IJCSE International Journal of Computer Sciences and Engineering Open Access
Review Paper Volume-2, Issue-4 E-ISSN: 2347-2693

Comparative Analysis of Reactive Protocols in Mobile Ad-Hoc Networks

Nisha Mannan[1*] and Shipra Khurana[2]

Dept. of Computer Science, DVIET, Karnal, India

www.ijcseonline.org

Received: 09/03/2014 Revised: 29/03/2014 Accepted: 22/04/2014 Published: 30/04/2014

Abstract— MANETs have three types of routing protocols, Reactive protocols, Proactive protocols and Hybrid Protocols. The routing protocols designed majorly for internet are fundamentally different from the mobile Ad-Hoc networks (MANET). In research community very little attention has been given towards performance issues in MANET. This review focuses on MANETs focused mainly on comparing different reactive protocols or proactive protocols.

***Index Terms*— MANETS, Performance Issues, Protocols**

I. INTRODUCTION

In the past few years, we have seen a rapid expansion in the field of mobile computing due to the proliferation of economical, widely available wireless devices. However, modern devices, Applications and protocols are solely focused on cellular or wireless local area networks (WLANs), not taking into account the great potential offered by mobile ad hoc networking. A mobile ad-hoc network is an self-governing collection of mobile devices (laptops, smart phones, sensors, etc.) that communicate with each other over wireless links and cooperate in a distributed manner in order to provide the necessary network functionality in the absence of a fixed infrastructure.

MOBILE AD-HOC NETWORKS (MANETs)

A Mobile Ad-hoc network (MANET) is an autonomous collection of mobile routers or nodes communicating over radio links. MANET is a temporary network without infrastructure. The wireless routers or nodes moves randomly and organize themselves arbitrarily. The nodes directly communicate via wireless links within each other's radio range, while that are distant apart use other nodes as relay in a multi-hop routing function. As the nodes are mobile, the structure of the network changes dynamically and unpredictably over time. Ad-hoc networks are self-configuring and self-organizing, so to maintain communication between nodes in the network, each node behaves as a transmitter, a host and a router. It is an independent system of mobile hosts connected by wireless links.

Corresponding Author: *Nisha Mannan*

Dept. of Computer Science, DVIET, Karnal, India

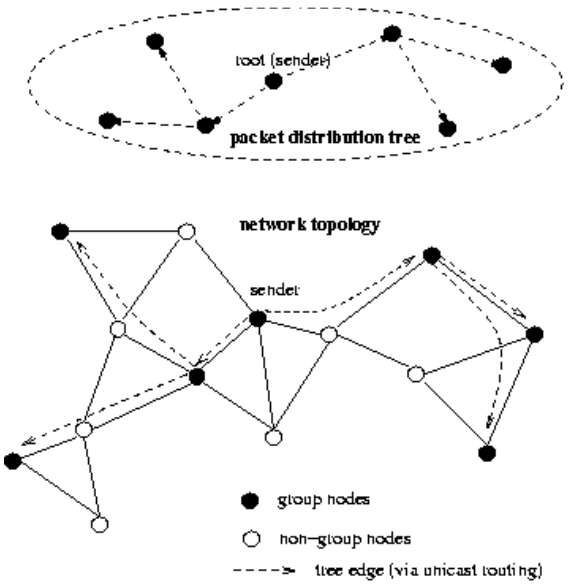


Figure:1 Mobile Ad-hoc Network

A MANET is required in situations where a fixed communication infrastructure, wireless or wired, does not exist or has been destroyed. A Mobile Ad hoc Network generally does not have any infrastructure and each mobile host also acts as a router. Communication between a variety of hosts takes place through wireless associations.

APPLICATIONS OF MANET[1-3]

Emergency Response Network: Ad hoc wireless network are very useful in emergency operations such as investigate and rescue, crowd control and commando operations.

Personal Area Network: The concept of personal area networks is about interconnecting different devices used by a single person, e.g. a PDA, cellular phone, laptop etc.

Disaster Area Networks: Ad hoc networking allows for the quick deployment of a communication network in areas where no fixed infrastructure is available or where the fixed infrastructure has been destroyed by natural disasters or other events.

Military Applications: Ad hoc wireless networks can be very useful in establishing communication among soldiers for tactical operations. They provide infrastructure for

communication among soldiers in enemy territories or in inhospitable terrains.

