A number of methods have been discussed to improve the quality of service of mobile ad hoc network to achieve efficient routing and reduced energy consumption. Few of them are discussed in this section.

Jiwa Abdullah [1] presented QOSRGA routing protocol for MANET with a small population, specialized encoding, initialization, crossovers, mutations, fitness selections and route search using genetic algorithm with multiple constraints. The nodes are mobile and must move randomly. The QOSRGA routing protocol has focused on finding the best QoS route in order to optimize the design of MANET routing protocols. The effect of maximum node velocity on the protocol performances has been completed and it conclusively proved that QOSRGA had the potential to be the protocol for MANET.

Aydin Guney, Baris Atakan and Ozgur B. Akan [2] took the first step towards designing a mobile ad hoc molecular nanonetwork (MAMNET) with electrochemical communication, that is based on, collision based molecular communication. The nanonetworks are designed to accomplish such as drug delivery and health monitoring. In MAMNET, the intermittent connectivity is introduced by the mobility of nanomachines and infestations. They evaluated the performance of MAMNET using numerical analysis, and concluded that, MAMNET achieves high throughput adequately.

In Nanoscale Communication with Molecular Arrays in Nano networks Baris Atakan [3] has proposed Molecular ARray-based COmmunication (MARCO) model in which the transmission order of different molecules is used to convey molecular information without any need for time synchronization. This model was first theoretically derived, and the intersymbol
interference and error probabilities were obtained. Based on the error probability, achievable communication rates were analytically obtained.

A Physical Channel Model and Analysis for Nanoscale Molecular communications with Forester Resonance Energy Transfer (FRET) by Murat Kuscu and Ozgur B.Akan [4] presented a novel and physically realizable nanoscale communication paradigm based on molecular communication channel comprising a single transmitter–receiver nanomachine pair and an extended version of this channel with a relay nanomachine for long-range applications.

Kristian L.Espensen, Mads K.Kjeldsen, and Lars M.Kristensen [5] discussed the Dynamic MANET On-demand (DYMO) routing protocol which is intended for use by mobile nodes in wireless multihop networks. It offers a quick adaptation to dynamic conditions, low processing and memory overhead, low network utilization, and determines unicast routes between nodes within the network.

Sadder Bella, Sagged Madame [6] designed an enhanced routing protocol specifically designed for city environment which used vehicular speed and directional density for dynamic junction selection whose simulation results exhibited an increase in the packet delivery ratio, but a decrease in end-to-end delay when compared with state of the art protocols. Bagwari.A, Raman Jee, Pankaj Joshi and Bisht.S [7] analyzed the performance of the AODV routing protocol by increasing the number of nodes and observed its effect on Quality of Service.

Jyh-Huei Chang [8] proposed an Energy Aware Cluster-Based Multipath Routing (EACMR), which formed several clusters and found energy aware node-disjoint multiple routes from the source to destination. It uses optimal routes to increase the network lifetime.

Proximity based groupcast in MANET by A.G.Kriyanov and Gim [9] emphasized on the routing of multimedia streams where the packet delivery time and loss ratio have restrictions. They designed a new model which supported groupcast based on proximity. JiaJia
Liu [10] extended the conventional two hop relay and proposed a general group-based two-hop relay algorithm with packet redundancy. In such an algorithm with packet redundancy limit and group size, each packet is delivered to at most distinct relay nodes and accepted by its destination if it happens to be a fresh packet to the destination.

In Protocol Architecture for end-to-end security between server and wireless client M. P. Sebastian [11] predicted that the upcoming generations of wireless communication would be observing a form of faultless integration made up of a variety of platforms. It would be transporting various multimedia applications such as voice, video and data with an additional protection feature.

Nilima H Masulkar, Archana A Nikose [12] proposed a method that aims to determine all node-disjoint routes from source to destination with minimum routing overhead by using Node Disjoint Minimum Interference Multipath (ND-MIM) routing protocol when one route is broken and the data is transmitted through other route.

