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Original Research Article

DETECTION AND PREVENTION STRATEGY AGAINST JAMMING ATTACK IN MANET

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Abstract: Mobile ad hoc Networks (MANET) is associate promising technology and have large prospective to be operative in essential things like battlefields and industrial applications like traffic investigation, building, surroundings looking and sensible homes and far of additional things. one in every of the key challenges in wireless device networks face presently a days is security. During this paper we tend to planned a profile based mostly protection scheme PPS security scheme against jamming attack. These kings of attacks are flooding access quantity of excess packets in network by that the network bandwidth are consumed by that information delivery in network are affected. Our main aim is visualized the results of jamming attack in network and establish the node or nodes that are affected the network performance by flooding unwanted packets in network. The profile based mostly security scheme are check the profile of every node in network and only the attacker is one in all the node that flooded the excess packets in network then PPS has block the performance of attacker. The performance of network is measured on the idea of performance metrics like routing load, output etc. The simulation results are represents a similar performance simply just in case} of traditional routing and in case of PPS scheme; it means the PPS scheme is effective and showing 0% infection in presence of attacker.

Kevwords— MANET. Jamming Attacks. Defensive mechanisms. PPS.

Introduction: Mobile ad-hoc network could be a self organizing network that consists of mobile nodes that are capable of communication with one another while not the help of fixed infrastructure. On the contrary to ancient wired networks that use copper wire as a communication channel, ad-hoc networks use radio waves to transmit signals.

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Two nodes will have multiple links between them for communication and deployed in an extremely complete fashion, appropriate for value and time effective setting, and for a scenario where infrastructure is hard to setup. Security is difficult in MANETs attributable to its characteristics like peer to examine design, operational while not central arranger, dynamic topology, insecure operational setting, and frequent link breakage attributable to mobile nodes, battery period of time, machine capability and non uniformity.

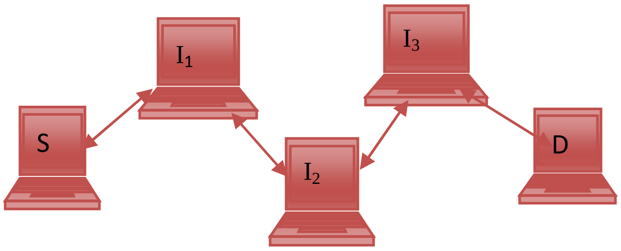

Fig 1: Ad Hoc Network

Communication in MANETs is through single hop in link layer protocols and multi hop in network layer protocols, supported the belief that every one the nodes in an exceedingly network are cooperative in coordination technique, however sadly this isn't true in hostile setting.

Malicious attacks will merely disrupt network operation by violating protocol specifications. The network layer operations in MANET are supported routing and data packet forwarding every are susceptible to malicious attacks.

Mobile ad-hoc networks lack permanent infrastructure and use wireless link for interaction makes them really liable to an adversary's Mobile ad-hoc networks area unit inclined to an large range of security threats, the essential reality that malicious attacks. Attackers are severe security threats in ad-hoc networks that will use with no trouble by exploiting susceptibility of on-demand routing protocols like AODV. This tries to use Intrusion Detection (ID) to prevent attacks obligatory by each single and multiple nodes then the Detection and healing routing misconduct below Manet. we attempt to reach up to the actual solution maximizes network performance by the assistance of minimizing production of management (routing) packets similarly as with success opposing attacks against mobile ad-hoc networks.

2. Manet Susceptibilities: Susceptibility is a weakness in security system. A meticulous system may be susceptible to illegal data manipulation because the system does not verify a user's distinctiveness before allowing data access. MANET is more susceptible than wired network. Some of the susceptibilities are as follows:

2.1 Absence of Centralized Authority: MANET doesn't have a centralized authority. The absence of centralized authority makes the detection of attacks difficult because it is not east to monitor the traffic in a vibrant and large scale MANET.

2.2 Lack of Predefined Boundary: In MANET we cannot exactly identify a substantial boundary of the network. The nodes work in a itinerant environment where all nodes are free to join and leave the network at any instance of time. As soon as an opponent comes in the radio range of a node it will be able to communicate with that node.

2.3 Supportive in Communication: The Routing protocol of MANETs usually assumes that mobile nodes are cooperative and reliable (not malicious). The routing misbehavior through malicious attacker can easily become disrupts network operation.

2.4 Limited power supply: The nodes in MANET are completely performing energy or power dependent operations need to consider restricted power supply, which will cause several problems. A node in MANET may behave in a selfish manner when it is finding that there is only limited power supply.

