

A Survey on Hybrid Security Mechanism for MANET

Dhruvi Goswami, Krunal Panchal

Student, Information Technology engineering, L.J.I.E.T, Gujarat, India

Assistant Professor, Computer engineering, L.J.I.E.T, Gujarat, India

ABSTRACT

MANET is a type of network where the group of mobile devices generates the network without any kind of Infrastructure. In MANET mobile nodes cooperatively forward the packet to the nodes which is not in its direct range. Any node is free to join and leave the network when they want. Due to its self-configuration and infrastructure less characteristics it is very vulnerable to different types of attacks. There are two types of problems in this kind of network is network performance and security. Proposed technique provides secure data transmission in MANET. Technique involves hybrid cryptography; it uses symmetric key cryptographic technique (MAES) for data encryption and asymmetric key cryptographic technique (ECC) for session key encryption. For integrity it also uses MD5 algorithm.

Keywords: MANET, Hybrid cryptography, MAES, ECC, MD5

1. Introduction

1.1 MANET

Wireless ad hoc network is new generation Communication Technology. That is basically invented for those conditions where the management of huge infrastructure and maintenance is costly. That suffers from various performance and security issues. MANET is defined by its own characteristics: it is self-organizing, Distributed operation, Multi hop routing. In mobile communication topologies are dynamically created due to the ad hoc nature of the network infrastructure and mobility. ^[4]

MANET does not require any additional infrastructure and the nodes act as end device as well as routers. The lack of infrastructure and the open architecture, in which no restriction is placed on nodes to join or leave the network, make MANET vulnerable to a variety of attacks.

The attacks can be on the data packets payload or on routing protocol control packets. The attacks on the control packet payload are with the aim of misdirecting the data packets or denial of service. The routing protocols in the MANET assume a trusted behavior of the nodes and therefore have not incorporated any security measures. Securing of routing protocols is not only difficult but very complex. It is an active area of research and is being done by either use of cryptographic techniques or by monitoring the behavior of the nodes. ^[5]

MANET does not require a fixed network infrastructure; every node works as both a sender and receiver. The security solutions for wireless networks are to provide security services, such as authentication, confidentiality, integrity. ^[9]

1.2 AODV Routing Protocol

Ad hoc on-demand distance vector (AODV) routing protocol uses an on demand approach for finding routes, that is, a route is established only when it is required by a source node for transmitting data packets.^[5]

In an on demand routing protocol, the source node floods the RouteRequest packet in the network when a route is not available for the desired destination. It may obtain multiple routes to different destinations from a single RouteRequest.

It uses a destination sequence number (DestSeqNum) to determine an up-to-date path to the destination. When an intermediate node receives a RouteRequest, it either forwards it or prepares a RouteReply if it has a valid route to the destination. The validity of a route at the intermediate node is determined by comparing the sequence number at the intermediate node with the destination sequence number in the RouteRequest packet.

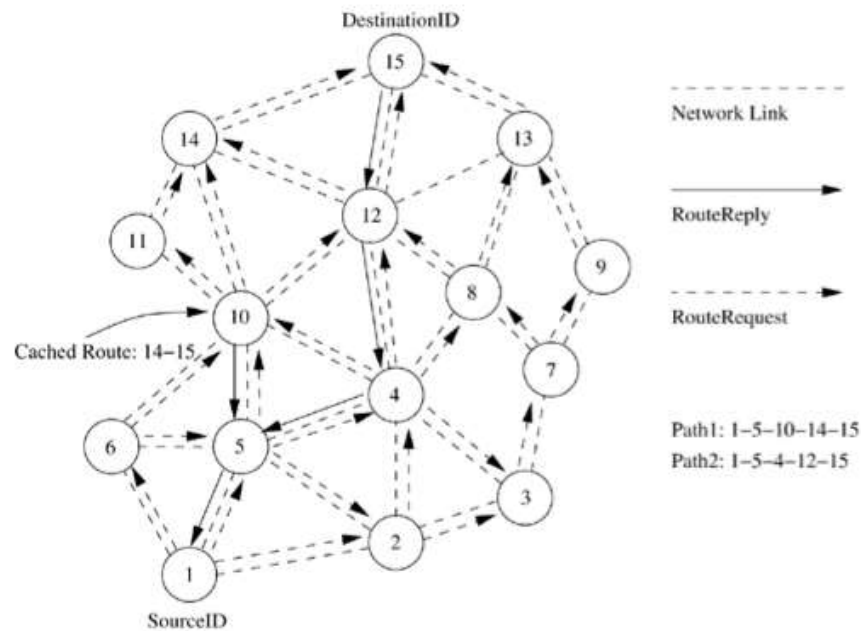


Figure 1: Route Establishment in AODV^[6]

1.3 MAES Algorithm

Modify AES is to provide less computation and better security for data. The modify AES algorithm adjusts to provide better encryption speed. In Modified-AES the block length and the key length are specified according to AES specification: three key length alternatives 128, 192, or 256 bits and block length of 128bits.^[7]

To overcome the problem of high calculation skip the Mixcolumn step and add the permutation.

