Volume 4, Issue 12, December 2014 ISSN: 2277 128X
International Journal of Advanced Research in Computer Science and Software Engineering
Research Paper
Available online at: www.ijarcsse.com

A Survey of Mobile Ad-Hoc Network Protocols and Its Tools

[1]L. Indhumathi*, [2]Dr. R. Vadivel
[1]MPhil Research Scholar, [2]Assistant Professor
Department of Information Technology, Bharathiar University,
Coimbatore, India

Abstract - Mobile Ad-hoc Network – (MANET) is a collection of wireless devices, it can be set up instantly anytime at anywhere without the needs of any pre-existing network infrastructure model. MANET is an autonomous system in which mobile devices are connected through wireless links and free to move randomly and often act as host and also as router at the same time. This paper discussed about mobile ad-hoc network, its characteristics, challenges, application, protocols and its performance related metrics. Most of the MANET related protocol designs and its related models are simulated through simulator tools like NS2, OMNET++, OPNET, GloMoSim, JSim and QualNet and its results of performance are taken into consideration.

Keywords: MANET, Simulator Tools, MANET Protocols, Mobile Ad-hoc Network, MANET Tools.

I. INTRODUCTION

Mobile ad-hoc networks (MANETs) are an infrastructure-less, dynamic network consisting of a set collection of wireless mobile nodes that communicate with each other without the use of any centralized authority [1]. It is a collection of independent mobile nodes that can communicate to each other via radio waves. The mobile nodes that area unit in radio range of each other can directly communicate, whereas others would like the help of intermediate nodes to route their packets.

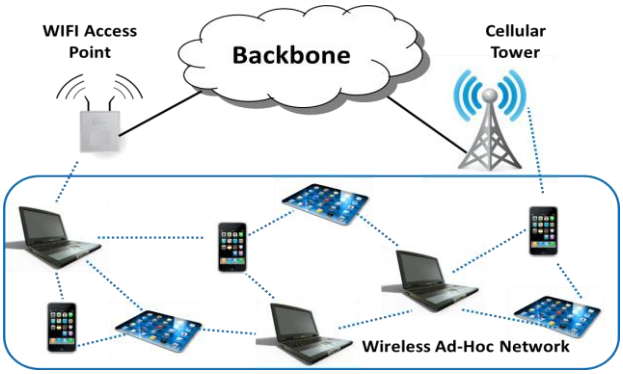

Fig.1 Mobile Ad-Hoc Network

A Mobile ad-hoc network is a self-configuring network of wireless devices connected by wireless links. It is a distributed network that does not require centralized management, and each host works not only solely as supply source and a sink but also as a router. This type of dynamic network is especially used in rescue operations, wherever an infrastructure cannot be support. The wireless nodes can form a network at any time that used to communicate with one another. During this manner each node will establish a connection to every other node that is included in the MANET.

II. CHARACTERISTICS OF MANET

Mobile ad-hoc network is a collection of autonomous and mobile elements such as laptop, smart phone, tablet PC etc. The mobile nodes can dynamically self-organize in arbitrary temporary network topology. It is an infrastructure less model, thus it does not have the clear boundary. The characteristics of MANET are *infrastructure less, wireless links, node movement, power limitation, dynamic topologies, self-configuring, bandwidth-constrained, variable capability links, energy-constrained operation and limited physical security [2]*. MANETs is vulnerable to various kinds of security attacks like worm whole, black hole, dashing attack etc. [1].

III. MANET APPLICATIONS

Mobile ad-hoc networking can be applied anywhere and there is little or no communication infrastructure or the existing infrastructure is expensive or inconvenient to use. The set of applications for MANET is various starting from large-scale to small and also static networks are forced by constrained by power sources. Besides the heritage applications that move from traditional infrastructure environment into the ad hoc context, a good deal of recent services can generate the new environment. Some of the typical applications that include [3, 4]

A. Military Battlefield

Ad-hoc networking would enable the military to take advantage of commonplace network technology to maintain an information network between the soldiers, vehicles, and military info headquarters.