2.5 Opponent inside the Network: At any time instant, the assumed nodes within network may additionally conduct maliciously. In dynamic network it is severe to distinguish that the behavior of the node is malicious attacker. Attack is harmful on that kind of network.

3. Routing Protocols in Manet: In dynamic network the topology is regularly changes that are the explanation for link breakage are created as multiple-hop till the destination isn't found. The routing protocol is playing a essential part at network layer for data acceptive and forwarding through every router or node the data is cause by sender and accepted by receiver in that procedure routing strategy is extremely necessary a part of communication . For connecting to end and data delivery the routing protocol is necessary for routing the data in between sender to receiver each routing protocol has totally different routing approaches of link establishment but has same method of choose shortest path in between sender and receiver. The direct path is decided on the basis of least hop count importance in Manet. The classifications of routing protocols in manet are as follows:-

3.1 Proactive Routing Protocol: The proactive routing protocols are also known as as are maintaining the routing data of every node counter driven routing protocol and these routing protocols that are collaborate in routing procedure. In Mobile ad hoc network the topology in network is change by that the transparency of maintain the data of every node is very complicated and needed huge arrangement of memory for store routing information in network. In ad hoc network if the nodes are moves at slow speed then that protocol is assume to be higher for communication. The example of proactive routing protocol is DSDV routing protocol.

3.2 Reactive Routing Protocol: The Reactive routing protocols are also known as as on demand routing protocol and these routing protocols are maintain the routing data on the idea of demand of request receives by the neighbor. There is no routing information is keep of every node that are collaborate in routing procedure. In Mobile ad hoc network the topology in network is change by that the overhead of maintain the data of every node isn't desired to keep up. In ad hoc network if the nodes are move at random speed then that protocol is supposes to be increased for communication. The example of reactive routing protocol is AODV routing protocol.

3.3 Hybrid Routing Protocol: Proactive and reactive protocols every work superior in oppositely totally different situation, hybrid method uses each. it is used to find a balance between both protocols. Proactive operations square measure restricted to small domain, whereas, reactive protocols square measure used for locating nodes outside those domains.

4. Security Threats in MANET: The current mobile ad-hoc networks give many different kinds of attacks. although the analogous exploits place along exits in wired networks however it is simple to repair by infrastructure in such a network. Current MANET area unit primarily in danger of two different types of attacks: active Attacks and passive attacks. Active attack is attack once misbehaving node ought to settle for those energy costs so on perform the threat. On the opposite hand, passive attacks area unit among the most attributable to lack of cooperation with the aim of saving energy selfishly. Nodes that perform active attacks with the aim of damaging whole completely different nodes by inflicting network outage area unit thought-about as malicious whereas nodes that build passive attacks with the plan of saving battery life for his or own her communications sq. calculate thought-about to be mean .

5. Types of Attack in MANET: There are numerous kinds of attacks within the mobile ad hoc network, nearly all of which can be classified as the following types-

5.1 External attacks: In External attack, attacker aims to cause congestion, propagate replica routing information or disturb nodes from providing services.

5.2 Internal attacks: In Internal attack the adversary wants to gain the normal access to the network and involve you inside the network behavior, either by some malicious impersonation to find the access to the network as a new node, or by directly compromise a existing node and using it as a basis to conduct its malicious behaviors. in the two classes shown above, external attacks square measure the same as the normal attacks within the traditional wired networks in this the adversary is within the proximity however not a reliable node within the network, therefore, this kind of attack will be prohibited and detected by the protection methods like membership authentication or firewall, that square measure relatively typical security solutions.

However, due to the pervasive communication nature and open network media within the mobile unintentional network, internal attacks square measure are extra dangerous than the inner attacks: because the compromised nodes square measure originally the benign users of the ad hoc network, they can merely exceed the authentication and get protection from the security mechanisms.

As a result, the adversaries can make use of them to gain traditional access to the services to facilitate should only be available to the authorized users within the network, and they can use provided by the compromised nodes to cover their malicious behaviors. Therefore, we should forever pay extra attention to the inner attacks initiated by the malicious insiders once we consider the safety issues within the mobile ad hoc networks.

In the following, we discuss the most attack sorts that emerge within the mobile ad hoc networks.

5.3 Flooding Attack: Flooding attack [9] may be a denial of service methodology of attack at intervals which the malicious node broadcast the unneeded false packet in the network to consume the on the market resources so that valid or legitimated user cannot able to use the network resources for valid communication. Because of the restricted resource constraints within the mobile ad hoc networks resource consumptions a result of flooding attack reduces the throughput of the network.