A single 128-bit block is the input to the encryption and decryption algorithms. This block is a 4×4 square matrix consisting of bytes. This block is copied into the state array. The state array is modified at each stage of encryption or decryption. Similarly the 128-bit key is also depicted into a square matrix. The 128bit key is expressed into an array of key schedule words: each word is of four bytes. The totals key schedule words for ten rounds are 44 words; each round key is similar to one state.^[7]

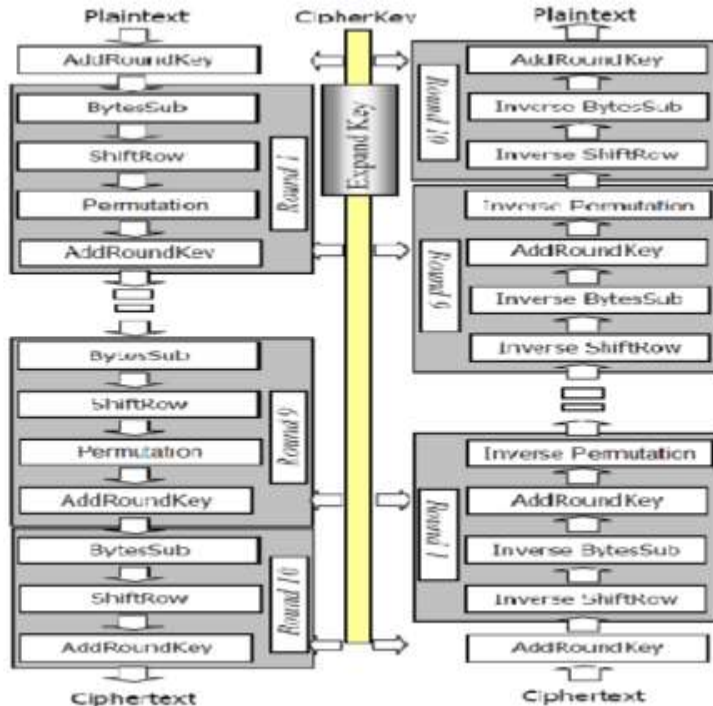


Figure 2: Modified advanced encryption standard^[7]

The functions Substitution Bytes and ShiftRows are also interpreted as 128 bits whereas the Permutation function takes 64 bits. Then divide the consequential bits of ShiftRows function into two parts of 64 bits and then take each part of 64 bits as input of permutation tables and shift bits one by one according to the table.

1.4 ECC (Elliptical Curve Cryptography)

ECC is one of the fastest computational methodologies with smaller key sizes, lower power consumption topology, lower bandwidth.

The equation of elliptical curve is given as,

$$y^2 = x^3 + ax + b \text{ [8]}$$

In the encryption process a selected number d with a range of n is selected.

$$Q = d * p \text{ [8]}$$

Where, Q is the public key,

d is the selected random number private key with

p as the curve point

Let m be the message sent with the implementation details.

The selected k is represented within k from 1 to $(n-1)$.

Two cipher texts are generated based on the analysis they are,

$$C_1 = k * p \text{ [8]}$$

$$C_2 = M + k * Q \text{ [8]}$$

After encrypting the message the information should be sent to the original form which is represented as,

$$M = C_2 - d * C_1 \text{ [8]}$$

2. Related work

2.1 Hybrid Cryptography for Malicious Behavior Detection and Prevention System for MANETs^[1]

Shreyas S. Jathe , Vidya Dhamdhare^[1] proposed to reduce network overhead, packet delivery ratio caused by Digital Signature Algorithm we are using the concept of (RSA) Rivest, Shamir Adleman and (DES) Data

Encryption standard algorithm. Compared to present approaches Hybrid Cryptography determining higher malicious action detection rates, in certain states while does not greatly affected the network performances.^[1]