CHARACTERISTICS OF MANET

Infrastructure less, decentralized operation: Usually, ad hoc networks do not rely on any kind of infrastructure support for routing, network management, etc.
Dynamic topologies: Nodes are free to move arbitrarily; thus, the network topology which is typically multi-hop may change randomly and rapidly at unpredictable times, and may consist of both bidirectional and unidirectional links.
Mobility: Mobility causes recurrent change in network topology when new nodes join in, some nodes leave or some links break down.
Heterogeneity: Each node may have different capabilities. In some cases, to be able to connect to an infrastructure-based network (to form a hybrid network), some nodes can communicate with more than one type of network.

ADVANTAGES OF MANETS[1-3]

Fast installation: The level of flexibility for setting up MANET is high, since they do not require any previous installation or infrastructure, thus they can be brought up and torn down in very short time.
Dynamic topologies: Nodes can arbitrarily move around the network and can disappear temporally from the MANET, so the network topology graph can be continuously changing at undetermined speed.
Fault tolerance: Owing to the limitations of the radio interfaces and the dynamic topology, MANET supports connection failures, because routing and transmission control protocols are designed to manage these situations.
Mobility: The wireless mobile nodes can move at the same time in different directions. Although the routing algorithms deal with this issue, the performance simulations show that there is a threshold level of node mobility such that protocol operation begins to fail.
Cost: MANET could be more economical in some cases as they eliminate fixed infrastructure

LIMITATIONS OF MANETS

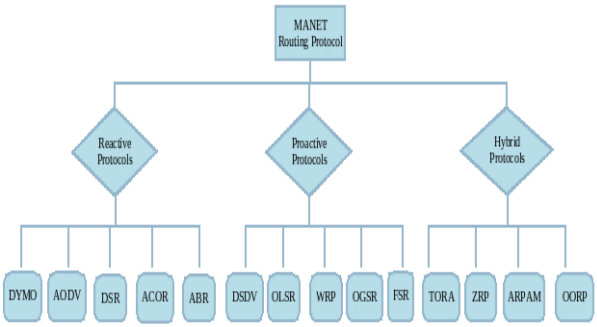
Transmission errors: Attenuation and interferences are other effects of the wireless links that increase the error rate.
Security analyses: Some of the vulnerabilities and attacks MANET can suffer. The authors divide the possible attacks in passive ones, when the attacker only attempts to discover valuable information by listening to the routing traffic; and active attacks, which occur when the attacker injects arbitrary packets into the network with some proposal like disabling the network. This is major limitation of MANET.
Roaming: The continuous changes in the network connectivity graph involve that the roaming algorithms of the fixed network are not applicable in MANET, because they are based on the existence of guaranteed paths to some destinations.

MANET ROUTING PROTOCOLS[2,3,4,5,6]

Routing is the act of moving information from a source to a destination in an internetwork.

REACTIVE ROUTING PROTOCOLS

Reactive MANET protocols only find a route to the destination node when there is a need to send data. Initially, sender will start by transmitting route requests throughout the network. The source node will then wait for the destination node or an intermediate node (which has a route to the destination) to respond with a list of intermediate nodes between the source and destination.

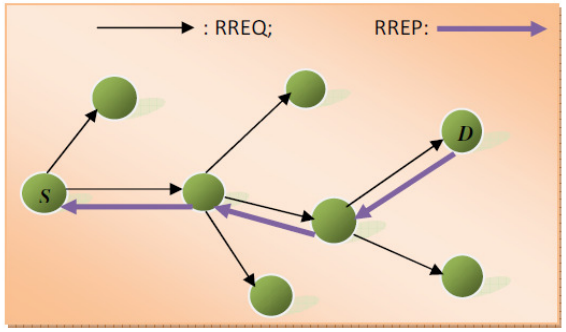


PROACTIVE ROUTING PROTOCOLS

These protocols are table driven and will actively determine the layout of the network. Through the continuous and regular exchange of network topology packets between the nodes of the network, also a complete picture of the network is maintained at every single node.

HYBRID ROUTING PROTOCOLS

The conceptual idea behind hybrid routing protocols is to use proactive routing mechanisms in some areas of the network at certain times and reactive routing for the rest of the network.
AODV (Ad hoc On Demand Distance Vector Routing Protocol)
AODV is a very simple, efficient, and effective routing protocol for Mobile Ad hoc Networks which do not have fixed topology. AODV is an on-demand routing protocol used in ad hoc networks. This algorithm, like any other on-demand routing protocol, facilitates a smooth adaptation to changes in the link conditions. In the case a link fails, notifications are sent only to the affected nodes. This information enables the affected nodes invalidate all the routes through the failed link.



