Study and Literature or Research Survey of Routing Protocols and Routing Attacks in MANET with Different Security Technique in Cryptography for Network Security

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Abstract -Security is a most important issue on mobile ad hoc networks under various attacks. Mobile ad hoc network is categories of infrastructure less network. In this network each node connected without any central device and without topology. In this network routing protocols are classified into three different categories with different properties as reactive, proactive and hybrid protocols. Routing attacks in network defines a malicious node called attacker node, attacks on secret information in network. Routing attacks is classified into two categories internal and external attacks. External attacks can be divided into two categories as passive and active attacks. Most security techniques used in the network, can be classified into two categories symmetric called private and asymmetric called public key algorithm. In this research survey we study the various routing protocols, various routing attacks in mobile ad hoc networks (MANET) with different security techniques in cryptography.

Keywords*-Mobile adhoc network (MANET), OLSR, FSR, Black Hole Attack, FPGA*

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1. *INTRODUCTION*

Wireless network is a network, based on unguided media. In this network all nodes are connected without guided media. In this network, the communication between all node using air or signal medium.

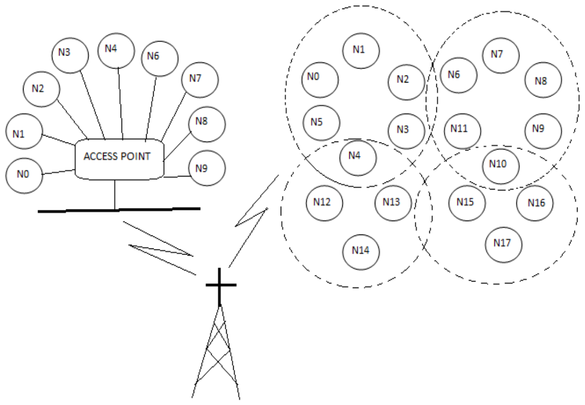

Figure1.Infrastrucure and Infrastructure less Network in Wireless Network

There are two category of Wireless Network-

1.1. Infrastructure Network.

1.2. Infrastructure less or Ad hoc Network.

1.1. Infrastructure Network

In infrastructure network, all nodes connected to a central device called Access point. This network is based on infrastructure and certain topology. Example of this network is Wireless Sensor Network.

1.2. Infrastructure less Network

In Infrastructure less Network, all nodes connected to without central device. This network have no any pre existing infrastructure this reason called to this network is Ad hoc Network. Example of this network is Mobile Ad Hoc Network (MANET).

2. *LITERATURE SURVEY*

Sagheer Ahmed and Amar Singh (2016), Describe the various Routing protocol in MANET and compare between three protocols as Reactive, Proactive and Hybrid, basis of various parameter as routing philosophy, routing schemes, routing overhead, latency, scalability level. The Result of this literature survey is theoretical and select the protocol according to requirements. Future works of this survey paper is focus on security of MANET protocol under various routing attack because security is the main challenge on MANET [11].

Opinder Singh, Dr. Jatinder Singh and Dr. Ravinder Singh (2016), Describe the detail study of various routing attacks in MANET. Due to open nature of mobility the security is most challenge in Mobile ad hoc network (MANET) under various routing attack. Future Work is Focus on Security in MANET and provides a security under various attacks [12].

A Arjuna Rao, K Sujatha, A Bhavana Deepthi and L V Rajesh (2017), focus to security using various cryptography technique for security and compare between symmetric algorithms such as AES and Blowfish and Asymmetric algorithms such as RSA and ECC used for authentication. The result is ECC (Elliptic curve Cryptography) is better than RSA. Future work is focus on other security techniques in Cryptography [13].

Suman Bala, Er.Amandeep Singh Bhandari and Dr. Charanjit Singh (2017), Describe the various routing protocols in MANET and various Routing attacks in MANET with various protection schemes. In this research paper, describe the different type of routing attack present in the MANET as the functioning of various security protocols. With the help of security protocols we find a better solution of these kinds of various attacks. In future work, these security protocols are implemented in MANET to reduce the effect of the attacks [14].

