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Conceptual Aspects on Mobile Ad-Hoc Network System

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***Abstract*—** A mobile ad hoc network is made up of mobile wireless hosts. When hosts move, the routes change, necessitating the need for a system to find new routes. A crucial aspect of the development of wireless networks is ad-hoc networking. Ad-hoc networks often consist of identical nodes that connect with one another via wireless links without the use of a centralized controller. Ad-hoc wireless networks carry over the standard issues with wireless and mobile communications, like bandwidth optimization, battery management, and improvement of transmission quality. Due to its self-upkeep and self-configuration characteristics or behavior, mobile ad hoc networks (MANET) have achieved great success and attention. Routing attacks are used to quickly alter the network topology of MANETs based on wired and wireless networks. Therefore, securing this network without infrastructure is a big problem. In recent years, experts from all over the world have paid particular attention to research on improving the performance of mobile ad-hoc networks (MANETs). Routing methods are especially crucial in a dynamic network environment like MANET for enhancing overall network performance. In addition to discussing the technical difficulties that protocol designers and network engineers must overcome, this paper offers insight into the possible applications of ad hoc networks. Routing, service and resource discovery, Internet access, billing, and security are some of these difficulties.

***Keywords*— Ad Hoc Networking, Applications, Routing, Security**

I. INTRODUCTION

In a mobile ad hoc network, data travels from one device to another and through a number of different systems before it is finally received. Since some information, like that associated with electronic payments, is extremely sensitive, it must be handled with care while it is transmitted over the network. The security needs for this sort of network are also rising as a result of the mobile ad hoc network's ability to move nodes around the network and its current widespread use. Therefore, cryptography techniques may be used to provide security for mobile ad hoc networks. One of the most popular methods to safeguard sensitive data and prevent unauthorized parties from changing it is cryptography via mobile ad hoc networks [1]. Without relying on a permanent infrastructure, mobile users can interact using mobile ad-hoc networks (MANETs). These networks can be utilized, for example, to increase access point range, enable communication in disaster zones, or provide inter-vehicle communications. There are several technical difficulties in designing MANETs, yet many of these difficulties have solutions.

Routing protocols have become a current research hotspot because Mobile Ad hoc Network (MANET) is widely employed in military battlefields, traffic control, environmental monitoring, disaster assistance, and smart cities. The effectiveness of the routing protocol affects how well the network as a whole performs [2-5]. A collection of wireless nodes or terminals form the basis of a mobile ad hoc network, which is self-contained, self-organized, and self-managed. It uses distributed administration, does not require fixed infrastructure, and leverages wireless structures for communication between its sensor nodes. Wireless networks have evolved significantly thanks in part to ad-hoc networks [6]. Ad-hoc networks often consist of identical nodes that connect with one another via wireless links without the use of a centralized controller. Ad-hoc networks are still primarily used for military tactical communication, but business interest in these networks is

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constantly rising. Only a few conceivable business examples include sensor networks, police enforcement operations, disaster relief efforts, and commercial and educational uses.
In the absence of a fixed infrastructure, a mobile ad hoc network is an autonomous grouping of mobile devices (laptops, smartphones, sensors, etc.) that collaborate in a distributed way and interact with each other using wireless links. This kind of network opens the door for many innovative and exciting applications, whether it is used alone or in conjunction with one or more points of attachment to cellular networks or the Internet. Emergency and rescue operations, conference or campus settings, automobile networks, personal networking, etc. are only a few examples of application situations. A mobile ad hoc network, or MANET, is a type of wireless network that does not rely on a fixed infrastructure to function, as opposed to infrastructure wireless networks where each user directly communicates with an access point or base station, as seen in figure 1 below [7].