Dongjie Zhu, Gang Cui and Zhongchuan Fu [13] designed the technique On-Demand Routing Protocol based DTN in VANET. This is a fundamental part of the future intelligence which constitutes communication between cars, and road side route. This provides operating convenience and security with people’s travel. It can transmit real time information to avoid accidents. Experimental comparison shows that DT-AODV is more suitable for VANET than other classical routing protocol.

On the Performance Analysis of AODV Protocol in Mobile Ad hoc Network, Mitali Sinha [14], Mira Rani Debbarma, Sangita Rani Bhowmik, Trina Sil, Jhunu Debbarma devised a technique which is in contrast with the topology of existing internet, where the router is essentially static. But their system consists of mobile platforms that are free to move arbitrarily.
Asha Ambhaikar, H.R. Sharma and V. K. Mohabey [15] suggested a method for solving link failure in MANET by improved AODV. As link breakage is frequent in MANET, the moving source node is able to reinitiate the Route Discovery Protocol (RDP) to find a new route to the destination using path updation. A local repair procedure is used to update the path to improve the performance.

Amirhossein Moravejosharieh, Hero Modares, Rosli Salleh and Ehsan Mostajeran [16] analysed the performance of AODV, AOMDV, DSR, DSDV routing protocols in VANET. They comprehensively compared all the routing protocols in terms of routing performance based on vehicle velocity and vehicle density.

In their research concerning the Comparative performance exploration of AODV, DSDV and DSR routing protocol in cluster based VANET environment, Yatendra Mohan Sharma and Saurabh Mukherjee [17] concluded that high speed moving road vehicles like cars, trucks, etc, in VANET behave as mobile nodes and can move in any direction with varying speeds.

Samyak Shah, Amit Khandre, Mahesh Shirole and Girish Bhole [18] evaluated ad hoc protocols with regard to the performance differentials using varying network load, mobility and network size.

Energy Efficient AODV is a routing protocol in which Dijkstra algorithm is enhanced to improve the overall performance of the network and it was proposed by Jaspreet Singh and Kartik Sharma [19]. They devised a collection of nodes connected through a wireless medium that are formed by changing topologies. Continuous change of position of nodes in this considerably drains battery charge. They used Dijkstra algorithm to improve the overall performance of the network. Here performance parameters are packet delivery ratio, throughput and energy consumption and routing overhead.
Annapurna P. Patil, Bathey Sharanya, M. P. Dinesh Kumar and Malavika J [20] selected two existing energy efficient routing protocols based on AODV each of which is based on a different energy cost metric. They evaluated the combination of two energy cost metrics and found that the performance of this protocol is more efficient than traditional AODV. The performance parameters evaluated by them are packet delivery ratio, throughput, convergence time, network life time and the average energy consumed.

Modern multimedia and real time applications consume a good deal of network resources so, there will be high flow rates and very small transfer delay. Maamar Sedrati, Azeddine Bilami and Mohamed Benmohamed [21] utilized a new variant of AODV to improve the Quality of Service in MANETs. According to them this variant gives better results than the original AODV protocol under different constraints taking into account the limited resources of mobile environments like bandwidth, energy, etc.,. This variant provides for discovering an operation for paths reconstruction that should be done from the source by determining multiple disjoint separated routes.

Nitiket N Mhala and N K Choudhari [22] have done research work on Ad hoc routing protocol using simulation only because of the difficulty in creating real time implementation. In this the developer controls the whole system but the real time implementation demands interoperation with large complex system and its components. They discussed socket based mechanism especially when AODV routing algorithm communicates changes to the IP route table and in the implementation of generic network family.

P.Periyasamy and Dr.E.Karthikeyan [23] evaluated the performance of routing protocols of unipath and multipath of AOMDV. They selected AOMDV protocol due to its edge over other protocols in various aspects such as reducing delay, routing load, etc. By
using simulation they carried out the evaluation in terms of scenario patterns like RWM, RPGM, MGM and GMM in two different traffic patterns such as CBR and TCP.