Different types of route messages are used to maintain and discover the links that are:

Route Request, Route Reply, Route Error

DSR (Dynamic Source Routing)

DSR is a reactive routing protocol for ad hoc wireless networks. It also has on-demand characteristics like AODV but it's not table-driven. It is based on source routing. The node wishing to send a packet specifies the route for that packet. The whole path information for the packet traversing the network from its source to the destination is set in the packet by the sender. The source node collects the addresses of all the intermediate nodes between itself and the intended destination when discovering routes. During the process of route discovery the path information collected by the source node is cached by all the nodes involved in this process.

II. RELATED WORK

Tamilarasan, Santhamurthy.et.al[7], Mobile Ad-Hoc Network (MANET) is a collection of wireless mobile hosts forming a temporary network without the aid of any stand-alone infrastructure or centralized administration. In MANETs routing algorithm is necessary to find specific routes between source and destination. The primary goal of any ad-hoc network routing protocol is to meet the challenges of the dynamically changing topology and establish an efficient route between any two nodes with minimum routing overhead and bandwidth consumption.

Sajjad J.Gudakahriz, et.al[8], Routing protocols have central role in any mobile ad hoc network (MANET). There are many routing protocol that exhibit different performance levels in different scenarios. In this paper they compare AODV, DSDV, DSR and TORA routing protocol in mobile ad-hoc networks to determine the best operational conditions for each protocol.

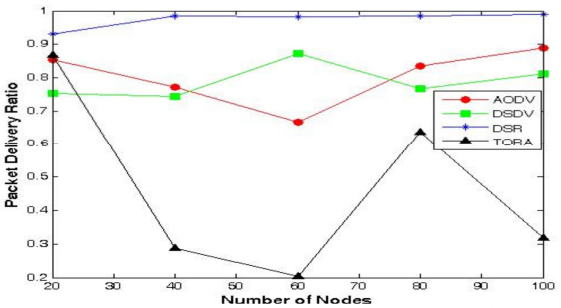


Figure:2 Packet Delivery Ratio versus Number of Nodes

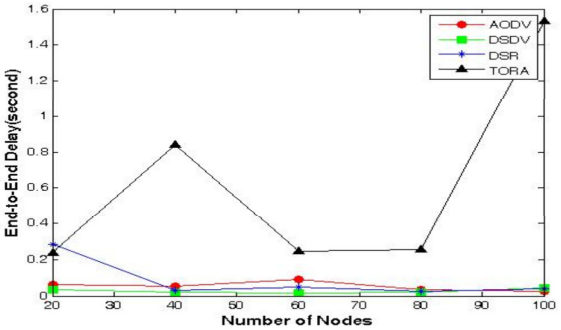


Figure 3: End-to-End Delay versus Number of Nodes

This paper is an attempt to evaluation performance of four commonly used mobile ad hoc routing protocols namely AODV, DSDV, DSR and TORA. Performance evaluation did in NS-2 simulator by doing many simulations. Comparison was based on Packet Delivery Ratio, Network Life Time, System Life Time, End-to-End Delay and Routing Overhead.

Bakht, Humayun,et.al[9],Routing is a challenging issue in mobile ad-hoc network. Concerning routing various solutions have been reported. Mobile ad-hoc network is deployed in applications such as disaster recovery and distributed collaborative computing, where routes are mostly multi-hop and network hosts communicate via packet radios. Routing is one of the challenging issues in mobile ad-hoc network. Existing protocols for ad-hoc network can generally be categorized into pro-active and re-active protocols types.

Nyirenda, Bained, and Jason Mwanza,et.al[10] In this paper, they modelled MANET scenarios with varying traffic loads and mobility scenarios and evaluated the performance of AODV, DSR, OLSR and TORA with respect to throughput, packet delivery ratio, end-to-end delay and routing overhead. The premise in this research is that no single routing protocol among AODV, DSR, OLSR and TORA is clearly superior to the others in terms of overall network performance. One protocol may be superior in terms of average end-to-end delay while another may perform better in terms of routing overhead and throughput. The performance of the routing protocol will greatly depend on various factors such as network load and mobility effects.

