A Review of Mobile Adhoc Networks

[1]Ms. V.M. Gayathri and [2]R. Nedunchelian

[1]Research Scholar, Saveetha University,
[2]Professor & Head Department of Computer Science and Engineering,
Sri Venkateswara College of Engineering,

Abstract: A Mobile Adhoc network is a type of adhoc network where each node in the network are self-configured and infrastructure less network. Each and every node in MANET are mobile in nature. Because of mobility the network connectivity will change often. The network structure will also change if the nodes are mobile. Routing from source to destination can be done with the help of various routing protocol follows the concept of MANET. If mobility increases complexity of the network will become high. In this paper, explaining the concept of mobile adhoc networks, challenges and opportunities, routing protocols defined, applications and simulator used for MANET. This paper will be a treasure for the research scholar of this area.

Key words: MANET · Packet Delivery Ratio · Protocols · Simulators

INTRODUCTION

In recent days, networks play a vital role in communication area. A network is a group of nodes formed together for gathering, processing and distributing the information. As simple, network is divided into two types called wired and wireless network. A wired network is a network where each node are connected with physical devices such as optical fibre, twisted cable, copper wire cable etc., In contrast, wireless networks are connected without any physical devices. Again wireless networks are divided into infrastructure network and infrastructure less network. In infrastructure network need an access point to connect the nodes? But in the latter one, no need of access point, each and Every node in the network acts as a router as well as source/destination. An example of infrastructure network is 802.11 and for other type are adhoc networks. An Adhoc Network is an infrastructure less network where it is not depend on pre-existing structure, neither routers in wired networks nor access point infrastructure wireless networks.

Instead of that each node in the router acts as routers. A Mobile Adhoc Network (MANET) is a network where each node ca n move in any direction on its own. If it moves frequently /continuously there will be a change in network topology that leads to network partitioning /network re-joining. If the network size increases, the overhead of mobility will increase high.
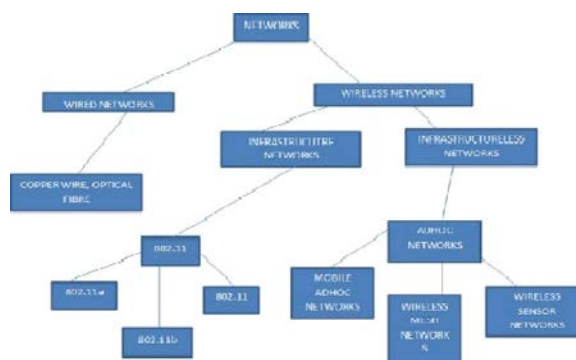

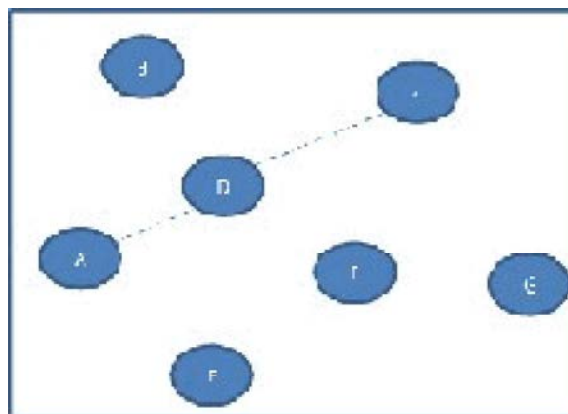Fig. 1: Classification of networks

At time 0

Fig. 2: Position of nodes in the network at time=0.

Corresponding Author: Dr. R. Nedunchelian, Professor & Head Department of Computer science and Engineering,
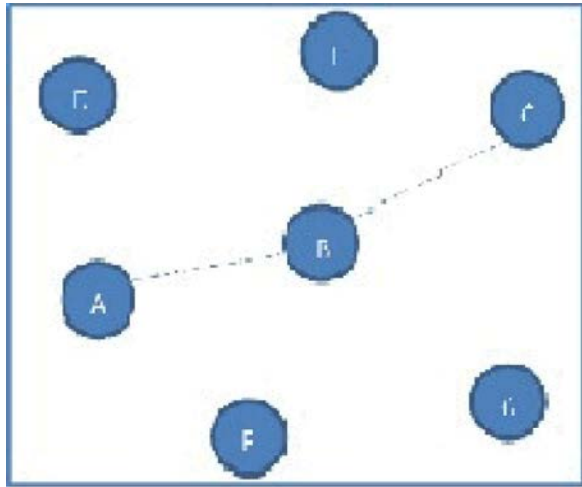Sri Venkateswara College of Engineering,   E.mail: Chelian1959@gmail.com

At time n

Fig. 3: Position of nodes at time=n where the position of D, B changes.

The above two diagram represents the network topology at two different value of time t. When time t=0 represents initial position of nodes, the node A is a source and C is a destination routing map A—D—C. But after time t=n the nodes are changed its position because of its mobility and the same routing changes as A—B—C. so it infers that continuous monitoring of route table entry is necessary for proper routing to be takes place.