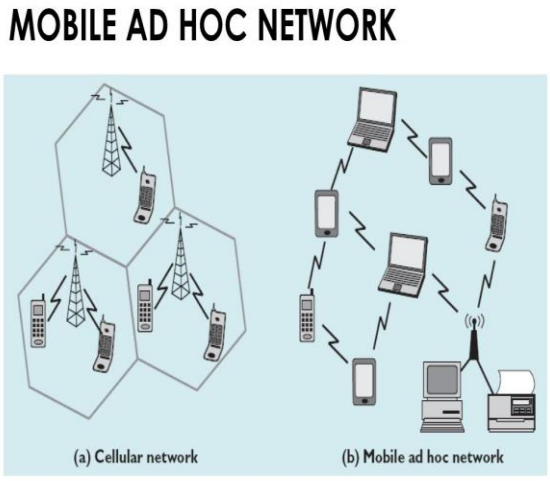

Figure 1 Cellular network versus mobile ad hoc networks [7]

The network is an autonomous, ephemeral grouping of moving nodes that connect to one another over wireless channels. Nodes are in charge of dynamically discovering one another and communicating directly when they are in each other's transmit range. Intermediate nodes serve as routers that redirect packets generated by other nodes to their destinations, enabling communication between nodes that are not directly inside each other's transmit range.

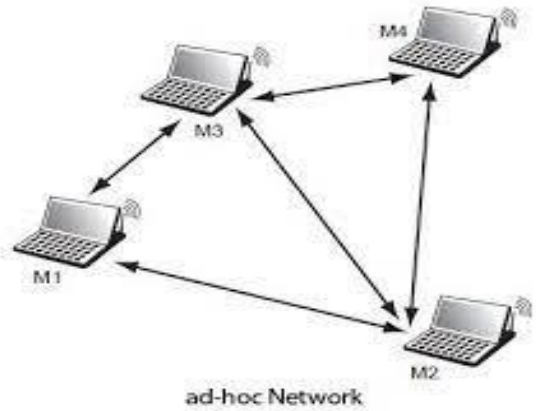

Figure 2 A Mobile AD Hoc Networks [9]

These nodes are frequently energy-constrained, battery-powered, and have a wide range of capabilities. A MANET is described as a self-organizing network of different devices that facilitates

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seamless communication [8]. Although this description is usually acceptable, it does not take into account certain important aspects of MANET, such as its decentralized management and lack of reliance on pre-existing network infrastructure. The phrase "an autonomous, infrastructure-less, self-configuring, and self-healing system of mobile nodes connected by 1wireless links" might be a better way to describe a MANET [9].

II. AN OVERVIEW ON MOBILE AD HOC NETWORK

A self-contained and distributed network, MANET stands for mobile ad hoc network. MANET nodes are self-contained and linked by wireless connections. The primary feature of MANET is the ongoing mobility of nodes, which may lead to frequent topology changes and other difficulties, including how to route data packets between nodes. Vehicular Ad-hoc Network (VANET), Wireless Sensor Network (WSN), and Disaster environments are some of the environments where MANET can be used to quickly establish and easily use the network. Each of these environments has specific characteristics that set it apart from the others; for example, a VANET node moves quickly along predetermined routes as opposed to WSN nodes, which are stationary and have a finite amount of energy. Since MANET nodes vary in transmission range and have limited power resources that cannot typically be recharged or replaced, they face numerous challenges, including low bandwidth, high power consumption, low memory, processing limitations, and changes in mobility patterns [10, 11]. Examples of these devices include mobile phones, PDAs, digital cameras, earphones, watches, iPads, and laptops. The difficulty with mobility patterns causes periodic reorganizations of the network topology. The wireless connection is unique compared to wired networks because of issues with interference, intra-flow, inter-flow, and fade. In the absence of a centralized node, nodes interact with one another through peer-to-peer queries. As a result, data must be transmitted through intermediary nodes, making routing a significant problem in a mobile ad hoc network.