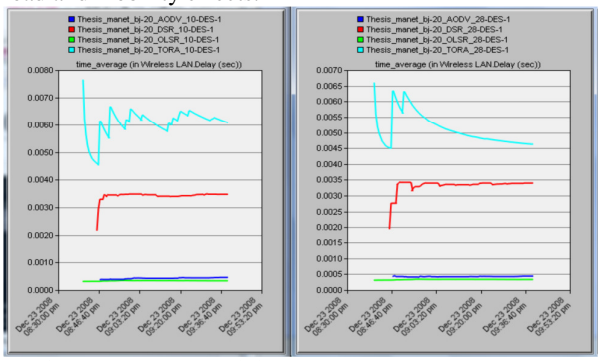


Figure 4: End-to-end delay – 20 sources at 10m/s and 28m/s

AODV outperforms DSR and OLSR in low and medium load networks with low node speeds. It also outperforms DSR and OLSR at high-speed mobility under medium and heavy network conditions. In these comparisons, TORA does not offer an overall superiority except in low load networks with low-speed mobility where it had the highest packet delivery ratio. From this study, we conclude that among the protocols considered, there is no single one with an overall superior performance. One protocol may be superior in terms of routing overhead whilst others may be superior in terms of packet delivery ratio, packet end-to-end delay or throughput. The choice of a particular routing protocol will depend on the intended use of the network.

Md.Masud Parvez, et.al[11] This paper presents the performance analysis of different routing protocols of a Mobile ad hoc Network (MANET) including cellular wireless nodes. The connections between these cellular nodes have been conducted without any typical control. MANET is a self organized and self configurable program where cellular nodes are modified randomly. The cellular nodes can acquire and forward the packets as a wireless router. Random movement of different nodes makes the packet forwarding even more complicated. This paper has dealt with four routing protocols i.e. AODV, DSR, DSDV and TORA using ns2 simulator. The performance of these routing protocols has been analyzed by five metrics: throughput, end to end delay, packet drop, routing overhead and bandwidth.

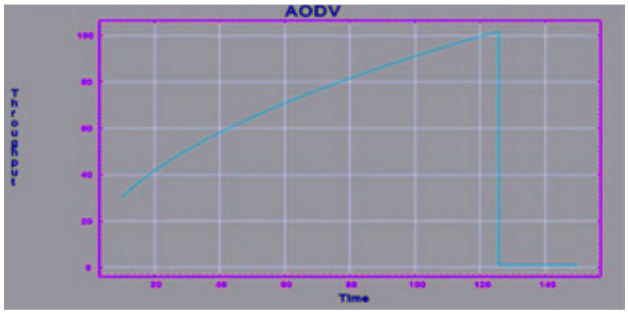


Figure 5:Throughput vs. Time for AODV protocol

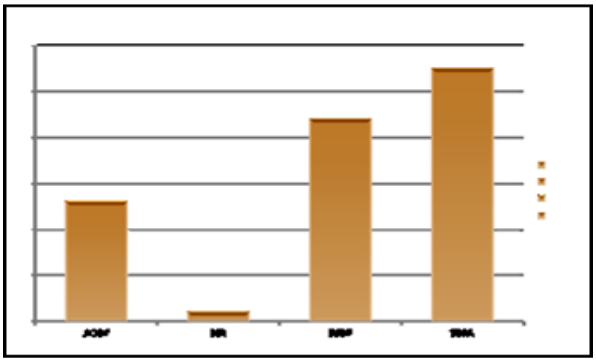


Figure 6: Packet dropping ratio for four routing protocols

For throughput AODV and DSR perform better, for packet drop DSR performs better, for end-to-end delay DSR and DSDV perform better and for routing overhead and bandwidth DSR perform well. To verify the result, the performance of the proposed system was examined and analyzed using ns2. And it is found that the DSR routing protocol perform best in different situation.

K. Thamizhmaran, et.al[12] Several secure routing protocols are proposed for MANETs. Security in MANETs is critical when deployed in real-world scenarios, such as battlefield, and event coverage, etc. In this paper we evaluate the performance comparison of three s routing protocols such as SEAD, AODV and DSR. Across the models with respect to considered metrics for comparison, SEAD outperformed others followed by AODV and DSR. The following are the metrics which we have used for the performance analysis.