Challenges and Oppourtunities
Mobility: The foremost major issue of MANET is mobility since nodes are always in moving nature it is tedious to specify the neighbouring nodes. For each and every time of neighbour node selection it should broadcast HEELO message. Also network partitioning and re-joining often occurs because of mobility.

Network Performance: Because of these issues there is a chance for degradation of network performance. It includes lifetime of the network, how much data received by sender, packet delivery ratio which in turn specifies quality and quantity of the communication between the nodes within the network.

Scalable: Here, performance factor should be directly proportional to the network size. If the network size increases, the performance factor should either increase or constant.

Security: Since it is wireless there are lot of loopholes for the intruders. Some of the attacks are flooding, black hole, grey hole attacks etc.,

Reliability: It speaks about how much reliable the communication was.

Reliability=packet delivery ratio

Packet delivery ratio=number of packets received/total number of packets send

Resource Constraints: Resources are limited to serve. Some of the resources are power constraints, battery constraints, bandwidth constraints etc.,

Routing Protocols
Proactive Protocols: It is otherwise called as TABLE-DRIVEN protocol where the routes between nodes are pre-defined. Some of the protocols are

E.g. DSDV (Destination Sequence
Distance Vector)

OLSR (Optimized Link State Routing)

Reactive Protocols: It is also known as On-Demand Protocols where the nodes will communicate only if necessary. Some of the protocols are,
E.g. DSR (Dynamic Source Routing) AODV (Adhoc on Demand Vector Routing)

Hybrid Protocols: It is a combination of both proactive and reactive protocols.
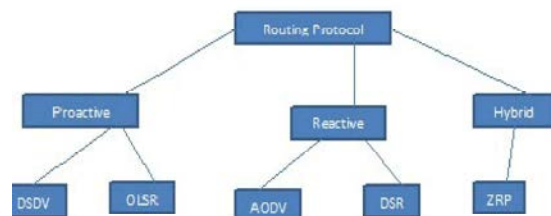
E.g. ZRP (Zone Routing Protocol)

Fig. 4: Classification of Routing protocols

Applications of Manet:
Military Battlefield: for Military purpose, it will create a network between soldiers, tankers with the outside people.

Collaborative Work: it plays a role in business environment, where outside environment are much important than inside the office.

Local Level: These kinds of networks are used to connect to a local level communication such as conference or classroom via laptop or mobile phone.

Personal Area Network and Bluetooth: Bluetooth is a mobile communication between the nodes where it is connected with either laptop or mobile phone.

Commercial Sector: Some of the applications are fire alarming, flooding indication etc., related to the natural climatic attacks.

Various Simulators Used for Manet

NS-2: NS -2 software was developed by university of Berkeley. It is open source discrete event simulator software for simulating the wired and wireless adhoc networks and for large satellite based communication. NS-2 Simulator simulates the given network using TCL and C++ where TCl acts as a front end and C++ acts as a backend. TCL means Tool Command Language which is responsible for placing, arranging and changing the properties of the nodes. It is used for the visualization of the users. C++ coding is used to change the implementation details of the network properties.

NS-3: NS-3 is a discrete event simulator used for research and education. Ns-3 software is developed to be used for real time network emulator to interconnect with the real world. NS-3 is mainly used for both IP and non-IP based networks. It includes models for Wi-Fi, WI-MAX and protocols such as OLSR and AODV for IP based applications. It uses simulation-in-the-loop use cases for interacting with the real systems.

Glomosim: Glomosim is used for wireless networks as a library-based sequential and parallel simulator. PARSEC is a c based parallel simulation language which is used to develop the library. It is mainly useful for wireless communications.

OPNET: Opnet is a commercial tool (Optimized Network Engineering Tool) which is used for communication of large networks. It defines the network topology, the nodes and link that creates a network. The properties can be change according to the user concern. Execution of simulation, result generation and analysing the result for any network element in the simulated network.

Qualnet: The QualNet is commercial simulating software which models the behaviour of the real communication network. It provides an environment for creating and animating network scenarios (drag and drop instead of writing programs), designing protocols and performance analyser. Some of the components of Architect, Analyser, Packet Tracer, File Editor, Command Line Interface.

OMNET++: An OMNET++ is a module based simulator where each and every module communicates with message passing. Simple modules are active and it is written using C++. Simple modules are grouped together to form a compound modules. The hierarchy level is unlimited. The whole network of OMNET++ is a compound module. Simple Modules can communicate with other modules using the gate. The data are sent via outer gate and received by inner gate of other module. This tool is efficiently describes the actual network system.