Stable AODV Routing Protocol with Energy-aware in Mobile Ad Hoc Network is a new improved routing protocol proposed by Jincheng Huang, Huihui Xiang, and Yaheng Zhang [24]. They aim to create the stable routing protocol based on hop AODV, node mobility speed and node communication state. They devised the protocol based on delayed relay program. This gave better performance on the aspects as packet transmission rate of improved protocol, control overhead and end-to-end delay.

In the wireless Ad hoc network the nodes communicate with each other and forward the data packets to other nodes in the network until they reach the destination node. However due to security vulnerabilities of the routing protocol the nodes remain unprotected to the attack of the malicious nodes. One of these attacks is the Black Hole Attack which absorbs all the data packets in the network. So, they cannot reach the destination. Romina Sharma and Rajesh Shrivastava [25] investigated and modified the AODV routing protocol to prevent Black Hole Attack on a MANET. With their algorithm they analysed network delay, throughput, network load, packets lost and end-to-end delay.

Amal. Boumedjout, Ali. Kies, Zoulkha. Mekkakia Maaza and Sidi Mohamed Senouci [26] presented behaviour comparisons of the routing protocols based on cross-layer approach among physical and network layers. MANETs multiple layer interactions allow them to exchange state information in order to achieve performance gain. They compared the functioning of the routing protocols based on cross-layer approach among the different physical and network layers. They used various protocols like AODV and OLSR. Both of them are based on Signal to Interference Noise Ratio (SINR) metric in their route discovery.
process. They found that the AODV based on SINR metric maximizes the packet delivery ratio and overhead costs compared to OLSE based on SINR metric.

Angela Sara Cacciapuoti, Cosimo Calcagno and Marcello Caleffi [27] proposed the modification of widely adapted AODV protocol in order to assure its functionality in a given scenario. The resulting protocol is referred to as Cognitive Ad hoc On Demand Vector (CAODV). This is based on three aspects, namely (i) to avoid the regions of route information and packet delivery without a common control channel (ii) to perform a joint path and channel selection at each forwarder to minimize route cost and (iii) to take the advantage of the availability of multiple channel to improve overall performance.

An innovative approach to deal with the traffic congestion using the characteristics of the VANETs is developed and tested by Patil V.P [28]. Traffic congestion is a major problem in today’s society. The developed system is tested using AODV simulations. He measured the performance in terms of the number of packets broadcast, percentage of packets delivered and percentage of traffic diverted and to manage the problem of data traffic congestion in VANETs.

M.Arthi and G.I.Pandian [29] devised an algorithm to compute an energy efficient path namely Energy Reduced AODV (Er-AODV) routing protocol in the wireless Ad hoc networks. They aimed to pick an algorithm to compute energy efficient path i.e to minimize the total energy required to transmit the packets from source to destination. They used small size terminals depending on the battery to reduce the loss of energy in the nodes and Er-AODV consumed less energy in terms of single source, multiple sources and high traffic density situations.

The control transmission power features are utilized by Amit Sahu, Rakesh Kumar [30] in the AODV protocol. In a local area wireless network a node can communicate with
another node that is immediately within their range or outside the range not relying on access point. As the nodes operate with limited battery energy, energy consumption becomes the main concern. They proposed an energy aware routing protocol i.e. TPC-AODV. The main aim of this protocol is to use of minimum transmission power in sending the data packet. The outcome is the improvement of network survivability by using energy optimal routes to control transmission power.

N.Arora [31] analysed the performance of AODV, DSR and ZRP in MANETs. Data transmission between nodes requires multiple hops as nodes range is limited. Mobility of the nodes makes the situation more complex. He conducted performance analysis of different routing protocols i.e AODV, DSR and ZRP. He evaluated them based on average jitters, average end-to-end delay, throughput and TTL based hop count in MANETs.

A comparative study of AODV, DSR and DSDV protocols in MANET was done by Kapang lego, Pranav kumar singh and Dipankar sutradhar [32]. The comparison was carried out on the three performance metrics packet delivery ratio, average end-to-end delay and routing overhead. They observed that efficient routing protocols will make MANET reliable.