PDF = no of Received Packets / no of sent packets

NRL = no of routing packets sent / no of data packet
AED =Σi=0…n (time Packet Receive i time Packet Receivedi) /Total no of Packet Received

Performance comparisons of AODV, DSR and SEAD routing protocols in MANETs have been done in this research paper, based on the performance metrics rather than security metrics such as PDF, NRL and AED. The SEAD is high secure compare the other two. The routing protocols AODV, DSR and SEAD. Although prior studies have been conducted to evaluate these routing protocols.

III. CONCLUSION

Performance in Mobile Ad-Hoc Network is major concern for the functionality of the networks. The Availability of network services, their confidentiality and data integrity can be achieved by assuring that all performance issues have been resolved. MANET often suffer from bottle necks because of the features MANETs supports with open medium, shifting topology, No central control monitoring or management, peer dependent algorithms and no defense mechanisms. In this work we have summarized the routing protocols including reactive, pro-active and also hybrid. In future we would like to work on implementing performance analysis scenarios for the same.

REFERENCES

[1]. Neeraj Kumar Pandey and Amit Kumar Mishra, "An Augmentation in a Readymade Simulators Used for MANET Routing Protocols: Comparison and Analysis", International Journal of Computer Sciences and Engineering, Volume-02, Issue-03, Page No (60-63), Mar -2014

[2]. Dipali D. Punwatkar and Kapil N. Hande, "A Review of Malicious Node Detection in Mobile Ad-hoc Networks", International Journal of Computer Sciences and Engineering, Volume-02, Issue-02, Page No (65-69), Feb -2014

[3]. Deepesh Tamrakar, Sreshtha Bhattacharya and Shitanshu Jain, "A Scheme to Eliminate Redundant Rebroadcast and Reduce Transmission Delay Using Binary Exponential Algorithm in Ad-Hoc Wireless Networks", ISROSET-International Journal of Scientific Research in Network Security and Communication, Volume-02, Issue-02, Page No (1-5), Mar -Apr 2014.

[4]. Leena Pal, Pradeep Sharma and Netram Kaurav, "Performance Analysis of Reactive and Proactive Routing Protocols for Mobile Ad-hoc –Networks", ISROSET-International Journal of Scientific Research in Network Security and Communication, Volume-01, Issue-05, Page No (1-4), Nov -Dec 2013.

[5]. Pradeep Sharma, Shivlal Mewada and Aruna Bilavariya, "Group Rekeying Management Scheme for Mobile Ad-hoc Network", ISROSET-International Journal of Scientific Research in Network Security and Communication, Volume-01, Issue-05, Page No (5-12), Nov -Dec 2013.

[6]. Pradeep Kumar Sharma, Shivlal Mewada and Pratiksha Nigam, "Investigation Based Performance of Black and Gray Hole Attack in Mobile Ad-Hoc Network", ISROSET-International Journal of Scientific Research in Network Security and Communication, Volume-01, Issue-04, Page No (8-11), Sep -Oct 2013

[7]. Tamilarasan, Santhamurthy. "A Quantitative Study and Comparison of AODV, OLSR and TORA Routing Protocols in MANET." International Journal of Computer Science Issues(IJCSI) 9, no. 1 (2012).

[8]. Khiavi, Mina Vajed, Shahram Jamali, and Sajjad Jahanbakhsh Gudakahriz. "Performance Comparison of AODV, DSDV, DSR and TORA Routing Protocols in MANETs." International Research Journal of Applied and Basic Sciences 3, no. 7 (2012): 1429-1436.

[9]. Bakht, Humayun. "Survey of routing protocols for mobile ad-hoc network."International Journal of Information and Communication Technology Research1, no. 6 (2011).

[10]. Nyirenda, Bained, and Jason Mwanza. "Performance Evaluation of Routing Protocols in Mobile Ad hoc Networks (MANETs)." Blekinge Institute of Technology" in January (2009).

[11]. Parvez, Md Masud, Shohana Chowdhury, SM Bulbul Ahammed, AKM Fazlul Haque, and Mohammed Nadir Bin Ali. "Improved Comparative Analysis of Mobile Ad-hoc Network." International Journal of Emerging Technology and Advanced Engineering 2, no. 8 (2012): 205-211..

[12]. Thamizhmaran, K., R. Santosh Kumar Mahto, and V. Sanjesh Kumar Tripathi. "Performance Analysis of Secure Routing Protocols in MANET." International Journal of Advanced Research in Computer and Communication Engineering 1, no. 9 (2012).