Smriti Jain and Nakka Marline Joys Kumari (2017), Analyze and surveyed the trust based security routing with trust in multiple perspectives in MANET. Due to open nature it is difficult to maintain trust based security in MANET, it is the main challenge of MANET. In this survey analyses all the possible trust management for secure routing with necessary protocols. The trust to be computed and social communities makes use of it to validate the measurements of a trust [15].

3. MANET (MOBILE AD HOC NETWORK)

Mobile Ad hoc Network is a without infrastructure based network in wireless network. In this network all nodes is connected to without any topology and without pre existing infrastructure. In this network all nodes is communicate without any central device called access point.

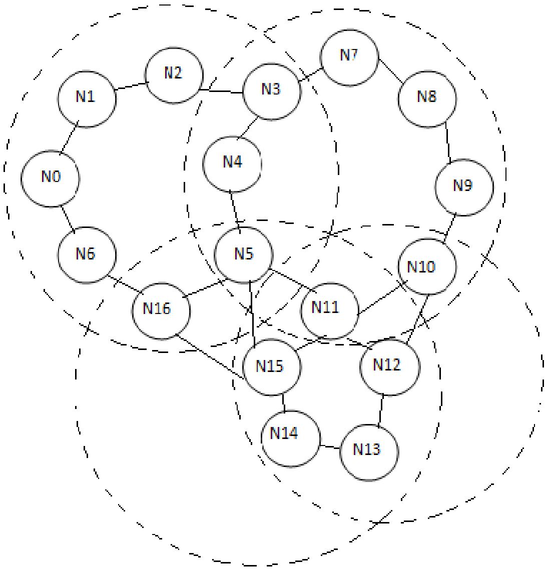

Figure 2.Mobile Ad Hoc Network in Wireless Network

3.1 *Category of MANET Routing Protocol*

In this research work we discuss the following category of MANET

3.1.1. Flat Vs Hierarchical Routing Protocol

A flat routing protocol is a protocol based on contention based scheduling, and each network ID in this represented individually in routing table and the network ID have no network or subnet structure. Example of flat routing protocol is OLSR (Optimized Link State Routing) protocol.

A hierarchical routing protocol is a protocol based on reservation based scheduling, and group of network ID in this protocol represented in a single routing table and entry through route summarization. In this protocol the network ID have network or subnet or subnet structure. Example of hierarchical routing protocol is FSR (Fisheye State Routing) Protocol.

3.1.2. Unicast Vs Multicast Protocol

A unicast routing protocol is a protocol based on one to one communication. In this protocol the communication between one source node and one destination node. Example of unicast protocol is AODV (Ad hoc On demand Distance Vector) protocol.

A multicast routing protocol is a protocol based on one to many communications. In this protocol the communication between one source node and many destination node. Example of multicast protocol is AOMDV (Ad hoc On -demand Multicast Distance Vector) protocol.

3.2. Classification of Routing Protocol in MANET

The classification of routing protocols into three main routing protocols in Mobile ad hoc Network.

3.2.1. Reactive or On - Demand Routing Protocol
3.2.2. Proactive or Table Driven Routing Protocol
3.2.3. Hybrid Routing Protocol

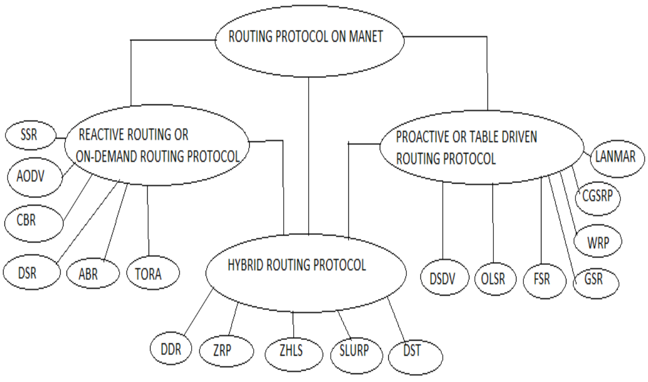
ROUTING PROTOCOL ON MANET
REACTIVE ROUTING OR ON-DEMAND ROUTING PROTOCOL
PROACTIVE OR TABLE DRIVEN ROUTING PROTOCOL
HYBRID ROUTING PROTOCOL
SSR
AODV
CBR
DSR
ABR
TORA
LANMAR
CGSRP
WRP
GSR
FSR
OLSR
DSDV
DDR
ZRP
ZHLS
SLURP
DST

Figure 3.Classification of Routing protocol in MANET.