B.Manimekala and M.Kayalvizhi [33] carried out the research on data transfer in wireless sensor networks using AODV protocol. They evaluated hop to hop packet forwarding in the network layers. Information was collected from many sensor devices for further consumer application in the sensor network. For selecting a cluster head K-means algorithm was used.

Neha Purushothaman, Neeta Abiraami T N, Sherin Varghese and Varada Sananathan Menon [34] compared the performance of prominent on demand reactive routing protocol (AODV) along with a proactive routing protocol (DSDV). They evaluated throughput, packet
delivery fraction and routing overhead. They found that the AODV protocol is superior to DSDV protocol.

R. Prabhakar, Ravi Banoth, E. Vijay Babu and G. J. Chitra [35] compared the performance of AODV and MAODV using the parameters such as average end-to-end delay, packet delivery fraction and routing overhead. In this project the traffic sources using UDP and TCP were the main items under investigation. The route request and reoute reply packet types are those used by AODV as in the unicast route table.

Jahangir Khan, Nazir Shah Khattak and Hamid Jan [36] analyzed three routing protocols (DSR, AODV and TORA) with different ranges and frequencies and parameters for the best performance of fourth generation cellular networks.

Rajiv K. Nekkanti and Chung-wei Lee [37] in their paper proposed a routing protocol based on securing the routing information from unauthorized users. The protocols already in use are not efficient as they consume a lot of energy and time, as they use high level algorithms for every bit of routing information they pass from the intermediate to another in the path. Based on the level of trust factor the routing information will be, of low level, medium level, high level encrypted – the low level being normal AODV. They found that it not only saves the node’s power by avoiding unnecessary encoding, but also time.

A survey of MANET routing protocols were taken up by Changling Liu, Jörg Kaiser [38] in their project computing the needs of “anytime and anywhere” network connections, MANETs are well suited as they are self-organizing networks without depending on any network infrastructure. Because of their improved flexibility and reduced cost of the networks, they will play an important role in future mobile application. The routing protocol design for MANET is very essential. They present a state-of-the-art review and a comparison of routing
protocols designed for MANETs by identifying the major protocol classes with an in-depth comparison of related protocols.

D. Manjunatha, M. T. Somashekara, Archana K. S and S. Ravishankar [39] studied the performance of AODV with variation in simulation time and network size. In MANETs nodes are connected by wireless links that form temporary networks having dynamic topology, high node mobility, low channel bandwidth and limited battery power. They analyzed the effect of network size and simulation time on the performance of AODV routing also compared the results for networks with and without mobility nodes.

V.K.Taksande and Dr.K.D.Kulat [40] conducted an extensive simulation analysis of AODV protocol with IEEE 802.11 MAC for chain topology in MANET. They performed routing data packets directly from a source node to a given destination. They also researched IEEE 802.11 MAC protocol for various numbers of nodes and evaluated its performance by varying network size up to 55 nodes through simulation. Their main aim is to test the ability of AODV protocol to react on chain network topology while changing the number of nodes.

A New Algorithm AODV Routing Protocol in Mobile AD HOC Networks was utilized by Ali Khosrozadeh, Abolfazle Akbari, Maryam Bagheri and Neda Beikmahdavi [41]. Their new route maintenance algorithm is aimed at avoiding route breaks because each intermediate node on active route detects the danger of a link break to an upstream node and re-establishes a new route before a route break occurs.

The mobile nodes are dynamically and arbitrarily located in such a manner that the interconnections between the nodes are capable of changing continuously, Elizabeth M. Royer and Chai-Keong Toh [42] devised a routing protocol to discover routes between nodes. Their primary goal is to ensure correct and efficient route establishment between a pair of nodes so that messages may be delivered in a timely manner. The route construction must be done with
a minimum of overhead and bandwidth consumption. They evaluated their routing protocol for ad hoc networks based on a given set of parameters. They gave a comparative analysis of eight different protocols by presenting their characteristics, functionality, merits and drawbacks.