LITERATURE OVERVIEW MOBILITY

S.No	Paper Title	Author	Comments
1	An Overview of MANETs Simulation	Luc Hogie	[1] It explains about mobility which is akey feature of MANET along with simulation techniques.
2	Mitigating the impact of node mobility using mobile backbone for heterogeneous MANETs	Yang Xia, Chai Kiat Yeo	[2] Proposed a new protocol named FASTR which diminishes the impact of mobility by maintain ing with high node mobility and low group mobility.
3	On improving temporal and spatial mobility metrics for wireless ad hoc networks	Elmano Ramalho Cavalcanti, Marco Aurélio Spohn	[3] Regression model for mobility based on spatial and temporal dependencies.
4	Influence of mobility models on the performance of data dissemination and routing in wireless mobile ad hoc networks	Abdul Karim Abed, Gurcu Oz, Isik Aybay	[4] Comparison of various protocols such as AODV, DSR and DSDV based on their mobility models.
5	The impact of mobility on Mobile Ad Hoc Networks through the perspective of complex networks	Cristiano Rezende, Azzedine Boukerche	[5] Applying the mobility techniques on VAMET for vehicle mobility tracking. To find the characteristics of the networks and list of observations which analyze the performance of VANETs.

Continued

S.No	Paper Title	Author	Comments
6	Mobility prediction in mobile wireless networks	Javad Akbari Torkestani	[6] Mobile characteristics is predicted based on past and current characteristics of the node. It also explains how to predict the future behavior of node mobility based on mobility history. It is based on Gauss-Markov Process which exploits the correlation of the mobility over time.
7	The IMPORTANT framework for analyzing the Impact of Mobility on Performance Of RouTing protocols for Adhoc NeTworks	Fan Bai, Narayanan Sadagopan, Ahmed Helmy	[7] It applies various mobility models such as Random Waypoint, Group Mobility, Freeway and Manhattan to various routing protocols such as AODV,DSR and DSDV and measures the performance based on various mobile characteristics
8	Shortest route mobility assisted packet delivery with soft maximum delay guarantees in mobile ad hoc networks	Spyridon Vassilaras, Gregory S. Yovanof	[8] Proposed a Optimal Stopping rule Algorithm for finding the route from source to destination for minimizing routing delay.
9	Distributed node placement algorithm utilizing controllable mobility in mobile ad hoc networks	Hee-Tae Roh, Jang- Won Lee	[9] Considered a Mission-Critical networks whose degree is calculated based on their locations. Proposed a joint mission and communication aware node algorithm which concentrates mobility, Communication and location.
10	Scalable and efficient dual-region based mobility management for ad hoc networks	Ing-Ray Chen, Yinan Li, Robert Mitchell, Ding-Chau Wang	[10] Proposed a dual- region mobility management scheme for identifying nodes positions efficiently in scalable networks.
11	Mobility Prediction in Mobile Ad Hoc Networks Using Extreme Learning Machines	Lahouari Ghoutia, Tarek R. Sheltamia, Khaled S. Alutaibib	[11] ELM (Extreme Learning Machine) where nodes will know about their mobility characteristics such speed, location etc., based on that future node position will be predicted along with the distance between the neighbor nodes of current positions.

NETWORK PERFORMANCE

S.No	Paper Title	Author	Comments
1	Efficient service cache management in mobile P2P networks	P. Victer Paul	[12] Using DST (Distributed Spanning tree) with optimized ant colony optimization method improves fast cache service and retrieval for mobile peer to peer networks.
2	Performance evaluation of reactive routing protocols in MANET networks using GSM based voice traffic applications	Vishal Sharmaa Harsukhpreet Singh, Mandip Kaur, Vijay Banga	[13] It evaluate the performance of the GSM voice quality traffic based on the some parameters such as load, end-to-end delay, throughput, route discovery time in DSR protocol using OPNET simulator.
3	Adaptive resource discovery in mobile cloud computing	Wei Liu, Takayuki Nishio, Ryoichi Shinkuma, Tatsuro Takahashi	[14] Heuristics algorithm is presented to automatically transforms between the strategies according to the network environment.
4	Behavior of Ad Hoc routing protocols, analyzed for emergency and rescue scenarios, on a real urban area	Liliana Enciso Quispe, Luis Mengual Galan	[15] Chosen Real urban scenario for calculating the performance based on density of nodes and mobility model needed fro the study of AODV,DSDV and CBRP
5	OLSR performance measurement in a military mobile ad hoc network	Thierry Plesse	[16] Presented a real military urban scenario for calculating the performance measurements such as user traffic performance, network convergence speed and route repair
6	Reliable neighbor discovery for mobile ad hoc networks	Alejandro Cornejo Saira Viqar Jennifer L. Welch	[17] Presented a reliable region-based neighbor discovery protocol for transfer of packets.

Continued

S.No	Paper Title	Author	Comments
7	Maintaining Path Stability with Node Failure in Mobile Ad Hoc Networks	Abedalmotaleb Zadin and Thomas Fevens	[18] Improving the number of packets delivered by making the pah stable even if the node failure occurs
8	Performance analysis of AODV, DSR, OLSR and DSDV Routing Protocols using NS2 Simulator	S. Mohapatra, P.Kanungo	[19] Various performance analysis comparison of proactive and reactive protocols
9	Efficient power aware broadcasting technique for mobile ad hoc network	P.Vijayakumar, T. Poongkuzhali,	[20] Proposed a new scheme called Efficient power Aware Broadcasts? for increasing the throughput by reducing the number of packets dropped due to low battery power.
10	Performance Measures Modeling (PMM) in MANET	Pankaj Sharma, Ashok Kumar Sinha	Applied mathematical model such as PMM (Performance measure Model) for finding routing metrics like PDR fraction, Normalized Routing load, Average End-to-End delay.