3.2.1. Reactive or On - Demand Routing Protocol

Reactive routing protocol is also known on demand routing protocol, because when the new route demand arises in routing protocol, these protocols find a routing path and routing table. These protocols only find a route to the destination node when there is a need to send data. In these protocols route planned before the transfer of data packets between the source node and destination node. Examples of On - Demand routing protocols as

A. SSR (Signal Stability Routing) Protocol

SSR protocol is an On - Demand based routing protocols, that tries to discover stronger routes between source node and destination nodes, based on signal strength and location stability of the nodes in MANET.

B. AODV (Ad Hoc On – Demand Distance Vector) Routing Protocol

AODV is an On – Demand routing protocol based on distance vector routing, used when demand arises to new route in ad hoc network, When a link failed in ad hoc network, the affected node between sender node and destination node received a notification. By this notification information the affected nodes cancels the entire route by using failure link. This protocol is mostly capable of unicast, broadcast and multicast routing.

C. CBR (Cluster Based Routing) Protocol

CBR protocol is an On – Demand protocol based on clustering, the structure of nodes in this protocol in form of hierarchy. The nodes in this protocol are grouped into individual clusters.

D. DSR (Dynamic Source Routing) Protocol

DSR protocol is an On – Demand routing protocol based on source routing. This protocol define two mechanism first is Route Discovery and Second is Route Maintenance. When source node wants to send packet, DSR specifies the route of the packets between source node to destination node. DSR protocol is not suitable for large networks.

E. ABR (Associatively Based Routing) Protocol

ABR protocol is an On – Demand protocol, based on source initiated routing protocol, means there is no need for periodic route updates. This protocol defines Degree of association stability, which means define a new type of routing metric for mobile ad hoc networks.

F. TORA (Temporarily Ordered Routing Algorithm) Protocol

TORA protocol is an On – Demand protocol, belongs to link reversal routing algorithms. In TORA protocol each nodes are established by a Directed Acyclic Graph (DAG) between source node and destination node.

3.2.2. Proactive or Table Driven Routing Protocol

Proactive routing protocols are also known as table driven routing protocols, because each nodes in these protocols maintains one or more routing tables with containing routing information to every other node in other network between source node and destination node. Examples of table driven routing protocols as

A. DSDV (Destination – Sequenced Distance – Vector) Routing Protocol

DSDV protocol is a table driven protocol, is based on Bellman – Ford routing algorithm. In this protocol used a distance vector routing algorithm. in this protocol, every node contain a routing table in network, each routing table is maintain entry of node such as destination, number of hops and sequence number. This protocol provides a single path to a destination, with select a distance vector routing in shortest path routing algorithm.

B. OLSR (Optimized Link State Routing) Protocol

OLSR protocol is a table driven protocol, based on link state routing mechanism. This protocol define in Network with HELLO (Hello message), TC (Topology control), MPR (Multipoint relay), and HNA (Host or Network announcement). OLSR protocol is a unipath protocol based on multiple point relay in network. In this protocol, when source node sends the data to destination node, data is rotate in multiple points with HELLO message using unipath.

C. FSR (Fisheye State Routing) Protocol

FSR protocol is a table driven protocol, based on link state routing and flooding algorithm. This protocol is a multipath protocol, provide a special type of multiple path structure called fisheye. FSR avoids the traffic overhead in the ad hoc network, using by forwarding the update messages.

D. GSR (Global State Routing) Protocol

GSR protocol is a table driven protocol, based on link state routing algorithm and similar to DSDV protocol. it use the link state routing algorithm but improves it, by avoiding and finding of routing message. In this protocol, each node maintains a topology table, a neighbour list, a next hop table, and a distance table on network.

E. WRP (Wireless Routing Protocol)

WRP is a table driven protocol based on distance vector routing algorithm. In this protocol each node maintain a distance table, a routing table, a link cost table, and a message retransmission list. This protocol generally belongs to path finding algorithm and calculate a shortest path. This protocol reduces the number of overhead cases in network.