Parma Nand and Dr. S.C. Sharma [43] extensively studied the performance of broadcast based mobile ad hoc network based protocols – AODV, DSR and DYMO. The mobile nodes with wireless radio interface are connected by wireless links such that each device in the MANET is free to move independently and randomly with the capability of changing its links to other devices frequently. It becomes a multihop process because of the limited transmission range of energy constrained mobile nodes; so each device in this network topology acts as a router. They used the AODV, DSR and DYMO based on IEEE 802.11. They analyzed and compared their performance measuring metrics throughput, jitter, packet delivery ratio, end-to-end delay and error reply packets and dropped packets due to the nonavailability of routers.

Amol R. Kotkar and Nilesh S. Vani [44] conducted performance analysis of AODV routing protocol in MANET. They pointed out that due to the mobility of nodes in MANET, routing plays an important role in communication. They devised an ad hoc on demand distance vector protocol which not only includes the general AODV protocol but also the evaluation performance of AODV depending on different input parameters. They evaluated its performance by simulation and gave a survey of the evaluation of the performance of AODV protocol in MANET with different network parameters.

The design of robust routing algorithms that adapt to the frequent and random changing network topology on AODV, AOMDV for MANETs was taken up by R.Balakrishna, U.Rajeswar Rao and N.Geethanjali [45]. There have been a variety of
protocols that are proposed and extensively simulated. They compared the performance of two types of on demand routing protocols – Ad hoc on Demand Distance Vector (AODV) and Ad hoc on Demand Multipath Distance Vector (AOMDV). They found that AOMDV incurs more routing and packet delay than AODV. But AODV has a better efficiency when it comes to the number of packets dropped and packet delivery.

The performance analysis of DSR and AODV routing protocols was extensively studied by Shakeel Ahmed [46]. He researched on protocols which will adapt to dynamically changing topology. He proposed ad hoc routing protocols which include Destination Sequenced Distance Vector (DSDV), Ad hoc on Demand Distance Vector Routing (AODV), Dynamic Source Routing (DSR) and Temporally Order Routing Algorithm (TORA). With the help of simulation he analyzed the performance differentials by varying the network load, mobility and network size on DSR and AODV. He found that DSR performs perfectly with smaller networks with lower speed of nodes and AODV is more efficient in the use of bandwidth.

Sarabjeet Kaur and Birinder Singh [47] conducted a survey on Black Hole Attack on AODV routing protocol in the wireless ad hoc networks. A black hole attack is a network layer attack in which malicious node falsely advertises the source node that it is having shortest path to its destination, but actually it does not have and so drops the packets. Owing to the lack of infrastructure in ad hoc networks, routing protocols are vulnerable to various types of attacks. AODV protocol, which is one of the reactive routing protocols suitable for ad hoc network, is vulnerable to black hole attack. They suggested modifying AODV routing protocol using Qualnet simulator.

The reliability to data transferring in all end-to-end data stream services is provided by abstract Transmission Control Protocol (TCP). The performance evaluation of DSDV and
AODV routing protocols on the basis of TCP variants in wireless sensor network (WSN) and MANET were carried out by Shivangi Ranawat and Vandana Pandya [48]. TCP was originally created to handle the problem of network congestion collapse. They evaluated the different TCP variants to identify the best protocol variant for network expansion. They created a full comprehensive simulation environment for evaluating the performance of TCP variants like TCP New Reno, SACK, FACK, RTCP and Vegas with the routing protocols AODV and DSDV in WSN and MANET. They analyzed the performance of WSN and MANET by comparing on the basis of energy, end-to-end delay, throughput and packet delivery ratio of the network.

Performance metric comparison of AODV and DSDV routing protocols in MANETs was carried out by Sachin Kumar Gupta and R. K. Saket [49]. To obtain significant benefits to mobile ad hoc networks in terms of both performance and reliability using abstract efficient protocols was their goal. The performance of AODV and DSDV routing protocol have been evaluated for mobile ad hoc networks in terms of throughput, the average end-to-end delay, jitter and drop. They found that AODV is better than the performance of DSDV routing protocol. They designed and developed a mobireal simulator for determining the performance evaluation of AODV and DSDV routing protocol. They graphically analyzed the parameters stated above based on the quality of service metrics and the performance differentials based on network load, mobility and network size.

