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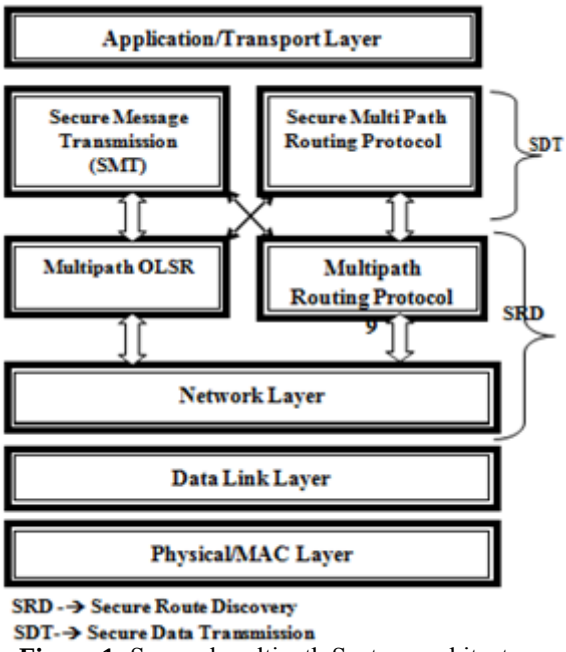

Figure 1: Secured multipath System architecture

The figure below shows the work flow model of our proposed system.

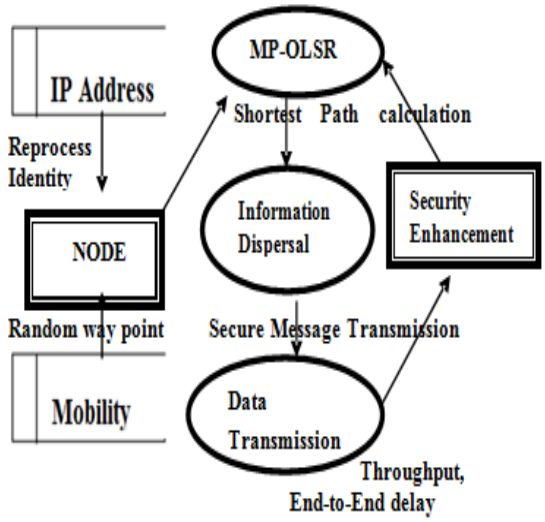

Figure 2

4. Simulation Setup

The evaluation is carried out with the Network simulator (NS-2) by performing several experiments that illustrate the performance of the system. The simulation parameters like number of nodes, terrain range etc. as given in table 1 along with their respective values are used to examine the performance of the network. The values can be adjusted according to requirements in this file.

Table 1: Simulation Parameters

Parameter	*Value*	*Description*
Simulator	NS2	Simulator Tool
Simulation time	300	Maximum execution time
Terrain Dimensions	500 X 500	Physical area in which the nodes are placed in meters
Number of Nodes	25	Nodes participating in the network
Traffic Model	CBR	Constant Bit Rate link used
Node Placement	Uniform	Node placement policy
Mobility	0-10(m/s)	Speed of node
Performance Parameter	Through put, End to End delay, Packet ratio, Speed	Parameter consider in evaluating
Routing Protocol	MP-OLSR	Routing protocol used

5. Performance Analysis

We compare the performance of MP-OLSR and Secure MP-OLSR according to the following performance metrics. In the below figure we have shown system model where the nodes send data from one node to other node.

***A)* Packet Delivery Ratio (PDR):**

Packet Delivery Ratio (PDR) is number of successfully delivered legitimate packets to number of generated legitimate packets. A higher value of PDR indicates that most of the packets are being delivered to the higher layers and is a good indicator of the protocol performance.

PDR=Total number of packets received (TPR)/Total number of packets sent (TPS)

As we can see from the result, during the attack, the target node in OLSR can hardly receive data packets. Our approach can achieve much higher packet delivery ratio. From these experiments, itis easy to see that in the secured OLSR protocol, attackers can easily prevent a target node from receiving data packets from other nodes and it also indicates that our approach can provide effective protection against the malicious attack.