SCALABLE

S.No	Paper Title	Author	Comments
1	SCALAR: Scalable data lookup and replication protocol for mobile ad hoc networks	Emre Atsan	[21] Proposed a SCALAR protocol for scalable and reliable data replication approach
2	Hierarchical multicast techniques and scalability in mobile Ad Hoc networks	Chao Gui, Prasant Mohapatra	[22] Proposed a scheme for hierarchical multicasting approaches are domain based and overlay driven.
3	Balancing the tradeoffs between scalability and availability in mobile ad hoc networks with a flat hashing-based location service	Abdelouahid Derhab, Nadjib Badache	[23] Presented a service FSLS to find exact node availability used for communication.
4	Scalable max-min fairness in wireless ad hoc networks	Congzhou Zhou N.F. Maxemchuk	[24] Proposed a min- max fair flow assignment model which is scalable and achieves high QOS for real time applications.
5	Exploring geographic context awareness for data dissemination on mobile ad hoc networks	Edison Pignaton de Freitas,	[25] Presented to get the positioning information with different network complexity in mobile adhoc networks.
6	Improving scalability in vehicular communication using one-way hash chain method	Ashraph Sulaiman	[56] To Reduce scalable issue by introducing a protocol called Hash chain based Authentication protocol.
7	Routing on large scale mobile ad hoc networks using bloom filters	João Trindade, Teresa Vazão	[27] The bloom filters presented here are used to reduce the number of control messages used for discovering and maintaining the routes.
8	Proactive versus reactive routing in low power and lossy networks: Performance analysis and scalability improvements	Joydeep Tripathi,	Proactive and reactive protocols are compared based on LLRs and Loading

SECURITY

S.No	Paper Title	Author	Comments
1	Algorithms for a distributed IDS in MANETs	P.M. Mafra, J.S. Fraga, A.O. Santin	Admit intrusions and to detect in their own algorithms
2	Influence of mobility models on the performance of data dissemination and routing in wireless mobile ad hoc networks	Abdul Karim Abed, Gurcu Oz, Isik Aybay	[4] Compares the performance of various routing protocols in MANET according to the network loads and mobility
3	Security in wireless ad-hoc networks - A survey	R. Di Pietro, S.Guarino, N.V. Verde, J. Domingo-Ferrer	Discussed about various wireless adhoc networks such as VANET,WSN etc (challenges, technologies, applications)
4	Survey of certificate usage in distributed	Yki Kortesniemi, Mikko Sa¨rel	Presented about various usage of certificates for access control preserving privacy
5	Self-organized public key management in MANETs with enhanced security and without certificate-chains	Soumyadev Maity, R.C. Hansdah	Routes are determined based on strong end to end trust value. They have used MAC instead of RSA certificates.

Continued

S.No	Paper Title	Author	Comments
6	An intrusion detection & adaptive response mechanism for MANETs	Adnan Nadeem, Michael P. Howarth	Detecting and overcome from various attacks based upon severity, range and degradation of network performance.
7	A probabilistic framework for jammer identification in MANETs	Massimiliano Albanese, Alessandra De Benedictis, Sushil Jajodia, Don Torrieri	Finding out the jamming attacks along with jammed and non-jammed nodes.
8	Trust management in mobile ad hoc networks for bias minimization and application performance maximization	Ing-Ray Chen, Jia Guo, Fenye Bao, Jin-Hee Cho	QoS based trust routing protocol
9	An accurate and precise malicious node exclusion mechanism for ad hoc networks	Lyno Henrique G. Ferraz, Pedro B. Velloso, Otto Carlos M.B. Duarte	Distributed access control method with two context (local and global)
10	SKAIT: A parameterized key assignment scheme for confidential communication in resource constrained ad hoc wireless networks	Ramon L. Novales, Neeraj Mittal, Kamil Sarac	Symmetric ley management and distribution
11	Lifetime elongation of ad hoc networks under flooding attack using power-saving technique	Fuu-Cheng Jiang, Chu-Hsing Lin, Hsiang-Wei Wu	Controlling flooding attacks using RREQ packets
12	TOHIP: A topology-hiding multipath routing protocol in mobile ad hoc networks		Making unaware of network topology from malicious nodes.
13	Secrecy transmission capacity in noisy wireless ad hoc networks	Jinxiao Zhu, Yin Chen, Yulong Shen, Osamu Takahashi, Xiaohong Jiang, Norio Shiratori	Checks for physical layer security

