affect the active routes. AODV does not put any additional overhead on data packets as it does not make use of source routing. Whereas, DSR protocol is not scalable to large networks and even requires significantly more processing resources [1][6]. Basically, in order to obtain the routing information, each node must spend lot of time to process any control packet it receives, even if it is not the intended recipient.

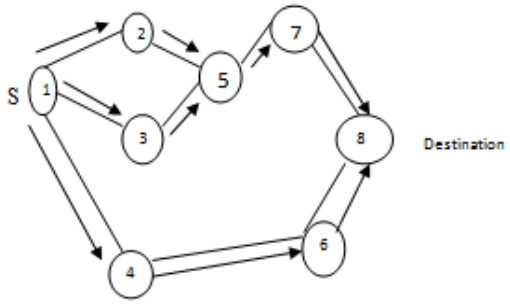

Figure 1: Propagation of Route Request (RREQ) Packet

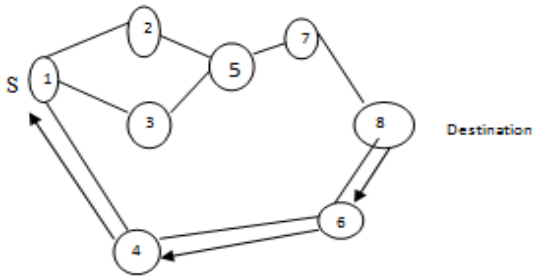

Figure 2: Path Taken by the Route Reply (RREP) Packet

AODV builds routes using a route request / route reply query cycle. When a source node desires a route to a destination for which it does not already have a route, it broadcasts a route request (RREQ) packet across the network. Nodes receiving this packet update their information for the source node and set up backwards pointers to the source node in the route tables. In addition to the source node's IP address, current sequence number, and broadcast ID, the RREQ also contains the most recent sequence number for the destination of which the source node is aware. A node receiving the RREQ may send a route reply (RREP) if it is either the destination or if it has a route to the destination with corresponding sequence number greater than or equal to that contained in the RREQ. Otherwise, it rebroadcasts the RREQ. Nodes keep track of the RREQ's source IP address and broadcast ID. If they receive a RREQ which they have already processed, they discard the RREQ and do not forward it.

As the RREP propagates back to the source nodes set up forward pointers to the destination. Once the source node receives the RREP, it may begin to forward data packets to the destination. If the source later receives a RREP containing a greater sequence number or contains the same sequence number with a smaller hop count, it may update its routing information for that destination and begin using the better route.

As long as the route remains active, it will continue to be maintained. A route is considered active as long as there are data packets periodically travelling from the source to the destination along that path. Once the source stops sending data packets, the links will time out and eventually be deleted from the intermediate node routing tables. If a link break occurs while the route is active, the node upstream of the break propagates a route error (RERR) message to the source node to inform it of the now unreachable destination(s). After receiving the RERR, if the source node still desires the route, it can reinitiate route discovery

.

Energy Formula

Total energy=initial energy- final energy

Average energy=Total energy/n

Where n is number of nodes

Applications of IEE_AODV Protocol

This energy efficient Ad hoc Net protocol finds various applications. A few of them have been listed here.

- **Vehicular Ad hoc Networks (VANETs)** - A set of vehicles that depart from a depot has to serve a set of customers before returning to the depot, while utilizing the minimum number of vehicles and the total distance traveled by them. More than one route might be required to serve all orders. This can also be replicated and applied for any type of traffic maintenance, such as finding the least congested path for emergency services like ambulance and fire brigades.
- Aviation sector – inter and intra aircraft communication.
- Military combat operations – Bugs released for investigation purposes
- Wireless Sensor Networks.
- Disaster Recovery - for recovery of communication channels in times of natural disasters such as earthquakes.

1. The Proposed Work

The technique which is used in this paper is to compare energy of mobile nodes using DSS and S to S key algorithm in AODV routing protocol. Creating connection between mobile nodes by agents that are TCP(transmission control Protocol) used for sending the information from one mobile node to other and other is CBR (Constant Bit Rate) which is used for generating the traffic signals. Route is computed by Hop Count method. Then RIP (Routing information Protocol) selects the best path from source to destination. The energy of mobile node in DSS and S to S key algorithm is calculated by NS2 simulator. It is found that by choosing the best path the energy consumption of mobile nodes using S to S key algorithm is less then energy consumption of mobile nodes in DSS algorithm. The throughput analyses in purposed algorithm are calculated after 5 milliseconds.

2. Testing and results

Step 1: Defining Topology and Parameter of the network.

Table 1. Network scenario for NS2 simulation Topology.

Sr No.	Parameters	Value
1.	Protocol	AODV
2.	Number of Nodes	15
3.	Area	1000*1000
4.	Initial Energy	100
5.	Antenna Type	Omni Directional
6.	Channel	Wireless
7.	Radio Propagation	Two way Ground

Step 2 : Creating Connection Between Mobile Nodes.

```
$ns attach-agent $n (0) $tcp0
//attaching agents for data transfer
$ns attach-agent $n (1) $tcp1
 $ns attach-agent $n (2) $tcp2
 $ns attach-agent $n (3) $tcp3
 $ns attach-agent $n (4) $tcp4
$ns attach-agent $n (5) $tcp5
$ns attach-agent $n (6) $tcp6
$ns attach-agent $n (7) $tcp7
$ns attach-agent $node $cbr // traffic generation
```

Step-3:- Route Computation from source to destination

Route is computer by Routing Information protocol (RIP) also known as Hop Count. Routing Information protocol select the best path to a destination network based only on the number of hops to the destination network.

Step-4:- Applying Digital Signature Standard (DSS) in Mobile ad-hoc networks for data encryption and decryption.