Nodes and devices in a MANET can move freely and independently in all directions. In MANET, there is no infrastructure (base station) that allows each network node to function as a router. The routers are unrestricted in their ability to arrange and move at random. As a result, the wireless network architecture may alter frequently and unexpectedly. Even though commercial interest in these networks is continuously growing, military tactical communication is still regarded as the principal application for ad hoc networks. And all the applications—such as those for law enforcement operations, rescue efforts during natural disasters, and commercial uses like in sensor networks—are examples of how it is now used and is becoming increasingly significant in our daily lives. The Defence Advanced Research Projects Agency (DARPA) Packet Radio Networking (PRNET) project in 1972[12–14] is where the earliest Ad Hoc Networking application can be found, which later developed into the survivable adaptive radio networks (SURAN) program [15].

Routing Protocol

Numerous routing protocols for Mobile Ad Hoc Networks (MANETs) have been developed, and they can be divided into two groups depending on their methods: topology-based and position-based routing protocols [16, 17]. Topology-based routing protocols use connection information already present in networks to conduct packet forwarding. These procedures can also be separated into hybrid, proactive (table-driven), and reactive (on-demand) techniques [18–20]. Due to the multi-hop network topology that mobile ad hoc networks have, which can change frequently as a result of mobility, effective routing protocols are required to create communication paths between nodes without placing an undue burden on the power-constrained devices' processing power or control traffic overhead [21]. Numerous alternatives have previously been put out, some of which are being standardized by the IETF. Several suggested systems make an effort to always have the most recent path to every other node. To achieve this, these protocols frequently and in response to topological changes communicate routing control information.

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These protocols, also known as proactive routing protocols, are usually modified variations of the common link state or distance vector routing algorithms used in wired networks, tailored to the unique needs of the dynamic mobile ad hoc network environment. It is not always required to have a current route to every other node. The topology information repeat update is crucial in this circumstance. to maintain the network's nodes' dynamic mobility.

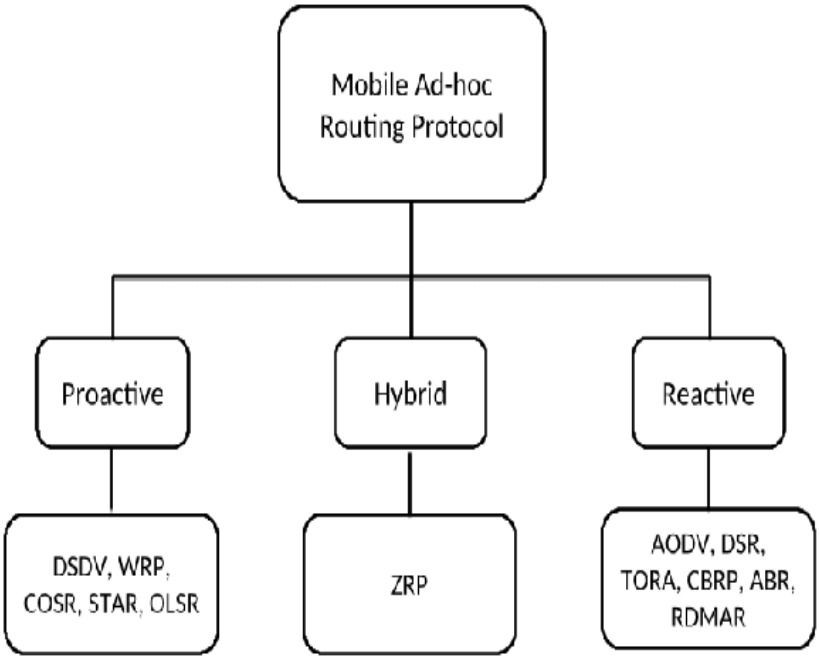

Figure 3 General type of routing protocols in mobile ad-hoc networks [21]