The flooding attack is probable in all most all the on require routing, relying upon the type of packet used to flood the network, flooding attack can be classified in two categories.

5.4 RREQ Flooding: RREQ flooding data flooding RREQ flooding in the RREQ flooding attack, the attacker broadcast the numerous RREQ packets per time interval to the ip address that does not exist within the network and disable the restricted flooding feature. On demand routing protocols uses the route discovery process to support the route connecting the 2 nodes. In the route detection the availability node broadcast the RREQ packets within the network. Because the priority of the RREQ control packet is higher than information packet then at the high load also RREQ packet are transmitted. A malevolent node exploits this feature of on demand routing to launch the RREQ flooding attack.

5.5 Jamming Attack or Data Flooding: In the data flooding, malicious node flood the network by sending impractical data packets. To start the data flooding, first malicious node designed a path to all or any the nodes then sends the big amount of imitative data packets. These impractical data packet exhausts the network resources and thus authorize user cannot ready to use the resources for valid communication.

The main influence bring by the attacks across routing protocols build network partition, routing loop; resource loss and route hijack. There are some attacks against routing that are studied and documented :

- perform another node to send-up route message.
- Advertising a false route metric to represent the topology.
- Sending a route message with wrong sequence selection to contain alternative lower-cost route messages.
- Because of the mobility and constantly dynamic topology of the mobile ad hoc networks, it is very tough to validate all the route messages.

6. Related Work Done in Field of Attack:

Let’s look out various researches already done by various researchers.

In this scheme, the first criterion that has been checked is the authenticity of a new node that wants to join the network. The authors proposed a secure algorithm based on cryptography. After authenticating it, if the node is approved to be reliable, then it is authorized to some of the network related jobs. In spite of granting full authorization, we move on to the second phase of detection if the newly joined node is found to be malicious. For this, we send an entire data set divided into some smaller parts. The node is able to construct an entire data getting minimum number of those data parts if it is non-malicious. If not, the same process is repeated again with an increase in the minimum number data sets to construct the original data. Post this phase; in case the node is detected to be malicious, then it is eliminated from the network.

In this study examined multipath routing protocols that will react to communication disturbance on-demand. In particular, a source node selects multiple different paths for reaching the destination in advance. The availability histories of paths are efficiently recorded and calculated via “availability history vectors”.

Leveraging AHVs, we have presented two AHV-based multipath selection algorithms: one selects multiple paths with the full knowledge of AHVs in the network, and the other computes the path in a distributed manner. AHV-based algorithms can effectively identify multiple paths that provide high end-to-end availability, even in the presence of a new jammer that did not affect the network before path selection. Additionally, the proposed distributed AHV-based algorithm accomplishes higher availability than AODV at a smaller communication cost for long-lived communication sessions

Jing-Wei Huang et al [4] proposed Multi-Path Trust-Based Secure AOMDV Routing in Ad Hoc Networks. In this work uses a trust based multipath AOMDV routing combined with soft encryption, yielding our so-called T-AOMDV scheme. More precisely, this approach consists of three steps: (1) Message encryption – where at the source node, the message is segmented into three parts and these parts are encrypted using one another using some XOR operations, (2) Message routing – where the message parts are routed separately through different trust based multiple paths using a novel node disjoint AOMDV protocol, and (3) Message decryption – where the destination node decrypts the message parts to recover the original message.

Shreenath et al [5] proposed Countermeasures against Multicast Attacks on Enhanced-On Demand Multicast Routing Protocol in MANETs. This work focus on improving the Secure Enhanced-On Demand Multicast Routing Protocol (EODMRP) to safeguard it against flooding and black hole attacks. The proposed mechanism is for flooding attack works even when the identity of the malicious nodes is unknown and does not use any additional network bandwidth. The performance of a small multicast group will degrade seriously under these types of attacks even the solution is available. The proposed algorithm provides protection against black hole attack in MANET.

Sujatha et al. [6] proposed Design of Genetic Algorithm based IDS for MANET. In this work a technique to analyze the exposure to attacks in AODV, specifically the most common network layer hazard, Black Hole attack and to develop a specification based Intrusion Detection System (IDS) using Genetic Algorithm approach. The proposed system is based on Genetic Algorithm, which analyzes the behaviors of every node and provides details about the attack. Genetic Algorithm Control (GAC) is a set of various rules based on the vital features of AODV such as Request Forwarding Rate, Reply Receive Rate and so on.