D.Loganathan and P.Ramamoorthy [50] conducted research on Modified AODV routing protocol with multicast parameter for effective communication in wireless ad hoc networks. Their protocol presents the mechanism which reduces route loops and ensures trustworthy message exchange. Using the Ad hoc on Demand Routing (AODV) algorithm in the ad hoc mobile nodes they analyzed the factors hop count, total interference, node link delay,
residual energy of a node and the node transmission power. They combined these parameters in different optimization functions with respect to various routing algorithms for selecting the optimal path.

The main classes of routing protocols are proactive (table driven), reactive (on demand) and hybrid. A popular routing strategy for wireless ad hoc network is the reactive routing the AODV routing protocol. Rahul Patel Anjuman Ranavadiya and Shreya Patel [51] have done extensive work on AODV routing protocol for MANET. They analyzed the characteristics, functionality and various protocol property parameters such as route discovery, flooding, route maintenance with respect to advantages as well as limitations. They used a simulator and surveyed various security enhancements that have been proposed by previous researchers.

Advancements in AODV routing protocols were exhaustively analyzed and reviewed by Jitendra Moond, Dharm Singh and Naveen Choudhary [52]. MANET is expected to be very useful for the deployment of temporary networks in military environments and emergency situations such as fire safety, search and rescue operations where general public wish to share information quickly. So the routing protocols of MANET must be adaptive and fast enough to maintain routes in spite of the continuously changing topology and available low bandwidth. They studied these aspects in detail and suggested improvements in the working of AODV routing protocol.

Comparative performance of routing protocols in MANET was analyzed by P. Manickam, T. Guru Baskar, M.Girija and Dr.D.Manimegalai [53]. They studied the performance comparison of proactive and reactive protocols DSDV, AODV and DSR based on the metrics like throughput, packet delivery ratio and average end-to-end delay by using simulator.
Simulative analysis of AODV routing protocol of MANET using OPNET modeler has been carried out by Charu Sharma and Jaspreet kaur [54]. In their work the performance of the most popular AODV reactive routing protocol has been evaluated. They described a whole network strategy with performance metrics which are to be used in OPNET simulation for their analysis. Throughput, queue size, transmitted packet rate and received packet rate are the performance metrics they used.

Kalyan Kalepu, Shiv Mehra and Chansu Yu [55] did elaborate research on evaluation of MANET with AODV routing protocol. They analyzed the transmission of packets with respect to their range. They discussed in detail the functioning of AODV and how well it adapts to the dynamic link conditions. They compared the performance of AODV implemented in two different locations and investigated the effect of node mobility on the performance of AODV. The throughput was similar to the ideal throughput, in which throughput increases and saturates after a particular value of packet size.

The performance enhancement of AODV routing protocol in wireless mesh networks was exhaustively studied by Tayyeba Minhas, Xu Ning, Satish Anamalamudi, Minglu Jin, and Zahid Minhas Khan [56]. They analyzed route optimization which plays a pivotal role in “self healing and self configuring” wireless mesh networks (WMN). Since traditional end-to-end TCP is designed for network congestion, it is difficult to identify route failure due to node mobility and buffer overflow. In addition, IEEE 802.11 MAC works on link connectivity which takes a long time to recover end-to-end route path. To enhance the performance of routing protocol it is essential to design a congestion control mechanism at the network layer. They used NS2 simulator and implemented Active Queue Management (AQM) in the network layer to avoid congestion due to buffer overflow and client mobility. They found that AQM based networks outperformed when compared with all other existing protocols.
Amandeep and Gurmeet Kaur [57] conducted performance analysis of the various modified versions of AODV protocols in MANETs. Many protocols have been proposed for MANET. Ad hoc On Demand Distance Vector (AODV) routing protocol is preferred because it minimizes the routing overhead than the other protocols and hence the performance of the network is enhanced. The performance analysis of AODV routing protocol has been done on the basis of a few performance metric parameters like average end-to-end delay, throughput and packet delivery ratio using simulation.