B. Commercial Sector

Ad-hoc can be used in emergency rescue operations for disaster relief efforts, e.g. in fire or earthquake. Emergency rescue operations should occur must take place where non-existing or damaged communications infrastructure and rapid deployment of a communication network is required. Alternative industrial eventualities scenarios embrace e.g. ship-to-ship ad-hoc mobile communication, social control, etc.

C. Local Level

Ad-hoc networks can autonomously link an instant and temporary multimedia network using notebook computers or palmtop computers to spread and share information among participants at e.g. conference or schoolroom.

D. Personal Area Network

Short-range MANET can simplify the intercommunication between various mobile devices such as an organizer, a laptop, and a cell phone.

E. MANET-VoVoN

A MANET is an enabled version of JXTA peer-to-peer, modular, open platform is employed to support user location and audio streaming over the JXTA virtual overlay network.

IV. MANET CHALLENGES

The following challenges show the inefficiencies and limitations, which have to be overcome in a MANET environment.

A. Limited wireless transmission range

In wireless networks the radio band will be limited and hence data rates it can offer are much lesser than what a wired network offers. This needs the routing protocols in wireless networks to use the bandwidth always in an optimal manner by keeping the overhead as low as accomplishable. The restricted transmission vary together imposes a constraint on routing protocols in maintaining the topological info. Particularly in MANETS attributable to frequent changes in topology, maintaining the topological data information at all nodes involves more control overhead that, in turn, ends up in additional information measure wastage [5].

B. Broadcast nature of the wireless medium

The broadcast nature of the radio channel, that is transmission created by a node is received by all nodes within its direct transmission vary. Once a node is receiving information, no other node in its neighborhood, except the sender, ought to transmit. A node should get access to the shared medium only when its transmissions do not affect any ongoing session. Since multiple nodes might contend for the channel simultaneously, the likelihood of packet collisions is quite high in wireless networks [4]. Even the network is prone to hidden terminal problem and broadcast storms.

C. Packet losses due to transmission errors

Ad-hoc wireless networks experiences a much higher packet loss due to factors such as high bit error rate (BER) in the wireless channel, increased collisions attributable to the presence of hidden terminals, presence of interference, location dependent rivalry, unidirectional links, frequent path breaks .this case typically ends in frequent route, and the inherent fading properties of the wireless channel [5].

D. Mobility-induced route changes

The network topology in an ad-hoc wireless network is highly dynamic due to the movement of nodes hence an on-going session suffers frequent path breaks. This case typically results in frequent route changes. Thus quality management itself is very vast research topic in ad hoc networks.

E. Battery constraints

This is one of the limited resources that form a major constraint for the nodes in an ad-hoc network. Devices utilized in these networks have restrictions on the power source in order to maintain immovable, size and weight of the device. By increasing the ability and processing ability makes the nodes bulky and less portable. Therefore solely MANET nodes must optimally use this resource.

F. Ease of snooping on wireless transmissions

The radio channel used for ad-hoc networks is broadcast in nature and is shared by all the nodes within the network. Data transmitted by a node is received by all the nodes within its direct transmission range. Therefore offenders will simply track the information data being transmitted in the network. Here the necessity of confidentiality can be violated if an adversary is also able to interpret the data gathered through snooping [9].

V. MANET ROUTING PROTOCOLS

A routing protocol is used to transmit a packet to a destination via number of nodes and numerous routing protocols have been proposed for such kind of ad- hoc networks. These protocols realize a route for packet delivery and to the correct destination. The routing protocol specifies how routers in a network share information with each other and report changes. A routing protocol shares this information first among immediate neighbors and then throughout the network. Some of the ad-hoc network routing protocols are,

A. Proactive protocols

Networks are utilizing the proactive routing protocol, each node maintain one or more tables representing the entire topology of the network. These tables area unit updated frequently so as regularly in order to maintain up-to-date routing information from each node to every different node. To take care of up-to-date routing data, topology data has to be exchanged between the nodes on a regular basis which in turn leads to relatively high overhead on the network. The advantage is that routes will always be available on request.