Konate et al [7] proposed an Attacks Analysis in mobile ad hoc networks: Modeling and Simulation. In this title present work is dedicated to study attacks and countermeasures in MANET. After a short introduction to what MANETs are and network security we present a survey of various attacks in MANETs pertaining to fail routing protocols. We also present the different tools used by these attacks and the mechanisms used by the secured routing protocols to counter them. In this defined the concept of DoS like its various types. They presented several alternatives of DoS attacks met in MANETs, their operating process thus the mechanisms used and the protocols which implement them to counter these attacks.

Gandhewar et al [8] proposed Detection and Prevention of Sinkhole Attack on AODV Protocol in Mobile Adhoc Network. This work mainly focuses on sinkhole problem, its consequences & presents mechanism for detection & prevention of it on the context of AODV protocol. Sinkhole is one of severe kind of attack which attempts to attract most of network traffic towards it & degrade the performance of network. AODV is mainly analyzed under blackhole, wormhole & flooding attack, which needs to analyze under other kinds of attack also. It also shows performance of AODV with no sinkhole attack, under attack & after applying our mechanism in the form of simulation result obtained for certain variation of nodes in network, by considering performance metrics as throughput, PDR, End to end delay & Packet loss.

Sharma et al [9] proposed An Efficient Prevention of Black Hole Problem in AODV Routing Protocol in MANET. In this work a solution to the black hole attack in one of the most prominent routing algorithm, ad-hoc on demand distance vector (AODV) routing, for the MANETs. The black hole attack is one of such security risks. In this attack, a malicious node falsely advertise shortest path to the destination node with an intension to disrupt the communication. The proposed method uses promiscuous mode to detect malicious node (black hole) and propagates the information of malicious node to all the other nodes in the network.

Jian-Ming Chang et al [10] proposed CBDS: A Cooperative Bait Detection Scheme to prevent malicious node for MANET based on hybrid defense architecture. They presented a mechanism to detect malicious nodes launching black/gray hole attacks and cooperative black hole attacks, known as Cooperative Bait Detection Scheme (CBDS). It integrates the proactive and reactive defense architectures, and randomly cooperates with a stochastic adjacent node. By using the address of the adjacent node as the bait destination address, it baits malicious nodes to reply RREP and detects the malicious nodes by the proposed reverse tracing program and consequently prevents their attacks.

Mazrouei et al. [11] proposed Mobile ad hoc networks: A simulation based security evaluation and intrusion prevention. They elaborate about the security attacks and two more popular security techniques, Intrusion Detection System (IDS) and Watchdog and Path rater (WPR). The two techniques are evaluated using two measures, viz., Availability Factor (AF) and Integrity Factor (IF). They also focused on the unique architecture of MANET offers several advantages and security challenges as passive and active attacks on the network.

7. Expected Work Against Jamming Attack

7.1. Intrusion Detection System: An IDS is shown below in figure 4.1 which have three different modules namely Normal Profile, Worm node and Intrusion information. Normal profile consists of TCP transmission, UDP transmission and CBR transmission. It also contains the path of packet flow in the network this information is before the worm node enters in the network. After that worm node enter the network in place of **Jamming attack**, it captures the information of normal profile and infect the vulnerable node in network through message passing (probing packets) between abstract network and detailed network and then worm node set the scan rate, scan port, percentage of vulnerability and infection parameters. If probing port of detailed network and abstract network are same then worm node sends the infected packets to all the vulnerable nodes and infects the network. Intrusion Information takes the information from both normal profile and worm node and detects the intrusion by comparing both the information's. It checks for fields like worm node number, port number, time of intrusion and type of attack.

7.2 An IDS (Intrusion Detection System) Algorithm of detecting the Jamming Attack

Jamming attack Misbehavior of nodes may cause serve damage, even fails whole of the network. In proposed work we create a new protection scheme against Jamming attack misbehavior of nodes. The IDS node identified the attacker on the basis of profile of nodes in network. The attacker profile is not match with normal nodes and in case of attacker only infection is found.