In the research work Digital Signature Standard (DSS) algorithm has been implemented in Mobile ad-hoc Network using Network Simulator 2(NS-2.35). The results have been analyzed in the form of graphs. Ubuntu version 13.10 is required for the installation of NS-2.35. Parameters considered for graphs are:-

III. THROUGHPUT

Throughput is the ratio of number of packets received successfully by a node within a given period of time. Throughput of the network fluctuates with respect to time depends upon the size of the interface queue.

X-axis:- Simulation Time

Y-axis:- Number of bits

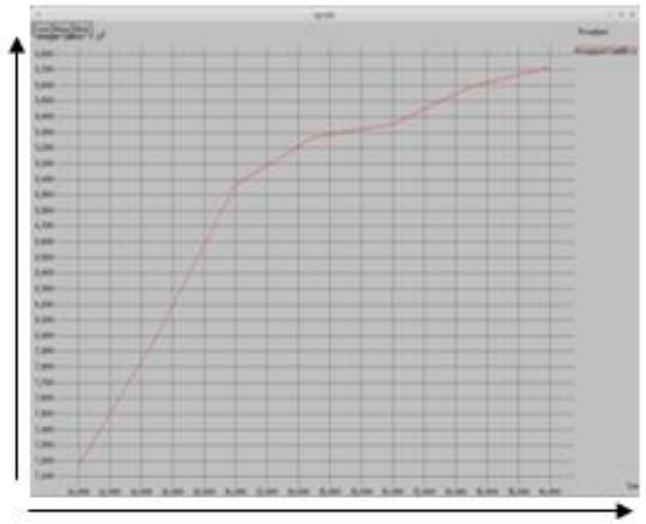

Figure 4.1: Throughput Analyses of DSS Algorithm

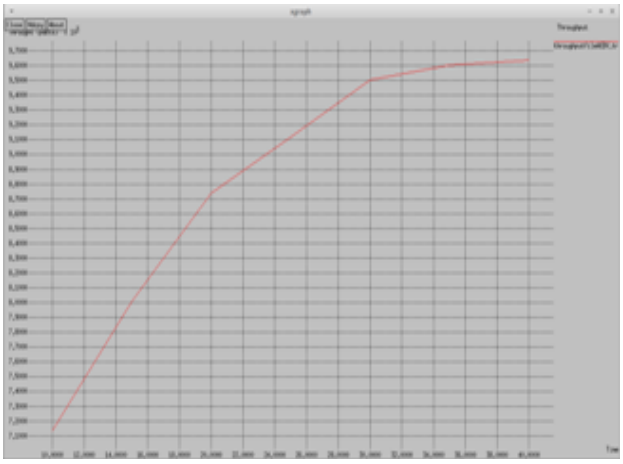

Figure 4.2: Throughput Analyses of STS Algorithm.

Energy graphs: - Graph below shows the energy consumed by mobile nodes in Mobile adhoc Network. Energy consumption is shown in killo joule per second.

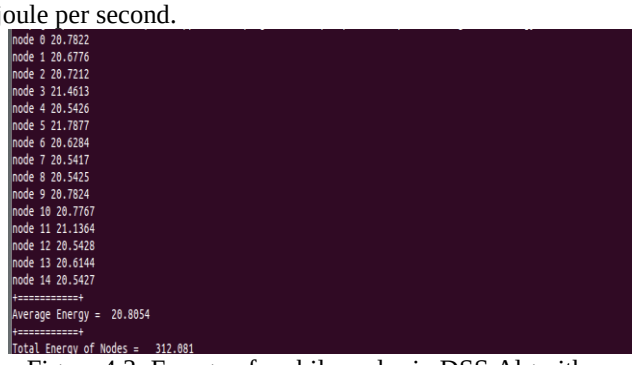

Figure 4.3: Energy of mobile nodes in DSS Algorithm

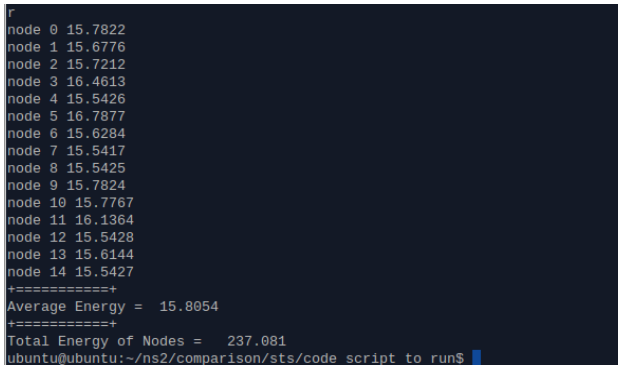

Figure 4.4: Energy of mobile nodes in STS Algorithm

IV. CONCLUSION

In this work, it is observed that energy consumption of mobile nodes using S to S key algorithm is less then energy consumption of mobile nodes using DSS algorithm. Further to the proposed work, the algorithm has been implemented and is evaluated using performance metrics like throughput and energy graphs. Each signatory has a public and private key and is the owner of that key pair. The private key is used in the signature generation process. The key pair owner is the only entity that is authorized to use the private key to generate digital signatures. After Implementing Digital Signature Standard Algorithm in MANET which achieved desired security. The Network is now safe from attackers. DSS provides the assurance of Confidentiality, Integrity and Authentication. The results were analyzed using network stimulator tool such as NS2 by comparing 15 mobile nodes. This has helped to maximize the network lifetime using S to S key algorithm.

V. FUTURE WORK

In future work any two security algorithms can be combined and then implemented in Mobile ad-hoc Network. Complexity of the Security algorithms can be reduced to increase the battery life of mobile nodes. There are may be other techniques for improving the overall performance of the network such as data compression techniques.

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