F. CGSR (Cluster Gateway Switch Routing) Protocol

CGSR is a table driven protocol based on flat routing protocol, having a more clusters in ad hoc network. This protocol is used to DSDV protocol for basic routing. In this protocol, all nodes are aggregated to clusters and cluster heads. This protocol has same routing overhead as DSDV. In this protocol, all nodes in communication range of the cluster head is belong to clusters.

G. LANMAR (Landmark Ad Hoc Routing) Protocol

LANMAR protocol is a table driven routing protocol, based on link state routing protocol. It is a hierarchical routing protocol, and extends to FSR protocol. This protocol collects a feature of FSR protocol as link state, table driven, multipath and hierarchical. This protocol used the concept of landmark or large structure from LANMAR. This protocol is basically developed for static WAN, the purpose for routers whose close or neighbours router within a certain number of hops contain routing entries for that type of router.

3.2.3. Hybrid Routing Protocol

Hybrid routing protocol is combination of on – demand and table driven protocol, this protocol is used for large network in MANET. In this protocol used route discovery mechanism of on - demand and table maintenance mechanism of table – driven protocol. Examples of hybrid routing protocols as

A. ZRP (Zone Routing Protocol)

ZRP is a hybrid routing protocol, based on link state routing. This protocol is a hierarchical protocol and used for wide range in MANET. In this protocol, nodes have routing zone, routes are immediately available and the node lies outside the routing zone. ZRP protocol determined on-demand with the help of any existing on demands protocol in order to determine a route for the specific destination in network.

B. ZHLS (Zone – Based Hierarchical Link State) Protocol

ZHLS is a hybrid routing protocol based on link state routing protocol. This protocol is a hierarchical routing protocol. In this protocol the structure of nodes is hierarchical, in which the network is subdivided into non overlapping zone.

C. SLURP (Scalable Location Updates Routing Protocol)

SLURP is a hybrid routing protocol based on link state routing. This protocol is a hierarchical protocol similar to ZHLS. In this protocol nodes are arranged in non overlapping zones. SLURP protocol is reduced the cost of maintaining routing information by eliminating a global route discovery on the network.

D. ***DST (Distributed Spanning Tree Based Routing*) Protocol**

DST is a combination of on demand and table driven protocol, based on link state routing. This is a hierarchical protocol, based on spanning tree. In this protocol nodes are arranged in hierarchical structure and nodes in network are sequenced a number of spanning trees. In this protocol structure each tree have two types of nodes first is route node and second is internal nodes.

E. DDR (Distributed Dynamic Routing) Protocol

DDR is a hybrid routing protocol, based on link state routing protocol. DDR protocol is tree based protocol and hierarchical routing protocol. In DDR protocol do not require any root node as compare to DST protocol. The arranged of nodes in this protocol in hierarchical structure on MANET.

4. ROUTING ATTACKS IN MANET

A Routing attacks in MANET, defines through a malicious or attacker node on network. An attacker, attacks in network using malicious node and read the secret information or data and change the information or data.

4.1. Classification of Routing Attacks in MANET

The Routing attacks in MANET classified into two parts.

4.1.1. Internal Attacks.

4.1.2. External Attacks.

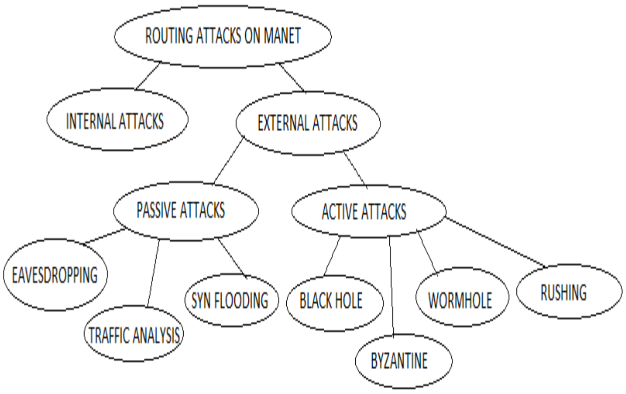

Figure 4.Classification of Routing Attacks on MANET

4.1.1. Internal Attacks

An Internal attacks is an attack, directly attack to node which presented in network and links between them. This attack is a danger attacks, broadcast wrong type of routing information to another nodes. Internal attack is a danger attack compare to external attack, difficult to handle and occurs on more trusted nodes.