1. Proactive Protocols

These sorts of routing protocols, known as proactive routing protocols, will continuously work to maintain on all routing information at any time for all nodes. These protocols are classified into two types. Also included are the first event-driven protocol and the second regularly updated protocol. If there is no change in the network topology, the event-driven protocols remain in place and do not send any routing packs. By change topology, we mean any change that may occur, such as a change in the neighbor set. Is there a change or a message received that suggests a link node failure or a change in some of the nodes? Depending on the routing protocol's approach, it will transmit a message to another node. Then, at regular intervals, the protocols that have updated information for the changing topology will send this update to a second node [22].

a. DSDV Protocol (Destination Sequence Distance Vector)

Unlike other distance vector-based routing protocols, DSDV is based on a distance-vector algorithm and introduces sequence numbers to ensure a loop-free path [23]. Every destination is listed in a routing table that nodes keep updated with information about the next hop, the number of hops, and the destination sequence number. Route updates are periodic transmissions of a node's route table data to nearby nodes. Each update has a sequence number associated with it. An unreachable destination is indicated by an odd sequence number, whereas a reachable destination is indicated by an even sequence number. The update is more recent the higher the sequence number. The same sequence number may be used for many updates to the same destination. In these situations, nodes favor the route that requires the fewest hops to reach the destination.

This protocol, which belongs to the proactive protocol family and regularly refreshes the information, uses Bellman Ford in an ad hoc networking context. The routing table, which contains

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a list of all destinations, the number of hops necessary to get there, and the number of sequences that were appointed from the destination node, now includes the sequence number as part of the protocol's new idea. This number (sequence number) was created from the destination and delivered with the update in order to minimize network loops, pick the best route, and revoke the route that serves no purpose.

Distance-Vector Routing on the Internet is essentially the same as DSDV, but with more destination sequence numbers of the record, which brings Distance Vector Routing more in accordance with the requirements of this dynamic network MANET. In addition, DSDV is used within each node, along with a table, to record the routing table changes from the last part of the exchange so far, if you change a lot of the conduct of all the information, when network topology changes are less frequent and the routing table does not need to exchange all the information. If there is very little change in the exchange, it simply affects the portion of the exchange known as the incremental packet [24, 25].

b. AODV Protocol- (AD-Hoc On-Demand Distance Vector)

The distance vector method is the foundation of the reactive protocol known as AODV. Only when two nodes want to communicate or when one of the nodes acts as an intermediary node for data transmission to help preserve connectivity between two other nodes does AODV discover and maintain routes between the nodes. Sequence numbers provide a guarantee of loop-free pathways. Nodes update their route tables in accordance with the higher the sequence number, the more recent the route. For each destination it is talking with, each node keeps a routing table with a single path entry [26]. A routing table is not maintained by AODV in a number of different ways [27–29], but instead a routing table is built only when a node needs to connect with another node. The first to broadcast a Route Request (RREQ) packet [30], where the record that this is given by which a source is to be used to find which of a destination node, is sent when a node in the network wants to deliver data to another node. A node in the network can only be processed once on the same RREQ in order to prevent the creation of routing loops. RREQ in the network is a form of flooding of the transfer mode, destination until they were received.

A sequence number exists for each node. A node includes its sequence number and the most recent sequence number it has for the destination when it wishes to start the route discovery process. Only when the sequence number of its path is more than or the same as the sequence number contained in the RREQ packet, does the intermediate node that received the RREQ packet replay to the RREQ packet. With the address of the intermediate node's first copy of RREQ stored, a reverse path from that node to the source is formed.

c. Dynamic Source Routing (DSR)

One of the mobile ad-hoc protocols, the DSR protocol was created to be a dynamic source protocol. The dynamic nature of the DSR protocol allows for rapid topology changes in the network, but it also allows for the discovery of routes to a destination. To prevent network loops, the DSR protocol sends packets from nodes that contain the data link for a list of the nodes that are actively participating in the network in their headers. By maintaining the source route header for each data packet, the cache of routing information is kept for use in the future. This protocol uses source routing and is an on-demand routing protocol. This indicates that the mobile nodes contain caches to preserve the source routes that are already familiar to them. A new route will be added to the route cache as it becomes available. In this protocol, there are two basic approaches. When a node wishes to send a packet to another node, it first checks the cache routes to see whether there is a route that leads there.