1. Destination-Sequenced Distance-Vector (DSDV)

DSDV is proposed by Perkins and Bhagwat. The Destination-Sequenced Distance-Vector (DSDV) [6] Routing protocol is based on the idea of the classical Bellman-Ford Routing Algorithm with certain improvements such as making it loop-free. The distance vector routing is a smaller strong robust than link state routing due to problems such as count to infinity and bouncing impact. In this, each device maintains a routing table containing entries for all the devices in the network. Therefore on the routing table totally in order to keep the routing table completely updated at all the time each device periodically broadcasts routing message to its neighbor devices. Once a neighbor device receives the broadcasted routing message and knows the current link cost to the device, it compares this worth and also the corresponding value stored in its routing table. If changes were found, it updates the worth and re-computes the distance of the route which includes this link in the routing table.

2. Optimized Link State Protocol (OLSR)

Clausen and jacquet proposed the Optimized Link State Protocol, a point-to-point proactive protocol that employs an efficient link state packet forwarding mechanism called multipoint relaying [7, 8]. It optimizes the pure link state routing protocol. Optimizations are done in two ways: by reducing the size of the control packets and by reducing the number of links used for forwarding the link state packets. Here each node maintains the topology information about the network by periodically exchanging link-state messages among the other nodes. OLSR is relies on the subsequent three mechanisms: neighbor sensing, efficient flooding and computation of an optimal route using the shortest-path algorithm. Neighbor sensing is that the detection of changes in the neighborhood of node. Each node determines an optimal route to every known destination using this topology information and stores this information in a routing table. The shortest path algorithm is then applied for computing the optimal path. Routes to every destination are immediately available when data transmission begins and remain valid for a specific period of time till the information is expired.

3. Wireless Routing Protocol (WRP)

The Wireless Routing Protocol, as proposed by Murthy and Garcia-Luna-Aceves [9], is a table-based protocol similar to DSDV that inherits the properties of Bellman- Ford Algorithm. The main goal is maintaining routing information among all nodes in the network regarding the shortest distance to every destination. Wireless routing protocols (WRP) is a loop free routing protocol. WRP may be a path-finding rule with the exception of avoiding the count-to-infinity problem by forcing each node to perform consistency checks of predecessor information reported by all its neighbors. Every node within the network uses a set of four tables to maintain more accurate information: Distance table (DT), Routing table (RT), Link-cost table (LCT), Message retransmission list (MRL) table. In case of link failure between 2 nodes, the nodes send update messages to their neighbors. WRP belongs to the class of path-finding algorithms with an important exception. It counters the count-to-infinity problem by forcing each node to perform consistency checks of predecessor information reported by all its neighbors. This eliminates looping situations and enables faster route convergence when a link failure occurs.

4. Source Tree Adaptive Routing (STAR)

The STAR protocol [10] is also based on the link state algorithm. Every router maintains a supply tree that could be a set of links containing the popular preferred paths to destinations. This protocol has considerably reduced the amount of routing overhead disseminated into the network by using a least overhead routing approach (LORA), to exchange routing data. The optimum routing (ORA) approach obtains the shortest path to the destination while LORA minimizes the packet overhead. Garcia–Luna–Aceves and Spohn propose STAR where each node maintains a source tree which contains preferred links to all possible destinations. Close supply trees exchange data to maintain up-to-date tables.

5. Fisheye State Routing (FSR)

Pei et al. propose the FSR protocol [11] which takes inspiration from the ‘‘fisheye’ ’technique of graphic information compression proposed by Klein rock and Stevens. When adapted to a routing table, this technique means that a node maintains accuracy distance and path quality information about its immediate vicinity, but the amount of detail retained decreases with the distance from the node. Each node considers a number of surrounding fish-eye scopes, areas

which can be reached with 1, 2 ... hops. FSR reduces the size of the update messages by updating the network information for nearby nodes at a higher frequency than for their mote nodes, which lie outside the fisheye scope. This makes FSR additional ascendible to massive networks than the protocols.