In this scheme first analyze the routing behavior of malicious nodes against the behavior of Jamming attack and flooding attack, then apply the proper well planned security scheme on it that block the whole misbehavior of malicious nodes and enhance the network performance.

```
Create node =IDS ; //  Node as a IDS
Set routing Protocol = AODV;
If ((node in radio range) && (next hop !=Null))
{
 Capture load (all_node)
 Create normal_profile();
Create abnormal_table();
If ((load < = max_limit) && (new_profile == normal_profile()))
 {
No attack found;
                    }
Else
        {
        Attack in network;
        If (new_attack == abnormal_table())
        {
        Block the infected node ;
Find_attack_info (node_number,
pkt_type,time)
        Captute infection type ;
        Infect percentage ;
        Port_number ;
        }
}
        Else
        {
node out of range or destination unreachable;
        }
}
```

8. Simulation & Result Analysis

8.1 Network Simulator: We simulate our work using network simulator -2 generally known as NS-2.

The entire simulations were carried out using ns 2.31 network simulator which is a discrete event driven simulator developed at UC Berkeley as a part of the VINT project. 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. A large number of institutes and researchers use, maintain and develop NS2. NS2 Versions are available for Linux, Solaris, Windows and Mac OS X.

8.1.1 Simulation Paramete: Let's get Evaluation Parameter like Number of nodes, Dimension, Routing protocol, transport layer protocol, application layer data and maximum speed of mobile nodes etc. According to below table 8.1 we simulate our network.

Table 8.1: Simulation parameter

Number of nodes	50
Dimension of simulated area	800×600
Routing Protocol	AODV, Blackhole AODV, IDS AODV
Simulation time(seconds)	50
Transport Layer	TCP, UDP
Traffic type	CBR, FTP
Packet size(bytes)	1000
Number of traffic connections	10
Maximum Speed (m/s)	Random

8.1.2 Data Collection and Implementation Strategy: For data collection and implementation we will use Network Simulator-2(NS-2). The description about simulation environment is as follows:

Network simulator 2 (NS2) is the result of an on-going effort of research and development that is administrated by researchers at Berkeley [59]. It is a discrete event simulator targeted at networking research. It provides substantial support for simulation of TCP, routing, and multipath protocol.

The simulator is written in C++ and a script language called OTcl2. Ns uses an Otcl interpreter towards the user. This means that the user writes an OTcl script that defines the network (number of nodes, links), the traffic in the network (sources, destinations, type of traffic) and which protocols it will use. This script is then used by ns during the simulations. The result of the simulations is an output trace file that can be used to do data processing (calculate delay, throughput etc) and to visualize the simulation with a program called Network Animator.

8.1.3 Feasibility Study: The feasibility studies are useful for both users and analyst. The feasibility studies decide the constraints and the assumed attitudes in the system development. The three key feasibility considerations in the development of this work are: -

- **Technical Feasibility:** As various project management systems have been developed so far and as well as available today so this work is technically feasible.
- **Time Feasibility:** Considering the total design and coding of the project which includes implementation of complex tasks such as the graphical representation and tree structure, the total time required for the development of this system is approximately 4 months.
- **Cost Feasibility:** This project is economically feasible as far as the cost is considered.

8.1.4 Performance Measure

We simulate our result on the basis of following parameter.

- **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.

- **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.
- **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.
- **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.

8.1.5 PDR Analysis of Jamming Attack and Proposed Security Scheme: The Packet Delivery Ratio(PDR) performance of jamming attacker and security scheme is describe in this graph. By jamming attacker technique the attacker drop of packet is humiliates the percentage ratio of data receiving. Before the attacker drop of packets is maximum and after using jamming attacker the drop of packets ratio is minimum .

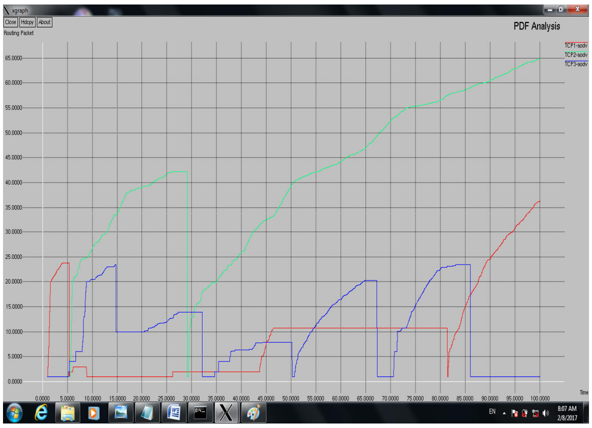

Fig:2 PDR Analysis

8.1.6 Throughput Analysis of Jamming Attacker and Security Scheme: In this graph Throughput Analysis of Jamming Attacker and Security Scheme the attacker aim is to drop the data packets or to hold the resources for that the communication is affected. The packets forwarding capacity of jammer attacker is a strictly increase with period of time. Overall related work the packets ratio drop is maximum and security are minimum and proposed work the packets ratio in minimum drop and and security is maximum.