4.1.2. External Attacks

An External attacks is an attack, prevent the network from normal communication and produces routing overhead to network. In this attack, attacker aims disturb nodes and propagate fake reply or fake routing information in network. An Examples of External attack is black hole attack, eavesdropping etc.

4.2. Classification of External Routing Attacks on MANET

An external routing attack is classified into two categories as

4.2.1. Passive Attacks.

4.2.2. Active Attacks.

4.2.1. Passive Attacks

A passive attack is an external attack, does not alternate transmit the message and not disrupt proper operation of network. In this attack, includes the unauthorized user called attacker, attacks on a secret information and only read message not change a data or message. Examples of passive attacks as

A. Eavesdropping Attack

Eavesdropping attack is a passive attacks, that aim to find a confidential or secret information during communication between sender and receiver on ad hoc network. The secret information may be public or privet key of sender or receiver or any cipher text or password.

B. Traffic Analysis Attack

Traffic analysis attack is a passive attacks, the attacker tries on communication path between source and destination. In this way attacker found the amount of data which is travel between the route of source and destination.

C. Syn Flooding Attack

Syn flooding attack is a passive attack based on denial of services attack. In this attack, attacker node attacks when group of nodes shows multiples address.

4.2.2. Active Attacks

An active attack is an external attacks, destroy and exchanged the data and disturbing the functionality of nodes in the network. In this attack malicious node called attacker node, attacks on secret information. This attacker read, exchanged and modification of information in network. Examples of active attacks as

A. Black hole Attack

A black hole attack is an active attack refers to intermediate node called attacker or malicious node between source and destination. In this attack malicious node or intermediate node attacks on network and this attacker node change information, data packets is absorbs and give a fake reply to source node.

B. Byzantine Attack

A byzantine attack is an active attack, involves multiple attacker or malicious node works in network, and degrade the performance of protocols in network. This attack degrade the various performance as packet dropped, create loop, packet forwarding and choose non optimal path of various routing protocols.

C. Wormhole Attack

A wormhole attack is an active attack, involves two attacker nodes, make a tunnel, this tunnel called wormhole. This attack in two attacker nodes, one node capture routing traffic at one point on the network and shares communication link between the malicious node then selects injects tunnel traffic back into the network, second node is distort topology in networks.

D. Rushing Attack

Rushing attack is an active attack based on wormhole attack. In this attack two malicious or attacker node used a tunnel procedure between source and destination. When source node send the data packets to the destination node, then attacker attacks on the data packets and forward to destination. Attacker performs duplicate route and then send the duplicate message to the receiver again and again.

5. CRYPTOGRAPHY IN NETWORK SECURITY

Cryptography is an art and science provides a security key to network. This is a most important method used on network for security. When source send the data to destination, the protection is an important part of networking, then we create a cipher text and protect the data using cryptography techniques. Most important concept used in cryptography as

Plain Text: The original data or message, understood by the source called plain text.

Cipher Text: When plain text converted by sufficient scheme of cryptography in form of coded message or secret message, called cipher text.

Encryption: The encoding process of converting plain text to cipher text called encryption.

Decryption: The decoding process or reverse process or back process of converting cipher text to plain text called decryption.

Key: Key is an important part of cryptography performs encryption and decryption for security.