6. Cluster Head Gateway Switch Routing (CGSR)

The Cluster head Gateway Switch Routing protocol differs from the other protocols as it uses hierarchical network topology, rather Than flat topology. As projected by Chiang, it organizes nodes into clusters, which coordinate among the members of each cluster entrusted to a special node named cluster head. Least Cluster Change (LCC) algorithm [12] is applied to dynamically elect a node as the cluster head. Each node must keep a cluster member table where it stores the destination cluster head for each mobile node in the network. These cluster member table's unit square measure broadcast by each node periodically using the DSDV rule. CGSR is associate in nursing extension of DSDV and thus uses it as the underlying routing scheme. It has the similar overhead as DSDV. However, it modifies DSDV by employing a cluster (hierarchical) routing approach to route traffic from source to destination. CGSR improves the routing performance by routing packets through the cluster heads and gateways.

B. Reactive protocols

Proactive routing protocols, reactive routing protocols do not build the nodes initiate a route discovery process until a route is needed. This ends up in higher latency than with proactive protocols, but lower overhead. [13].

1. Ad Hoc on-Demand Distance Vector Routing (AODV)

AODV is basically an improvement of DSDV. But, AODV could be a reactive routing protocol instead of proactive. It minimizes the quantity of broadcasts by creating routes based on demand that is not the case for DSDV. Once any supply node desires to send a packet to a destination, it broadcasts a route request (RREQ) packet. The neighboring nodes successively broadcast the packet to their neighbors and the process continues until the packet reaches the destination. Throughout the method of forwarding the route request and intermediate nodes record the address of the neighbor from which the first copy of the broadcast packet is received. This record is hold is in their route tables that help for establishing a reverse path. If extra copies of constant RREQsquare measure, these packets are discarded. [14]

2. Associatively-Based Routing (ABR)

ABR protocol defines a new type of routing metric "degree of association stability" for mobile ad hoc networks. During this routing protocol, a route is chosen selected based on the degree of association stability of mobile nodes. Every node sporadically generates beacon to announce its existence. The receiving the beacon message, a neighbor node updates its own associatively table. For every beacon received, the associatively tick of the receiving node with the beaconing node is hyperbolic. A high value of associatively tick for any particular beaconing node means that the node is relatively static. Associatively tick is reset once any neighbouring node moves out of the neighborhood of any other node [14].

3. Dynamic Source Routing (DSR)

Dynamic Source Routing (DSR) is a reactive protocol based on the source route approach. In Dynamic Source Routing (DSR) protocol is based on the link state algorithm in which source initiates route discovery on demand basis. The sender determines the route from supply to destination and it includes the address of intermediate nodes to the route record within the packet. DSR was designed for multi hop networks for small Diameters. It is a beaconless protocol throughout during which no HELLO messages are exchanged between nodes to notify them of their neighbors in the network [14].

4. Cluster Based Routing Protocol (CBRP)

In Cluster Based Routing Protocol (CBRP), unlike the on-demand routing protocols, the nodes are organized in a hierarchy [15]. The nodes in CBRP are grouped into clusters. Each cluster has a cluster-head that coordinates the information transmission within the cluster and to other clusters. The advantage of CBRP is that solely cluster heads exchange routing data, so the amount of management overhead transmitted through the network is far less than the traditional flooding strategies. The protocol suffers from temporary routing loops. This is because some nodes may carry inconsistent topology information due to long propagation delay.

5. Temporally-Ordered Routing Algorithm (TORA)

The Temporally-Ordered Routing Algorithm (TORA) was developed by Park and Corson. Temporarily ordered routing algorithm (TORA) is highly accommodative, loop-free, distributed routing algorithm based on the concept of link reversal. It uses directed acyclic graphs (DAG) to define the routes either as upstream or downstream. This graph permits TORA to provide higher better route aid for networks with dense, large population of nodes [16]. But to supply this feature TORA want needs synchronization of the nodes which limits the application of the protocol.