DSR overflows Route Request Packet to the network during route discovery. When a node takes a packet, it first adds its own address to it before sending it on to the next node. A route is acknowledged when the beleaguered node or a node with a route to the intended destination gets the Route Request and replies with a Route Reply. Each node must confirm that the link between itself

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and the next node is trustworthy before allowing a packet to follow an established path. Link layer acknowledgement, passive acknowledgment, and network layer acknowledgment are the first three steps that DSR offers in the Route maintenance process. One node sends a Route Error message to the original sender when it discovers a broken route [31, 32].

d. Optimized Link State Routing Protocol (OLSR)

The protocol OLSR is table-driven. It typically refreshes and maintains its routes so that when a route is needed, it can present it right away with no initial wait. Multipoint relays (MPRs), which are selected in OLSR, are in charge of blocking broadcast packets during the flooding process. Compared to the flooding process, this method lowers packet transmission overhead [33]. By using each node's most recent routing information, OLSR carries out hop-by-hop routing. MPRs are designed in such a way that they cover every node that is two hops away from it (i.e., a neighbor of a neighbor). A node uses control messages known as HELLO messages to sense and choose its MPRs. The usage of hello messages ensures a two-way connection with the neighbor. Greetings are given at regular intervals. To find out, nodes broadcast "TC" or topology control messages.

Gathering-Based Routing Protocol (GRP)

With minimal management overhead, this architecture gathers network data at a source node. The information gathered indicates that even if the present route is disconnected, the source node can still locate routes and continue to transfer data. With little overhead from control massages, this method produces quick transfer. Due to its ability to combine the benefits of proactive and reactive routing protocols, this strategy is frequently referred to as a hybrid routing system. Until the destination is reached, a packet with the name DQ is continuously forwarded to each node's neighbors. The destination node transmits a network information gathering (NIG) packet to its neighbors once it has arrived there. The source node determines the optimum path using the information gathered before starting to transmit data packets right away.

III. FEATURES OF MOBILE AD-HOC NETWORK

Autonomous Terminal

Each mobile terminal in a MANET is an autonomous node with the ability to act as a host and a router. In other words, in addition to their basic processing capacity as hosts, mobile nodes are also capable of switching tasks, such as acting as routers. Therefore, in MANET, endpoints and switches are typically indistinguishable**.**

i. Distributed Operation

The administration and control of the network are dispersed among the terminals because there is no background network for the central control of network operations. To accomplish tasks like security and routing, the nodes in a MANET should cooperate with one another and each node acts as a relay as necessary.

ii. Multi Hops Routing

Based on various connection layer characteristics and routing protocols, the two fundamental types of ad hoc routing algorithms are single-hop and multihop. In terms of structure and implementation, single-hop MANET is simpler than multihop, but at the expense of less capability and application. Data packets should be passed via one or more intermediary nodes when being sent from a source to a destination outside of the direct wireless transmission range.

iii. Dynamic Network Technology

Because the nodes are movable, the connectivity between the terminals may change over time, and the network topology may change quickly and unexpectedly. The traffic and propagation conditions, as well as the mobile network nodes' mobility patterns, should all be taken into account by MANET. The mobile nodes in the network create their own networks on the fly by dynamically establishing routing among themselves as they move around. Additionally, a user in the MANET

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may need connection to a public fixed network in addition to operating within the ad hoc network (e.g., Internet).

iv. Fluctuating Link Capacity

In a MANET, the nature of high bit-error rates of wireless connections may be more severe. Several sessions can share a single end-to-end path. The communication channel between the terminals is less bandwidth-efficient than a wired network and is vulnerable to noise, fading, and interference. Some scenarios allow any pair of users to be connected over numerous wireless links, each of which may be heterogeneous.

v. Light-Weight terminals

The majority of the time, MANET nodes are portable computers with limited CPU processing capacity, little memory, and low power storage. The techniques and algorithms used to implement the processing and communication functions on such devices must be optimized.