RELABILITY

S.No	Paper Title	Author	Comments
1	Improving delivery ratios for application layer multicast in mobile ad hoc networks	Peter Baumung, Martina Zitterbart, Kendy Kutzner	[28] Proposed a tailored mechanism for handling packet losses and reliability issues.
2	Survey of multipath routing protocols for mobile adhoc networks	Mohammed Tarique, KemalE.Tepe, SasanAdibi, ShervinErfani	[29] Issues, performance, objectives of multi path routing protocol of MANET has been summarized and explained.
3	Epidemic-based reliable and adaptive multicast for mobile ad hoc networks	[30] Oznur Ozkasap, Zulkuf Genc, Emre Atsan	Proposed a protocol alled Era Mobile (Epidemic-based Reliable and Adaptive Multicast for Mobile ad hoc networks) for high reliability in multicast routing protocol even in network adverse conditions.
4	Using a new protocol to enhance path reliability and realize load balancing in mobile ad hoc networks	Antonios Argyriou, Vijay Madisetti	[31] Provides End- to -end scheme for load balancing and route/path failures in multipath routing network.
5	Protocol-independent multicast packet delivery improvement service for mobile Ad hoc networks	Chien-Chung Shen, Sundaram Rajagopalan	[32] Proposed an adaptive mechanism called Protocol- Independent Packet Delivery Improvement Service (PIDIS) to recover lost multicast packets to improve reliability over the network.
6	An efficient reliable broadcasting protocol for wireless mobile ad hoc networks	Chih-Shun Hsu, Yu-Chee Tseng, Jang-Ping Sheu	[33] Presented a efficient broadcasting approach for multicast reliability problem with low cost broadcast.
7	Analysis of link lifetime in wireless mobile networks	Abbas Nayebi, Hamid Sarbazi-Azad	[34] Analytical and mathematical approaches are given on each link behavior such as effect of buffer zone, effect of stationary nodes etc., for calculating the link lifetime and Residual Link lifetime of all links in the network.
8	A Resource Reservation and Traffic Categorization Agent for QoS in Medical Ad Hoc Networks	D. Vassisa, A. Kampouraki, P. Belsis, C. Skourlasa	[35] Guaranteed reliability over the network in Medical processing.
9	Maintaining Path Stability with Node Failure in Mobile Ad Hoc Networks	Abedalmotaleb Zadin and Thomas Fevens	[18] Proposed a technique to stable the reliability even in the presence of node failure in the network.

RESOURCE CONSTRAINTS

S.No	Paper Title	Author	Comments
1	Energy-aware and self-adaptive anomaly detection scheme based on network tomography in mobile ad hoc networks	Wei Wang	[36] Provides an energy aware mechanism for resource constrained MANETs. In addition to this it also provides link efficiency, network security and network topology.
2	An architecture for power-saving communications in a wireless mobile ad hoc network based on location information	Yu-Chee Tseng, Ten-Yueng Hsieh	[37] Provides an architecture for power-aware communicationin MANET.
3	A hybrid artificial immune system (AIS) model for power aware secure Mobile Ad Hoc Networks (MANETs) routing protocols	N. Mazhar, M. Farooq	[38] Proposed a protocol for secure and energy saving mechanism over the network.
4	Power-aware ad hoc networks with directional antennas: Models and analysis	Basel Alawieh, Chadi Assi, Hussein Mouftah	[39] Presented high throughput in high interference network. It also investigate the effect of collision on the energy consumption and propose an energy consumption model that utilizes all aspects of energy wastage.
5	Minimum energy hierarchical dynamic source routing for Mobile Ad Hoc Networks	Mohammed Tarique, Kemal E. Tepe	[40] Proposed two protocols namely Minimum Energy Dynamic Source Routing (MEDSR) and Hierarchical Minimum Energy Dynamic Source Routing (HMEDSR) to reduce energy consumption in MANET.
6	The slow start power controlled MAC protocol for mobile ad hoc networks and its performance analysis	Emmanouel A. Varvarigos, Gkamas Vasileios, Karagiorgas Nikolaos	[41] Slow Start Power Controlled (abbreviated SSPC) protocol to improves lifetime, throughput and degrades energy consumption over the network by using power control of RTS/CTS and Data frames in IEEE 802.11.
7	Energy efficient zone based routing protocol for MANETs	Shadi S. Basurra, Marina De Vos, Julian Padget, Yusheng Ji, Tim Lewis, Simon Armour	[42] Discussed the Zone based Routing with Parallel Collision Guided Broadcasting Protocol (ZCG) for reducing the energy consumption.
8	Energy Efficient CBMT for Secure Multicast Key Distribution in Mobile Ad Hoc Networks	D.Suganyadevi, Dr. G.Padmavathi	[43] Proposed a new efficient cluster based multicast tree (CBMT) algorithm for secure multicast key distribution, in which the source node uses a Multicast version of the Destination Sequenced Distance Vector (MDSDV) routing protocol to consume less energy.
9	Efficient power aware broadcasting technique for mobile ad hoc network	P.Vijayakumar, T. Poongkuzhali,	[20] Proposed a new way of broadcasting technique called ¯Efficient Power Aware broadcasts (EPAB)? to provide an optimal path with suitable bandwidth and battery capacity.
10	Fuzzy-controlled Power-aware Multicast Routing (FPMR) For Mobile Ad Hoc Networks	Paramartha dutta, Anuradha Banerjee	[44] Proposed a fuzzy controlled power aware multicast routing (FPMR) protocol that calculates residual energy, energy requires to complete multicast operations, link stability etc.,