TORA is a fairly complicated protocol but what makes it unique and prominent is its main feature of propagation of control messages only around the point of failure when a link failure happens .compared, all the opposite protocols want need to re-initiate a route discovery when a link fails but TORA would be able to patch itself up around the point of failure.

C. Hybrid routing protocol

This protocols belonging to this category combine the best features of the above two class Nodes at intervals a precise distance from the node concerned or within a particular geographical region are said to be within the routing zone of the given node. For routing at intervals this zone a table-driven approach is employed. For nodes that area unit settled on the far side this zone an on-demand approach is used.

1. Zone Routing Protocol (ZRP)

ZRP is suitable for wide variety of MANETs, particularly for the networks with massive span and diverse mobility patterns. During this protocol, every node proactively maintains routes within a local region that is termed as routing zone. Route creation is finished employing a query-reply mechanism. For making completely different zones within the network, a node first has got to apprehend UNagency its neighbors are. A neighbor is outlined as a node with which direct communication can be established, which is, among one hop transmission range of a node. Neighbor discovery data is employed as a basis for Intra-zone Routing Protocol (IARP). Instead of blind broadcasting, ZRP uses a question management mechanism to scale back reduce route query traffic by directing query messages outward from the query source and away from covered routing zones. During the forwarding of the query packet, a node identifies whether or not it is coming back from renowned neighbor or not. If yes, then it marks all of its renowned neighboring nodes in its same zone as coated. The question is thus relayed till it reaches the destination. The destination successively sends back a reply message via the reverse path and creates the route. [17].

2. Zone-Based Hierarchical Link State routing (ZHLS)

ZHLS is based on hierarchical structure in which the network is divided into non-overlapping zones. According to Joe and Lu [18], each node is assigned one unique node ID and a zone ID, that area unit calculated using geographical information. Hence the network follows a two-level topology structure: node level and zone level. Respectively, there are two types of link state updates: the node level LSP (Link State Packet) and the zone level LSP. A node level LSP contains the node IDs of its neighbors in the same zone and the zone IDs of all alternative zones. A node sporadically broadcast its node level LSP to all other nodes in the same zone. Therefore, through periodic node level LSP exchanges, all nodes in a zone keep similar node level link state info. Before transmission, the supply node first checks its intra-zone routing table. If the destination lies in its zone, the routing information is already present. Otherwise, the source sends a location request to all other zones through gateway nodes, which in turn replies with a location response containing the zone ID of the desired destination. The header of the data packets originated from the source contains the zone ID and the node ID of the destination node.

3. Sharp Hybrid Adaptive Routing Protocol (SHARP)

SHARP [19] adapts between reactive and proactive routing by dynamically varying the amount of routing information shared proactively. This protocol defines the proactive zones around some nodes. The quantity of nodes in an extremely specific proactive zone is determined by the node-specific zone radius. All nodes within the zone radius of a selected node become the member of that particular proactive zone for that node. If for a given destination a node is not present within a particular proactive zone, reactive routing mechanism (query-reply) is used to establish the route to that node. Proactive routing mechanism is employed among used within the proactive zone. Nodes among the proactive zone maintain routes proactively only with respect to the central node. During this protocol, proactive zones area unit created automatically if some destinations are frequently addressed or sought within the network. The proactive zones act as collectors of packets that forward the packets expeditiously to the destination, once the packets reach any node at the zone vicinity.

4. Neighbor-Aware Multicast Routing Protocol (NAMP)

NAMP [20] is a tree-based hybrid routing protocol, which utilizes neighborhood information. The routes in the network are built and maintained using the traditional request and reply messages or on-demand basis. This hybrid protocol uses neighbor information of two-hops away for transmitting the packets to the receiver. If the receiver is not within this range, it searches the receiver using dominant pruning flooding method [21] and forms a multicast tree using the replies along the reverse path. Although the mesh structure is known to be more robust against topological changes, the tree structure is healthier in terms of packet transmission.