Packet dropping and hacking is the most critical concern in MANET's when security issues are considered. For that we have given IDS named Hybrid Cryptography with some new techniques and methods for prevention of attacks, which are added.^[1]

2.2 Improved acknowledgement intrusion detection system in MANETs using hybrid cryptographic technique^[2]

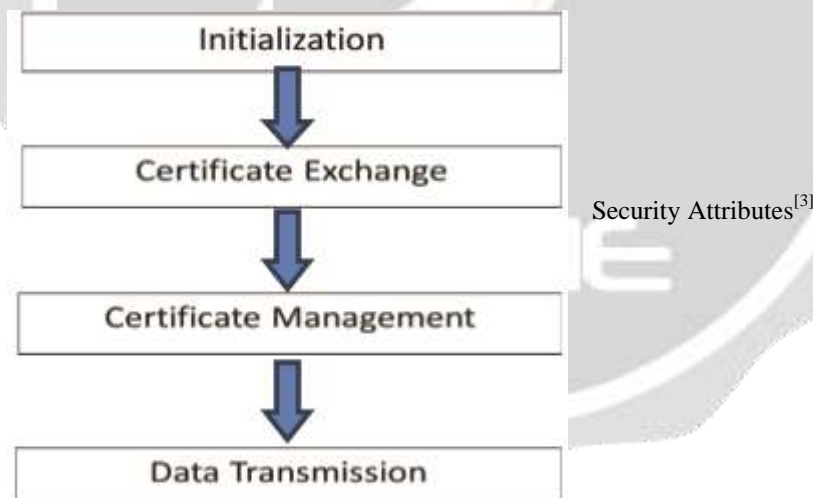
Trupti Patil , Dr.Bharti Joshi^[2] proposed this paper introduces a hybrid technique to reduce Network Overhead, which is caused by the digital signature and provides security to a network. Here hybrid technique of RSA and AES is used, to make the system more secure as RSA algorithm is used to communicate with the receiver through session key and AES algorithm is used to encrypt this session key which makes the key more secure as a result enhancing the security level.^[2]

A hybrid cryptographic technique which is proposed in the system uses RSA and AES algorithms. The combination of both algorithms in a protocol uses multiple ciphers with their advantages. In this proposed system, we present a new circle symmetric algorithm to encrypt the plaintext and asymmetric algorithm RSA with AES are used to encrypt the symmetric key.^[2]

2.3 A secure and efficient certificate based authentication protocol for MANET^[3]

Utpal Kumar Verm, Sushil Kumar, Ditipriya Sinha^[3] proposed this paper presents a robust and secure mechanism for authentication of nodes in the MANET. The proposed authentication protocol is based on certificate exchange between the nodes. This protocol also uses digital signature with a hash function to maintain the authenticity of certificates. In addition, it also has less computation and communication overhead, which makes it suitable for MANETs.

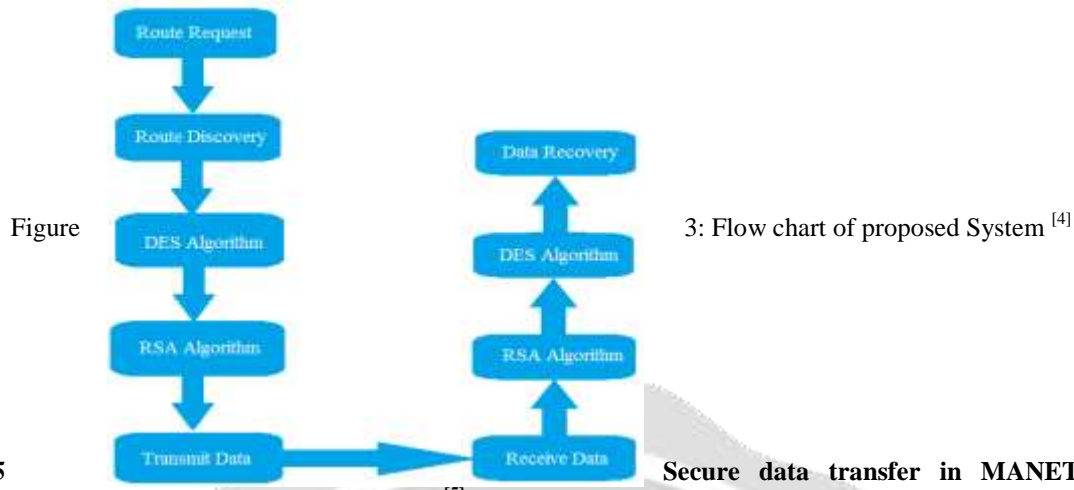
Figure 2:



This paper presents an authentication protocol for MANET, which is based on certificate exchange. In this proposed protocol, certificate exchange is mutual and all the nodes in the MANET have a considerable role in the authentication of new node.^[3]

2.4 Secure data transmission on MANET by hybrid cryptography technique^[4]

Ashish sharma, Dinesh Bhuriya, Upendra singh^[4] proposed system to provide security and increase performance in MANET, we have applied SAODV protocol and our solution uses Hybrid Cryptography Technique (DES, RSA Algorithms) on SAODV. This paper presents comparison based on simulation of AODV, SAODV routing protocol of MANET with Different parameters like energy, packet delivery ratio and throughput.



2.5 Secure data transfer in MANET using symmetric and asymmetric cryptography [5]

Raj Kamal Kapur, Sunil Kumar Khatri^[5]In this paper we have proposed a technique which provides secure transmission of data. The secure transmission of data over MANET is a critical requirement. The technique involves encryption of data using symmetric cryptographic technique, and also generating the digital signature of the data using the asymmetric cryptographic technique from the Hash of the data. The encrypted data is transmitted through the network to the destination where the received data and digital signature of the data are validated using symmetric and asymmetric cryptography. The data on validation is accepted thus ensuring secure data transmission. The proposed technique provides confidentiality, integrity, authenticity and non-repudiation to the data.

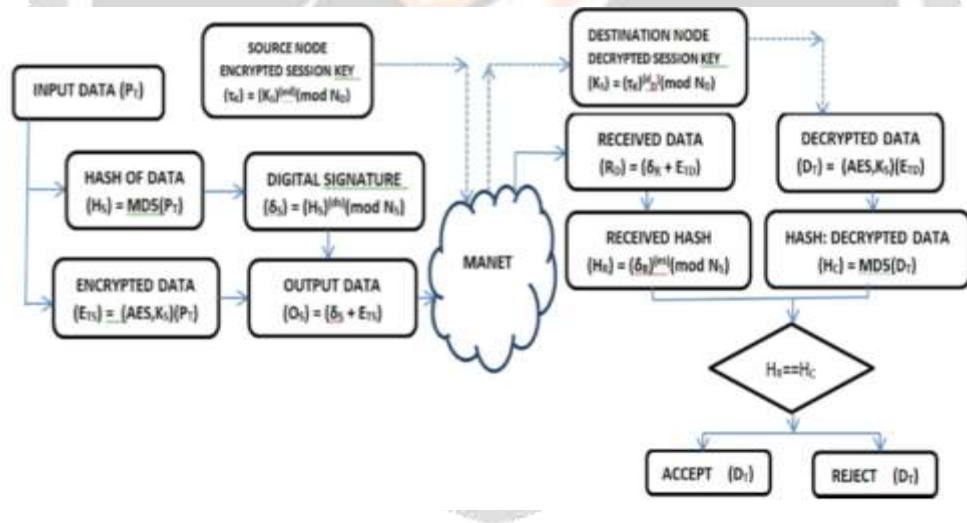


Figure 4: Architecture of Secure Data Transmission [5]

3. Comparative Study

Sr No.	Paper Title	Method Used	Advantage	Disadvantage
1	Secure Data Transmission on MANET by Hybrid Cryptography Technique	RSA, DES	Throughput and packet delivery ratio is high	Energy is low

2	Secure Data Transfer in MANET Using Symmetric and Asymmetric Cryptography	MD5, AES, RSA	It protect the data from snooping, modification, relay and fabrication	Consumes more resources and increase latency
3	A Secure and Efficient Certificate based Authentication Protocol for MANET	Certificate and digital signature	Provide authentication	Certificate exchange is manual
4	Hybrid Cryptography for Malicious Behavior Detection and Prevention System for MANETs	RSA, DES, Digital signature	Intense anticipation and it is difficult for attacker to break network	Acknowledgment might create traffic.
5	Improved Acknowledgement Intrusion Detection System in MANETs Using Hybrid Cryptographic Technique	ZRP, RSA, AES	Use of Intra-routing reduces network overhead	Network formulation is difficult.

4. Conclusion

The Primary focus is to improve security in MANET which is very vulnerable to different attacks. Cryptographic system is very much in trend to provide security to networks. So in proposed flow chart work is derived on Hybrid cryptosystem to make Ad-Hoc network secure. And also considered other parameters like energy, overhead to make system more secure and energy efficient.

5. References

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