Research on Efficient AODV routing protocol for MANET with the goal of enhanced packet delivery ratio and minimized end-to-end delay was done by V.P.Patil [58]. The main causes for link break are mobility between nodes such as node failure and node power off. The bandwidth constraint Quality of Service (QOS); which is an extremely challenging task, becomes the main issue. The objective of the work was to enhance the network performance of AODV, when frequent link failure occurs due to several inherent reasons. After conducting an exhaustive analysis by using NS2 simulator he proposed a new protocol Enhanced AODV (E-AODV), which is a modified version of AODV with enhanced packet delivery ratio and minimized end-to-end delay.

Anuj K. Gupta, Dr. Harsh Sadawarti, and Dr. Anil K. Verma [59] conducted exhaustive performance analysis of AODV, DSR and TORA routing protocols. They subjected on demand routing protocols with identical loads, environmental conditions and evaluated their relative performance with respect to two performance metrics – average end-to-end delay and packet delivery ratio. They investigated under various simulation scenarios with varying pause times. By conducting detailed simulation and analysis, a suitable routing protocol can be chosen for specified network and goal.
An efficient secure AODV routing protocol in MANET has been studied by Durgesh Wadbude and Vineet Richariya [60]. As the network wireless security becomes the major issue in MANETs, some of security attacks such as modification, fabrication, denial of service attacks and impersonation are due to misbehaviour malicious nodes that disrupt the transmission. They proposed a routing algorithm that provided a better level of security and performance than the existing ones in terms of overhead and end-to-end delay to the secure AODV routing protocol.

Tahira Farid and Anitha Prahladachar [61] also made an extensive study on secure routing with AODV routing protocol. They identified the factors that cause security risks in AODV. As there are no centrally administered secure routers, attackers can easily exploit the network. In addition to this open peer to peer architecture, shared wireless medium and dynamic topology adds problems to the security. The traditionally secured routing schemes meant for wired networks are unsuitable for mobile ad hoc environment. They carried research on the AODV protocol and proposed various enhancements.

In the AODV routing protocol traditional routing table’s one entry per destination and sequence numbers to determine whether routing information is up-to-date and to prevent routing loops. Maintenance of time based states in each node should be ensured. In case the route is broken, the route recovery is based on query and reply cycles. So Prashant Kumar Maurya, Gaurav Sharma, Vaishali Sahu, Ashish Roberts and Mahendra Srivastava [62] devised the following control packets for use. They are route request message (RREQ) that is broadcasted by a node, route reply message (RREP) that is unicast to the source of RREQ and route error message (RERR) that is sent to notify other nodes, informing the loss of link. HELLO messages are used for detecting and monitoring links to the neighbours.
Abolfazl Akbari, Mehdi soruri and Ali Khosrozadeh [63] suggested a new routing protocol in mobile ad hoc networks. They pointed out that most of the on demand routing protocols reestablish a new route after a route break. They proposed a new route maintenance algorithm to avoid route breaks because each intermediate node on an active route detects a danger of a link break in an upstream node and re-establishes a new route before a route break occurs. Their algorithm was based on AODV.

A new enhanced routing protocol for MANETs was proposed by Ashraf Abu-Ein and Jihad Nader [64]. They proposed Power-Hop based Ad hoc on Demand Distance Vector (PH-AODV). It uses the node power and hop count parameters to select best routing path. They compared the performance of their PH-AODV with the existing ones in terms average delay, average dropped packets and average throughput. The results showed that PH-AODV is better than AODV.

A node disjoint minimum interference multipath (ND-MIM) routing protocol for MANETs based on AODV protocol which focuses on the method of finding all node disjoint routes from source to destination with minimum routing overhead. This method was suggested by Nilima H. Masulkar, Archana A. Nikose [65].

**SUMMARY**

Various schemes on QoS and its improvement have been studied from literature survey. However all these methods do not provide simplicity in the efficient routing achievement process. This work remains a representation of simple methods which can be efficiently used as routing factor in MANET.