APPLICATIONS

S.No	Paper Title	Author	Comments
1	Sleep-based topology control in the Ad Hoc networks by using fitness aware learning automata	Mina Shirali, Nasrin Shirali, Mohamad Reza Meybodi	[45] A sleep based topology control algorithm and probabilistic method to decide whether the node has to sleep or not has been proposed.
2	Vehicular communication adhoc routing protocols: A survey	BaraaT.Sharef, RaedA.Alsaqour, MahamodIsmail	[46] A review on related works to vehicular adhoc networks has been carried out

Continued

S.No	Paper Title	Author	Comments
3	Human mobility in opportunistic networks: Characteristics, models and prediction methods	Poria Pirozmand, GuoweiW u, Behrouz Jedari, Feng Xia	[47] Proposed human mobility issues based on three characteristics such as mobility model, mobility characteristics and mobility prediction techniques.
4	Vehicular networks and the future of the mobile internet	Mario Gerla, Leonard Kleinrock	[48] Examined interplay between wired and wireless and extract a message for the design of a more efficient Future Wireless Internet.
5	Facebook or Fakebook? The effects of simulated mobile applications on simulated mobile networks	Iain Parris, Fehmi Ben Abdesslem, Tristan Henderson	[49] Examined differences in user behavior between a real and simulated mobile social networking application through a user study.
6	A Resource Reservation and Traffic Categorization Agent for QoS in Medical Ad Hoc Networks	D. Vassisa, A. Kampourakia, P. Belsisb, C. Skourlasa	[35] An intelligent agent is designed which is suitable For ad hoc networks, which categorizes medical traffic in classes and reserves bandwidth according to each node's needs?
7	A Multi-Agent Approach For Routing On Vehicular Ad-Hoc Networks	Samira Harrabi, Walid Chainbi, Khaled Ghedira	[50] Introduced a multi agent system approach to solve the problems mentioned above and improve Vehicular ad-hoc network routing.

SIMULATORS

S.No	Paper Title	Author	Comments
1	A Survey of Network Simulators Supporting Wireless Networks	Murat Miran K¨oksal	Survey about functionalities and properties of various network simulators
2	Survey on Simulation Tools for Mobile Ad-Hoc Networks	Sujata V. Mallapur	To measure the performance and behavior
3	A Performance Comparison of Network Simulators for Wireless Networks	Atta ur Rehman Khan, Sardar M. Bilal, Mazliza Othman	Compare the CPU utilization and scalability of various simulators.

CONCLUSION

In today's world, technologies are keep on changing and getting advance day by day. In order to keep intact with the technology, establishes connection to form a network. So that people communicate and share their things. Here, in this paper we discussed on mobile adhoc networks where nodes will be in mobility and networks structure will keeps on changing according to the specification. This paper gives an overall idea about MANET and its various factors. This paper will give an idea for the researcher to start with.

Future Direction: From the study, it is clear that, there are lot of issues related to the development of Mobile Adhoc Netowrks especially major issues such as data reliability which affects time, money and effort. So there are more research avenues for handling the data reliability issues. Secondly, the other important issue like secure communication requires more attention and detailed research. No significant research on security issues have been discussed before. So, there will be a large scope to do research on this unrevealed area. There are many research outcomes and books discussed in great detail about issues related to create a MANET. Hence, there are many opportunities for extended research and experimental reports for issues related to resolving various issues related to MANET.

REFERENCES

1. Luc Hogie, Pascal Bouvry and Fr´ed´eric Guinand, XXXX. An Overview of MANETs Simulation.
2. Yang Xia and Chai Kiat Yeo, 2012. Mitigating the impact of node mobility using mobile backbone for heterogeneous MANETs, Computer Communications, 35: 1217-1230.
3. Elmano Ramalho Cavalcanti and Marco Aurélio Spohn, 2012. On improving temporal and spatial mobility metrics for wireless ad hoc networks, Information Sciences, 188: 182-197.
4. Abdul Karim Abed, Gurcu Oz and Isik Aybay, 2014. Influence of mobility models on the performance of data dissemination and routing in wireless mobile ad hoc networks, Computers and Electrical Engineering, 40: 319-329.

5. Cristiano Rezende, Azzedine Boukerche, Richard W. Pazzi, Bruno P.S. Rocha and Antonio A.F. Loureiro, 2011. The impact of mobility on Mobile Ad Hoc Networks through the perspective of complex networks, J. Parallel Distrib. Comput., 71: 1189-1200.