IV. APPLICATIONS OF MOBILE AD-HOC NETWORK

Tactical Networks

- Military Communications & Operations
- Automated Battlefields

Emergency Services

- Search & Rescue Operations
- Disaster Recovery
- Replacement of fixed infrastructure in case of environmental disaster
- Policing & Fire fighting
- Supporting doctors & nurses in hospitals

Commercial & Civilian Environments

- E-commerce: electronic payments anytime and anywhere
- Business: dynamic database access, mobile offices
- Vehicular services: road or accident guidance, transmission of road and weather conditions, taxi cab network, inter-vehicle networks
- Sports stadiums, trade fairs, shopping malls
- Networks of visitors at airports

Home & Enterprise Networking

- Home/office wireless networking
- Conferences, meeting rooms
- Personal area networks (PAN), Personal networks (PN)
- Networks at construction sites

Education

- Universities and campus settings
- Virtual classrooms
- Ad hoc communications during meetings or lectures

Entertainment

- Multi-user games
- Wireless P2P networking
- Outdoor Internet access

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- Robotic pets
- Theme parks

Sensor Networks

- Home applications: smart sensors and actuators embedded in consumer electronics
- Body area networks (BAN)
- Data tracking of environmental conditions, animal movements, chemical/biological detection

Context Aware Services

- Follow-on services: call-forwarding, mobile workspace
- Information services: location specific services, time dependent services
- Infotainment: touristic information

Coverage Extension

- Extending cellular network access
- Linking up with the Internet, intranets, etc.

V. TECHNOLOGICAL CHALLENGES

The DARPA Packet Radio Network project in 1972 can be credited with giving rise to the idea of mobile ad hoc networking [34]. The benefits of fixed infrastructure, such as its flexibility, mobility, robustness, and independence, immediately piqued the interest of the military, police, and rescue organizations in using such networks in chaotic or dangerous circumstances. The creation of the Mobile Ad Hoc Networking working group within the IETF is evidence that the wireless research community finally realized the great potential and advantages of mobile ad hoc networks outside the military domain in the middle of 1990, with the advent of commercial radio technologies. For a long time, ad hoc network research was restricted to the military demonstrated by the IETF's establishment of the Mobile Ad Hoc Networking working group [35].

The research community is currently very active and engaged in mobile ad hoc network research, which is supported by current and emerging radio technologies that support MANET. All tiers of the protocol stack must overcome numerous obstacles imposed by MANET-specific characteristics [36]. Rapid changes in link properties must be handled by the physical layer. The media access control (MAC) layer must deal with exposed and hidden terminals, minimize packet collisions, and permit fair channel access. Nodes must work together at the network layer to calculate pathways. The transport layer must be able to handle network characteristics like packet loss and latency that are considerably different from those of wired networks. Applications need to be capable of handling potential disconnections and reconnections. All network protocol developments must also seamlessly function with established networks and take into account potential security issues.

VI. CONCLUSION

Mobile devices establish a wireless network that is self-creating, self-organizing, and self-managing, known as a mobile ad hoc network, as a result of the quick development in the field of mobile computing. Future pervasive computing environments will require it because of its inherent flexibility, lack of infrastructure, ease of deployment, auto-configuration, low cost, and prospective uses. Ad-hoc networks are regarded as being essential to the development of wireless networks. They can be employed in many environments and offer a number of potentials that regular wireless networks do not have. Mobile ad hoc networking research includes social and economic considerations and spans all networking layers, from the physical to the application layer. Mobile ad-hoc networks are envisioned for a variety of application models, even though some mobile ad-hoc network applications will necessitate being connected to the Internet. I provided a thorough

overview of the Mobile Ad Hoc Network (MANET) in this paper. We distinguished the features of standard wired networks, wireless ad hoc networks, wireless mobile methods, and other types of ad hoc networks, in addition to all the currently in use ad hoc protocols.