NAMP targets to achieve less end-to-end delay of packets, it uses the tree structure. There are mainly three operations addressed in NAMP: Multicast tree creation, Multicast tree maintenance and connection and leaving of nodes from the multicast group. All the nodes in the network keep neighborhood information of up to two-hop away nodes. This neighborhood info is maintained using a proactive mechanism. Periodic hello packet is used for this. To create the multicast tree, the source node sends a flood request packet to the destination with data payload attached. Secondary forwarder list is used for repairing any broken route in the network. In fact, link failure recovery is one in every of the greatest advantages of NAMP.

VI. MANET TOOLS

A. Network Simulator 2

In 1996-97, NS version 2 (NS-2) was initiated based on a refactoring by Steve McCann. Use of Tcl was replaced by MIT's Object Tcl (Octal), an object-orientednon-standardTcl. The core of NS-2 is additionally written in

C++, but the C++ simulation objects are linked to shadow objects in OTcl and variables can be linked between both language realms. Simulation scripts square measure written within the OTcl language, an extension of the Tcl scripting language [22].

NS-2 is a discrete event simulator which provides support for simulation of TCP, routing, and multicast protocols over wired and wireless (local and satellite) networks. It is the foremost common network machine used by researchers. The Network machine began as a variant of the REAL network simulator in 1989 and has evolved over the past years.

NS-2 is written in C++ and is based on two languages: C++ which is used to extend the simulator (i.e. to outline protocol behaviours), and OTcl, an object-oriented extension of Tcl developed by David Weather all as part of the VUsystem project at Massachusetts Institute of Technology, which is used for scenario configuration, manipulation of existing C++ objects, periodic or triggered actions, etc.

B. Network Simulator 3

A team led by Tom Henderson, Martyr poet, Sally Floyd, and Sumit Roy, applied for and received funding from the U.S. National Science Foundation (NSF) to create replacement for ns-2, referred to as called ns-3. This team collaborated with the Planate project of INRIA at Sophia Ant polis, with Mathieu Leakage because the package software leads, and fashioned a replacement open source project.

In the process of developing ns-3, it absolutely was determined to utterly completely abandon backward-compatibility with ns-2. The new simulator would be written from scratch, using the C++ programming language. Development of ns-3 began in July 2006. A framework for generating Python bindings (pybindgen) and use of the Waf build system were contributed by Gustavo Carencro.

The first release, ns-3.1 was made in June 2008, and subsequently the project continued creating making quarterly software releases, and a lot of recently has stirred to three releases per annum. Ns-3 created its eighteenth release (ns-3.18) in the third quarter of 2013[26].

C. OMNeT++

OMNeT++ [23] [24] (Objective Modular Network Test bed in C++) is an open supply, separate event machine tool written in C++. OMNET++ could be a general-purpose machine capable of simulating any system composed of devices interacting with one another. OMNeT++ supports wireless and mobile simulations within OMNeT++. This support is alleged to be fairly incomplete. OMNet++ is for academic and educational use. OMNeT++ [28] provides a component-based, hierarchical, standard and protrusile architecture. Components, or modules, square measure programmed in C++ and new ones are developed using the C++ class library which consists of the simulation kernel and utility classes for random number generation, statistics assortment, topology discovery etc. New modules may be derived from basic object classes like module, gate or connection. A high-level language called Network Description (NED) is used to assemble individual components into larger components and models. The simulator includes modules for Application Layer and Network Layer of OSI model as well as a Network Interface Card module which encapsulates MAC and PHY layers.