6. Javad Akbari Torkestani, 2012. Mobility prediction in mobile wireless networks, Journal of Network and Computer Applications, 35: 1633-1645.

7. Fan Bai, Narayanan Sadagopan and Ahmed Helmy, 2003. The IMPORTANT framework for analyzing the Impact of Mobility on Performance Of RouTing protocols for Adhoc NeTworks, Ad Hoc Networks, 1: 383-403.

8. Spyridon Vassilaras and Gregory S. Yovanof, 2012. Shortest route mobility assisted packet delivery with soft maximum delay guarantees in mobile ad hoc networks, Ad Hoc Networks, 10: 886-900.

9. Hee-Tae Roh and Jang-Won Lee, 2014. Distributed node placement algorithm utilizing controllable mobility in mobile ad hoc networks, Ad Hoc Networks, 15: 67-77.

10. Ing-Ray Chen, Yinan Li, Robert Mitchell and Ding-Chau Wang, 2014. Scalable and efficient dual-region based mobility management for ad hoc networks, Ad Hoc Networks, 23: 52-64.

11. Lahouari Ghoutia, Tarek R. Sheltamia and Khaled S. Alutaibib, 2013. Mobility Prediction in Mobile Ad Hoc Networks Using Extreme Learning Machines, Procedia Computer Science, 19: 305-312.

12. Victer Paul, P., D. Rajaguru, N. Saravanan, R. Baskaran, P. Dhavachelvan, 2013. Efficient Service Cache Management In Mobile P2p Networks?, Future Generation Computer Systems, 29: 1505-1521.

13. Vishal Sharmaa, Harsukhpreet Singh, Mandip Kaur and Vijay Banga, 2016. Performance Evaluation Of Reactive Routing Protocols In Manet Networks Using Gsm Based Voice Traffic Applications?, Optik, 124: 2013-2016.

14. Wei Liu, Takayuki Nishio, Ryoichi Shinkuma and Tatsuro Takahashi, 2014. Adaptive Resource Discovery In Mobile Cloud Computing?, Computer Communications, 50: 119-129.

15. Liliana Enciso Quispe and Luis Mengual Galan, 2014. Behavior Of Ad Hoc Routing Protocols, Analyzed For Emergency And Rescue Scenarios, On A Real Urban Area?, Expert Systems With Applications, 41: 2565-2573.

16. Thierry Plesse, Cedric Adjih, Pascale Minet, Anis Laouiti, Adokoe´ Plakoo, Marc Badel, Paul Muhlethaler, Philippe Jacquet and Je´R^Ome Lecomte, 2005. Olsr Performance Measurement In A Military Mobile Ad Hoc Network?, Ad Hoc Networks, 3: 575-588.

17. Alejandro Cornejo, Saira Viqar and Jennifer L. Welch, 2014. Reliable Neighbor Discovery For Mobile Ad Hoc Networks, Ad Hoc Networks, 12: 259-277.

18. Abedalmotaleb Zadin and Thomas Fevens, 2013. Maintaining Path Stability With Node Failure In Mobile Ad Hoc Networks?, Procedia Computer Science, 19: 1068 -1073.

19. Mohapatra, S. and P. Kanungo, 2012. Performance Analysis Of Aodv, Dsr, Olsr And Dsdv Routing Protocols Using Ns2 Simulator?, Procedia Engineering, 30: 69 -76.

20. Vijayakumar, P. and T. Poongkuzhali, 2012. Efficient Power Aware Broadcasting Technique For Mobile Ad Hoc Network, Procedia Engineering, 30: 782 -789.

21. Emre Atsan amd Öznur Özkasap, 2013. SCALAR: Scalable data lookup and replication protocol for mobile ad hoc networks, Computer Networks, 57: 3654-3672.

22. Chao Gui, Prasant Mohapatra, Hierarchical multicast techniques and scalability in mobile Ad Hoc networks, Ad Hoc Networks, 4: 586-606.

23. Abdelouahid Derhab and Nadjib Badache, 2008. Balancing the tradeoffs between scalability and availability in mobile ad hoc networks with a flat hashing-based location service, Ad Hoc Networks, 6: 1013-1030.

24. Congzhou Zhou and N.F. Maxemchuk, 2011. Scalable max-min fairness in wireless ad hoc networks, Ad Hoc Networks, 9: 112-119.

25. Edison Pignaton de Freitas, Tales Heimfarth and Flavio Rech Wagner, 2013. Carlos duardo Pereira, Tony Larsson, Exploring geographic context awareness for data dissemination on mobile ad hoc networks, Ad Hoc Networks, 11: 1746-1764.

26. Ashraph Sulaiman, S.V. Kasmir Raja and Sung Han Park, 2013. Improving scalability in vehicular communication using one-way hash chain method, Ad Hoc Networks, 11: 2526-2540.

27. João Trindade and Teresa Vazão, 2014. Routing on large scale mobile ad hoc networks using bloom filters, Ad Hoc Networks, 23: 34-51.