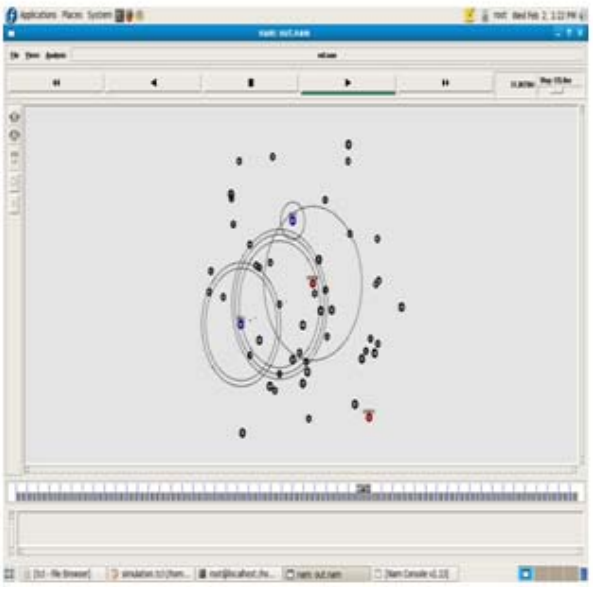

Figure 3: System model

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B) **Average End-to-end delay (AED):**

End-to-end delay indicates how long it took for a packet to travel from the CBR source to the application layer of the destination. It represents the average data delay an application or a user experiences when transmitting data.

AED = Total Delay (TD) / PacketReceived (PR)

From the figure 2 we can say that average end to end delay is more or less same in the both MP-OLSR and secured MP-OLSR because before while sending the data, it has to be encrypted and has been sent in multiple paths.

C) Package Dropping Rate:

It shows the number of data packets which were dropped during their journey to destination. From the figure 3, we can say that the packet drop is less because the data can be reconstructed from the redundancy even thought small amount of packet loss occurs.

D) Node Mobility:

Node mobility indicates the mobility speed of nodes.

Figure 4: Speed Vs Packet Delivery Ratio

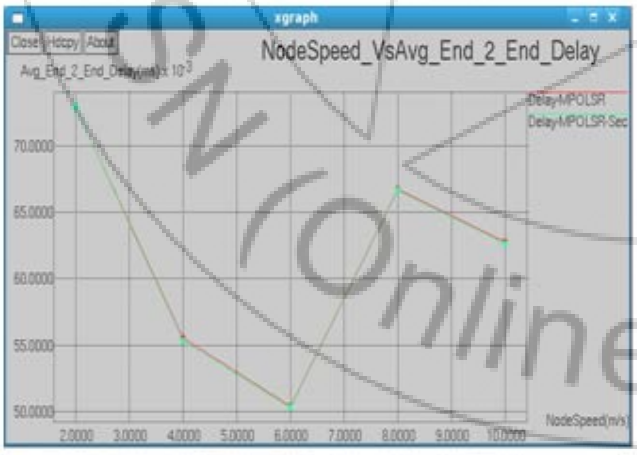

Figure 5: Speed Vs Average End to End delay

Figure 7: Speed Vs Packet Drop

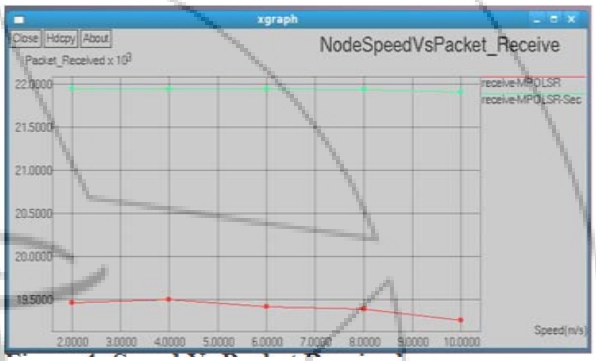

Figure 8: Speed Vs Packet Received

6. Conclusion

In this paper, we have presented a Secured Multi Path OLSR along with secured message transmission in multipath. Our approach is based on enhancing the security while sending the data from source to destination in multiple paths. Comparison was based on of packet delivery ratio, routing overhead incurred, average end-to-end delay and number of packets dropped, we conclude that Secured Multi Path OLSR performs better than the normal MP-OLSR even when the attacks have been introduced.

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