5.1. Classification of Cryptography Security Techniques in MANET

There are two types technique in cryptography as

5.1.1. Symmetric Cryptography

5.1.2. Asymmetric Cryptography

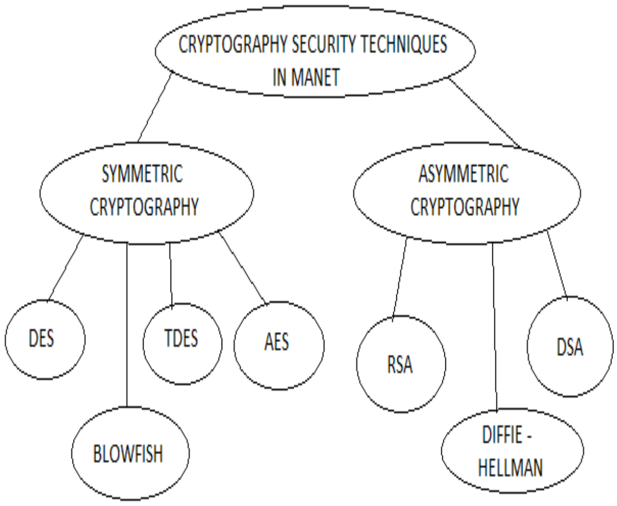

Figure 5.Classification of Cryptography security techniques in MANET for Network security

5.1.1. Symmetric Cryptography

Symmetric cryptography algorithm is a class of algorithm in cryptography, also known as private key cryptography. This key used for both encoding to plain text called encryption, and decoding to cipher text called decryption. Examples of symmetric key cryptography as

A. DES (Data Encryption Standard) Algorithm

DES algorithm is a private key algorithm, has two inputs one is plain text and second is cipher text or key. The length of plain text is 64 bits and cipher text or key is 64 bits. DES released FIPS – 46 in the federal register in 1997 by the NIST (National Institute of Standards and Technology).

B. Blowfish Algorithm

Blowfish is a private key algorithm, replaced DES, splits plain text or message into 64 bit blocks with individually them. Blowfish has 64 bit block size and key length 32 bit to 448 bit and 16 rounds. In this each round consist of a key dependent permutation, and key and data dependent substitution.

C. TDES or 3DES (Triple Data Encryption Standard) Algorithm

TDES is a private key algorithm, used three cipher text or key and three execution of data encryption standard (DES) algorithm. In this algorithm has three functions with sequence of encryption – decryption – encryption. The length of different cipher text or key in TDES 168 bit. The encryption algorithm used in TDES same as DES.

D. AES (Advanced Encryption Standard) Algorithm

AES is a private key cryptography algorithm, approved by FIPS (Federal Information processing Standard) , issue FIPS-197 in the federal register. AES uses three block ciphers, 128- bit blocks of data. Length of standard key used 128 bits, 192 bits, and 256 bits by AES algorithm.

5.1.2. Asymmetric Cryptography

Asymmetric cryptography algorithm is a class of algorithm in cryptography, also known as public key cryptography. This technique requiring two keys, one is secret called private, and second is known anybody called public key. This technique is based on mathematical function rather than functions of substitution and permutation. Examples of asymmetric cryptography as

A. RSA (Rivest Shamir Adleman) Algorithm

RSA algorithm is a public key cryptography, developed by Ron Rivest, Adi Shamir and Leonard Adleman in 1978, based on number theory and most popularly used in network. This algorithm is best of public key cryptography, for digital signature or key exchange or encryption of block of data. In RSA algorithm, encryption key is public and decryption key is private. It used a variable size encryption block and a variable size key.

B. Diffie – Hellman Algorithm

Diffie-Hellman algorithm is a public key cryptography, based on discrete logarithms. This algorithm used to help exchanged a secret key securely between two users, which can be used for subsequent encryption of messages. This algorithm is a key exchange, also called exponential key exchange, a method of digital encryption.

C. DSA (Digital Signature Algorithm)

DSA algorithm is a public key algorithm is a FIPS standard for digital signature. It is used by signature, to generate a digital signature on data, and by a verifier to verify the authenticity of the signature.

6. CONCLUSION AND FUTURE WORK

In this survey we tried to describe a various routing protocols, routing attacks and various security techniques in MANET. Routing protocols in MANET is divided into three protocols as on – demand, table driven and hybrid protocol. Routing attacks in MANET is divided into two attacks as internal attack and external attack. External attack is divided into two types as passive attack and active attack. Various cryptography security techniques used in networks, two categories of security algorithm used in cryptography as symmetric and asymmetric algorithm. Symmetric algorithm is known as private and asymmetric algorithm is known as public key cryptography. Future works is these various protocols implements under various routing attacks and provide a protection using various cryptography security techniques.

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