References

[1]. H. Darrel, et al., "Guide to elliptic curve cryptography," Springer-Verlag Professional Computing Series, pp. 1-311, 2004.
[2]. J. Liu, Y. Xu, Y. Shen, X. Jiang, and T. Taleb, ''On performance modeling for MANETs under general limited buffer constraint,'' IEEE Trans. Veh. Technol., vol. 66, no. 10, pp. 9483–9497, Oct. 2017.
[3]. D.-G. Zhang, X. Wang, X. Song, and D. Zhao, ''A novel approach to mapped correlation of ID for RFID anti-collision,'' IEEE Trans. Services Comput., vol. 7, no. 4, pp. 741–748, Oct. 2014.
[4]. J. Chen, G. Mao, C. Li, W. Liang, and D.-G. Zhang, ''Capacity of cooperative vehicular networks with infrastructure support: Multiuser case,'' IEEE Trans. Veh. Technol., vol. 67, no. 2, pp. 1546–1560, Feb. 2018.
[5]. W. A. Jabbar, M. Ismail, R. Nordin, and S. Arif, ''Power-efficient routing schemes for MANETs: A survey and open issues,'' Wireless Netw., vol. 23, no. 6, pp. 1917–1952, 2016.
[6]. NFS97 NFS Wireless and Mobile Communications Workshop, Northern Virginia, March 1997.
[7]. Basagni, S., Conti, M., Giordano S., and Stojmenovic, I. (Eds.) Ad Hoc Networking. IEEE Press Wiley, New York, 2003.
[8]. R. P. Salim and R. Rajesh, "A Survey: Optimal Node Routing Strategies in MANET 1 1," pp. 260– 267, 2016.
[9]. F. Maan and N. Mazhar, "MANET routing protocols vs mobility models: A performance evaluation," 2011 Third Int. Conf. Ubiquitous Future. Networks, pp. 179–184, 2011.
[10]. N. Gupta and R. Gupta, "Routing protocols in Mobile Ad-Hoc Networks: An overview," Int. Conf. "Emerging Trends Robot. Commun. Technol. INTERACT-2010, vol. 4, no. 1, pp. 173–177, 2010. https://doi.org/10.1109/interact.2010.5706220.
[11]. S. Henningsen, S. Dietzel, and B. Scheuermann, "Challenges of misbehaviour detection in industrial wireless networks," Lect. Notes Inst. Comput. Sci. Soc. Telecommun. Eng. LNICST, vol. 223 LNICST, pp. 37–46, 2018. https://doi.org/10.1007/978-3-319-74439-1_4.
[12]. Toh. C.K., 2002. Ad Hoc Mobile Wireless Networks Protocols and Systems. Prentice Hall, Inc
[13]. Freebersyser, J. A., and Leiner, B. A DoD perspective on mobile ad hoc networks. In: Perkins, C. (Ed.) Ad Hoc Networking, Addison Wesley, Reading, MA, 2001, pp. 29–51.
[14]. J. Jubin and J.D. Tornow, "The DARPA Packet Radio Network Protocols", proceedings of the IEEE, vol. 75, no. 1, January 1987, pp.21-32.
[15]. J. A. Freebersyser and B. Leinerr, "A DoD perspective on mobile ad hoc networks," in Ad Hoc Networking, C. E. Perkin, Ed. Addison-Wesley, 2001, pp. 29–51.
[16]. Mauve, M., Widmer, J., & Hartenstein, H. "A Survey on Position Based Routing in Mobile Adhoc Networks", IEEE Network Magazine, November 2001, 15(6):30–39.
[17]. Kaur, S., & Gupta, A. K. "Position Based Routing in Mobile Ad-Hoc Networks: An Overview", IJCST Vol. 3, Issue 4, Oct - Dec 2012.
[18]. Royer E.M. and Toh C., "A review of current routing protocols for ad hoc mobile wireless networks", IEEE personal communications, 1999, pp. 46–56.
[19]. Patel, Daxesh N., et al. "A survey of reactive routing protocols in MANET." Information Communication and Embedded Systems (ICICES), 2014 International Conference on. IEEE, 2014.
[20]. Maan, F., & Mazhar, N., "MANET Routing Protocols vs Mobility Models: A Performance Evaluation, in Proceedings of IEEE Conference ICUFN 2011, pp. 179- 184.
[21]. Corson, S., and Macker, J. Mobile Ad hoc Networking (MANET): Routing Protocol Performance Issues and Evaluation Considerations. RFC 2501, IETF, Jan. 1999.