D. GloMoSim

GloMoSim [25] is a scalable simulation environment for wireless network systems. It is being designed exploitation parallel discrete-event simulation capability provided by PARSEC [26]. Most network systems are currently built using a layered approach that is similar to the OSI layer network architecture. The set-up is to make GloMoSim employing a similar layered approach. Normal genus APIs are going to be used between the various simulation layers. This can enable integration of models developed at different layers by different individuals. The goal is to make a library of parallelized models that can be used for the evaluation of a variety of wireless network protocols. The projected protocol stack can embrace will include models for the channel, radio, MAC, network, transport, and higher layers. The flexibility to use GloMoSim in a very parallel environment distinguishes it from most other wireless network simulators

E. JSIM

J-Sim has been developed entirely in JAVA. This, coupled with the autonomous component architecture, makes J-Sim very platform-neutral, extensible, and reusable surroundings. J-Sim additionally provides a script interface to allow integration with different script languages such as Perl, tcl, or python [27].

In the current release, we have fully integrated J-Sim with a Java implementation of the Tcl interpreter (with the Tcl/Java extension), known as jacl. Instead, all the general public classes/methods/fields in Java can be accessed (naturally) in the Tcl environment. Java based simulation and animation environments support web based simulation is a rapidly emerging area of simulation research and developed.

F. OPNET

"OPNET" was Alain Cohen's (co-founder and current CTO & President) graduate project for a networking course while he was at Massachusetts institute of technology (MIT). OPNET stood for Optimized Network Engineering Tools. Alain, along with Brother Marc (co-founder and current CEO& Chairman) and classmate Steven Baraniuk, determined to commercialize the software package. The company's first product was OPNET Modeller, a software package tool for network modelling and simulation [28].

G. QualNet

QualNet communications simulation platform (QualNet) is a planning, testing and training tool that "mimics" the behaviour of a real communications network. Simulation could be a cost-effective methodology for developing, deploying and managing network-centric systems throughout their entire lifecycle. Users will value the fundamental behaviour of a network, and check combinations of network options that are likely to work. QualNet provides a comprehensive atmosphere for designing protocols, making and animating network situations, and analysing their performance [29].

In QualNet, a specific network topology is referred to as a situation. A situation permits the user to specify all the network components and conditions under which the network will operate. This includes: piece of ground details, channel propagation effects as well as including path loss, fading, and shadowing, wired and wireless subnets, network devices like such as switches, hubs and routers, the complete protocol stack of a variety of standard or user-configured network parts, and applications running on the network.

VII. MANET PERFORMANCE METRICS

MANETS uses a multiple variety of metrics to judge evaluate the performance of protocols in the network. They are:

A. Packet Delivery Fraction

The ratio of the data packets delivered to the destinations to those generated by the CBR sources is known as packet delivery fraction.

B. End-to-End Delay Network

The end-to-end delay of a path is the sum of the node delay at each node plus the link delay at each link on the path.

C. Routing overhead

It gives the total number of routing packets transmitted during the simulation. It is the ratio of routing packets to the total no. of packets generated by the supply

D. Throughput

Throughput is used to calculate the average throughput of the application traffic between the nodes.

E. Packet Loss

Amount of packets lost / dropped between the nodes due to traffic congestion and overloading in the network [30].

Packet loss = Number of loss packets / (Number of lost packet + Number of packet received successfully).

F. Packet drop

The number of data packets that are not successfully sent to the destination.

G. Average Jitter

Average jitter is the time variation between subsequent packet arrivals. This is caused by network congestion, timing drift, or route changes. For an efficient routing protocol, it should be as low as potential [31].

VIII. CONCLUSION

This paper studied and surveyed about the mobile ad-hoc network, its character, various mobile ad-hoc networks scenario applications, mobile ad-hoc network related protocols and mobile ad-hoc network supported tools. The mobile ad-hoc networks are used at the time of emergency rescue situations which is risk to use of man power. Nowadays mobile ad-hoc network is widely used for vehicle tracking, traffic management and healthcare related areas. The utilization of mobile ad-hoc network is only in the preliminary stage, still there is more areas are waiting to explore and will going evolve in future. There are some threats related to security issues are drag down and make some huddles to use the mobile ad-hoc network in effective manner. The trust based connectivity mechanism will bring some basic level of security for transferring the data between the source and destination safely. To overcome the basic security issues will bring tremendous changes in the usage of mobile ad-hoc network**.**

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