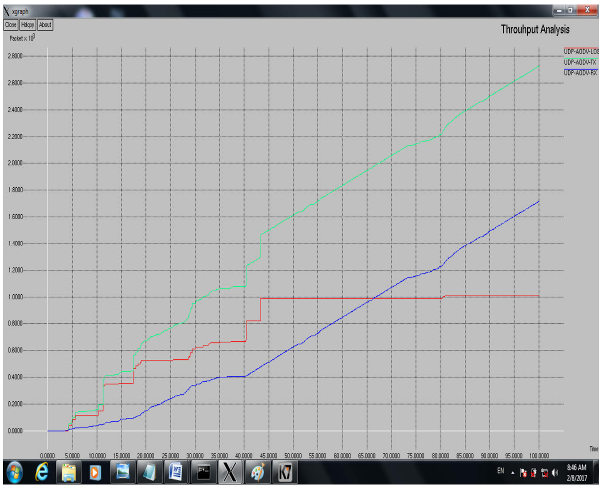

Fig: 3 Throughput Analysis

8.1.7 Overall Summery

Table 8.1: Overall Summery

SEND	6832.00
RECV	6055.00
ROUTING PAKETS	3394.00
PDF	88.63
NRL	0.56
Average e-e delay(ms)	385.75
No. of dropped data(packets)	711

8.2 Structure of NS2: NS2 is built using object oriented language C++ and OTcl (object oriented variant of Tool Command Language). NS2 interprets the simulation scripts written in OTcl. The user writes his simulation as an OTcl script. Some parts of NS2 are written in C++ for efficiency reasons. The data path (written in C++) is separated from the control path (written in OTcl). Data path object are compiled and then made available to the OTcl interpreter through an OTcl linkage. Results obtained by ns2 (trace files) have to be processed further by other tools like Network Animator (NAM), PERL, AWK script etc. The performance of ad-hoc network is found by varying the traffic load and mobility of nodes. Traffic generation models are used to study the effect of traffic load on the network and mobility generation models are used to study the effect of mobility of nodes.

8.2.1 TCL: *ns* is an object oriented simulator, written in C++, with an OTcl interpreter as a frontend. The simulator supports a class hierarchy in C++ (also called the compiled hierarchy in this document), and a similar class hierarchy within the OTcl interpreter (also called the interpreted hierarchy in this document). The two hierarchies are closely related to each other; from the user's perspective, there is a one-to-one correspondence between a class in the interpreted hierarchy and one in the compiled hierarchy. The root of this hierarchy is the class Tcl Object. Users create new simulator objects through the interpreter; these objects are instantiated within the interpreter, and are closely mirrored by a corresponding object in the compiled hierarchy.

The interpreted class hierarchy is automatically established through methods defined in the class TCL Class. User instantiated objects are mirrored through methods defined in the class TCL Object. There are other hierarchies in the C++ code and OTcl scripts; these other hierarchies are not mirrored in the manner of TCL Object.

In order to setup the simulation network in ns2, you must use a language called Tcl. It actually uses an extension of Tcl, called OTcl, which incorporates objects into Tcl. access an interactive OTcl prompt by running the ns command (from a Linux shell or Cygwin on Windows, for example). In the following examples everything in Tcl is a command followed by a number of arguments, which are separated by whitespace. Every line in your OTcl code will be based on the template command arg1 arg2 ... argn. For example, there is a puts command that takes two arguments. The first argument is the output stream and the second argument is what should be printed to that output stream. Try the following:

```
% puts stdout Hello
Hello %
```

The command here is puts, the first argument is stdout, and the final argument is Hello. Now, let's say we want to print "Hello World" instead of Just "Hello".

9. Conclusion & Future Work: In Manet the nodes are continuously interchanging the data in network. however the data is within the foam of large variety of packets flooded in network then in this case the network is affected from jamming attack. The proposed mechanism eliminates the requirement for a centralized authority which is not much in wireless detector network due to their self organizing nature. The results demonstrate that the presence of a jamming attack will increase the packet loss and routing load within the network significantly. The proposed PPS mechanism protects the network through a self organized, totally distributed and localized procedure. The attacker has infected the actual performance of network however due to that remaining performance of network is also affected. The PPS security theme showing the better results in presence of attacker.

In future we tend to projected the security scheme against blackhole attack. The blackhole attacker is that the packet dropping attacker and this attacker is drop all the packets send by sender to destination.

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