DOI:10.46647/ijetms.2022.v06i06.095 ISSN: 2581-4621

[22]. A. Sharma and R. Kumar, "Performance comparison and detailed study of AODV, DSDV, DSR, TORA and OLSR routing protocols in ad hoc networks," 2016 4th Int. Conf. Parallel, Distrib. Grid Comput. PDGC 2016, vol. 1, pp. 732–736, 2016.
[23]. C. E. Perkins and P. Bhagwat, "Highly Dynamic (DSDV) for Mobile Computers Routing," Proc. ACM SIGCOMM94, London, UK, pp. 234–244, 1994.
[24]. C. E. Perkins and P. Bhagwat, Highly Dynamic Destination-Sequenced Distance-Vector Routing (DSDV) for Mobile Computers, In Proceedings of ACM SIGCOMM, pages 234-244, 1994.
[25]. C. Hsin Liu, S. Chang," The study of effectiveness for ad-hoc wireless network", Department of Computer Science, Chinese Culture University, ICIS 2009, November 24-26, 2009 Seoul, Korea.
[26]. A. A. Hamidian, "A Study of Internet Connectivity for Mobile Ad Hoc Networks in NS 2," no. January, 2003.
[27]. Charles E. Perkings, Elizabeth M. Belding-Royer, Samir R. Das, Ad Hoc On- Demand Distance Vector (AODV) Routing, http://www.ietf.org/internetdrafts/ draft-ietf-manet-aodv-13.txt, IETF Internet draft, Feb 2003.
[28]. Perkins, C.E. and E.M. Royer, 1999.ah-hoc on-demand distance vector routing. In Proceeding of 2nd IEEE Workshop on Mobile Computing Systems and Application.
[29]. Perkins, C.E., E.M. Royer and S.R. Das, 2001. Ah Hoc on-demand distance vector (AODV) routing. http://www.ietf.org /internet-drafts/-draft-ietf-manet-aodv-08-txt, IETF Internet Draft.
[30]. Patrick McCarthy, Dan Grigoras, "Multipath Associativity Based Routing," Proceedings of the Second Annual Conference on Wireless On-demand Network Systems and Services (WONS'05).
[31]. R. Al-Ani, "Simulation and performance analysis evaluation for variant MANET routing protocols", International Journal of Advancements in Computing Technology, Volume 3, Number 1, February2011.
[32]. S. Sathish, K. Thangavel and S. Boopathi, "Performance analysis of DSR, AODV, FSR and ZRP routing protocols in MANET", MES Journal of Technology and Management, 2011.
[33]. R. Al-Ani, "Simulation and performance analysis evaluation for variant MANET routing protocols", International Journal of Advancements in Computing Technology, Volume 3, Number 1, February2011.
[34]. Freebersyser, J. A., and Leiner, B. A DoD perspective on mobile ad hoc networks. In: Perkins, C. (Ed.) Ad Hoc Networking, Addison Wesley, Reading, MA, 2001, pp. 29–51.
[35]. IETF MANET Working Group. http:// www.ietf.org/html.charters/manetcharter.html.
[36]. Toh, C-K. Ad Hoc Mobile Wireless Networks: Protocols and Systems. Prentice Hall, 2002.