28. Peter Baumung, Martina Zitterbart and Kendy Kutzner, 2005. Improving delivery ratios for application layer multicast in mobile ad hoc networks, Computer Communications, 28: 1669-1679.

29. Mohammed Tarique, Kemal E. Tepe, Sasan Adibi and Shervin Erfani, 2009. Survey of multipath routing protocols for mobile adhoc networks, Journal of Network and Computer Applications, 32: 1125-1143.

30. Oznur Ozkasap, Zulkuf Genc and Emre Atsan, 2009. Epidemic-based reliable and adaptive multicast for mobile ad hoc networks, Computer Networks, 53: 1409-1430.

31. Antonios Argyriou and Vijay Madisetti, 2006. Using a new protocol to enhance path reliability and realize load balancing in mobile ad hoc networks, Ad Hoc Networks, 4: 60-74.

32. Chien-Chung Shen and Sundaram Raagopalan, 2007. Protocol-independent multicast packet delivery improvement service for mobile Ad hoc networks, Ad Hoc Networks, 5: 210-227.

33. Chih-Shun Hsu, Yu-Chee Tseng and Jang- Ping Sheu, 2007. An efficient reliable broadcasting protocol for wireless mobile ad hoc networks, Ad Hoc Networks, 5: 299-312.

34. Abbas Nayebi and Hamid Sarbazi-Azad, 2012. Analysis of link lifetime in wireless mobile networks, Ad Hoc Networks, 10: 1221-1237.

35. Vassisa, D., A. Kampourakia, P. Belsisb and C. Skourlasa, 2013. A Resource Reservation And Traffic Categorization Agent For Qos In Medical Ad Hoc Networks, Procedia - Social And Behavioral Sciences, 73: 460-466.

36. Wei Wang, Huiran Wang, Beizhan Wang, Yaping Wang and Jiajun Wang, 2013. Energy-aware and self-adaptive anomaly detection scheme based on network tomography in mobile ad hoc networks, Information Sciences, 220: 580-602.

37. Yu-Chee Tseng and Ten-Yueng Hsieh, 2004. An architecture for power-saving communications in a wireless mobile ad hoc network based on location information, Microprocessors and Microsystems, 28: 457-465.

38. Mazhara, N. and M. Farooqb, 2011. A hybrid artificial immune system (AIS) model for power aware secure Mobile Ad Hoc Networks (MANETs) routing protocols, Applied Soft Computing, 11: 5695-5714.

39. Basel Alawieh, Chadi Assi and Hussein Mouftah, 2009. Power-aware ad hoc networks with directional antennas: Models and analysis, Ad Hoc Networks, 7: 486-499.

40. Mohammed Tarique and Kemal E. Tepe b, 2009. Minimum energy hierarchical dynamic source routing for Mobile Ad Hoc Networks, Ad Hoc Networks, 7: 1125-1135.

41. Emmanouel A. Varvarigos, Gkamas Vasileios and Karagiorgas Nikolaos, 2009. The slow start power controlled MAC protocol for mobile ad hoc networks and its performance analysis, Ad Hoc Networks, 7: 1136-1149.

42. Shadi S. Basurra, Marina De Vos, Julian Padget, Yusheng Ji, Tim Lewis and Simon Armour, 2014. Energy efficient zone based routing protocol for MANETs, Ad Hoc Networks.

43. Suganyadevia, D. and Dr. G. Padmavathi, 2010. Energy Efficient CBMT for Secure Multicast Key Distribution in Mobile Ad Hoc Networks, Procedia Computer Science, 2: 248-255.

44. Paramartha dutta, Anuradha Banerjee, Fuzzy-controlled Power-aware Multicast Routing (FPMR) For Mobile Ad Hoc Networks, Procedia Technology, 4: 38-49.

45. Mina Shirali, B. Nasrin Shirali and Mohamad Reza Meybodic, 2012. Sleep-Based Topology Control In The Ad Hoc Networks By Using Fitness Aware Learning Automata, Computers And Mathematics With Applications, 64: 137-146.

46. Baraat Sharef, N. Raeda Alsaqour, Mahamodismail, Vehicular Communication adhoc routing protocols:Asurvey Journal of Network and Computer Applications, 40: 363-396.

47. Poria Pirozmand, Guoweiwu and Behrouzjedari Fengxia, 2014. Human Mobility in opportunistic networks : Characteristics, Models And Prediction methods, Journal Of Network and Computer Applications, 42: 45-58.

48. Mario Gerla and Leonard Kleinrock, 2011. Vehicular Networks and The Future Of The Mobile Internet, Computer Networks, 55: 457-469.

49. Iain Parris, Fehmi Ben Abdesslem and Tristan Henderson, 2014. Facebook Or Fakebook? The Effects of Simulated Mobile Applications on Simulated Mobile Networks, Ad Hoc Networks, 12: 35-49.

50. Samira Harrabia, Walid Chainbib and Khaled Ghedirac, 2013. A Multi-Agent Approach For Routing On Vehicular Ad- Hoc Networks, Procedia Computer Science, 19: 578 -585.