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A Survey on Throughput Analysis of DSR Routing Protocol in MANETs

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ABSTRACT

Mobile Ad hoc networks are a group of wireless mobile nodes dynamically forming a network without any pre-existing infrastructure. This paper looks into (MANETs) environment that has reactive routing protocol DSR in which the throughput of DSR at varying nodes is to be found out. NS2 was used to evaluate the performance of DSR at varying nodes. The experiment result shows by xgraph and nam of different nodes of DSR protocol.

Keywords: Distance Source Routing (DSR), Mobile Ad Hoc Network (MANET), Throughput, NS-2

1. INTRODUCTION

In this section the mobile ad hoc networks discussed the Dynamic Source Routing which was implemented on existing ad hoc routing protocols to enhance their performance.

MANETs

Mobile Ad hoc Networks (MANET) is a collection of mobile nodes that are arbitrarily located so that the interconnections between nodes are dynamically changing. In mobile ad hoc network (MANET), the nodes work together in a distributed fashion to enable routing among them. MANET mobile nodes form a temporary network which is shown in figure1. Without the use of any existing network infrastructure or centralized administration. And it's an autonomous system in which mobile hosts connected by wireless links are free to be dynamically and some time act as routers at the same time. The special features of Mobile Ad Hoc Network (MANET) bring this technology great opportunity together with severe challenges. All nodes in a wireless ad hoc network act as a router and host as well as the network topology is in dynamically, because the connectivity between the nodes may vary with time due to some of the node departures and new node arrivals. The main goal of such an ad hoc network routing protocol is to establish correct and efficient route between a pair of mobile nodes so that messages delivered within the active route timeout interval.

Figure1 Ad-hoc Network

Characteristics and Complexities of MANETs

The specific characteristics and complexities, which are summarized below, impose many design challenges to the network protocols. In addition, these networks are faced with the traditional problems inherent to wireless communications such as lower reliability than wired media, limited physical security, time varying channels, interference, etc.

- Autonomous and infrastructure less
- Multi-hop routing
- Dynamic network topology
- Device heterogeneity
- Energy constrained operation
- Bandwidth constrained variable capacity links
- Limited physical security
- Network scalability
- Self-creation, self-organization and self administration

Despite the many design constraints, mobile ad hoc networks offer numerous advantages. First of all, this type of network is highly suited for use in situations where a fixed infrastructure is not available, not trusted, too expensive or unreliable. Because of their self-creating, self-organizing and self-administering capabilities, ad hoc

networks can be rapidly deployed with minimum user intervention. Also, ad hoc networks do not need to operate in a stand-alone fashion, but can be attached to the Internet, thereby integrating many different devices and making their services available to other users. Furthermore, capacity, range and energy arguments promote their use in tandem with existing cellular infrastructures as they can extend coverage and interconnectivity. As a consequence, mobile ad hoc networks are expected to become an important part of the future 4G architecture, which aims to provide pervasive computer environments that support users in accomplishing their tasks, accessing information and communicating anytime, anywhere and from any device. Table 1 provides an overview of present and future MANET applications.

Table1 : MANETs Applications

Applications	**Possible scenarios/services**
Tactical networks	• Military communication and operations • Automated battlefields
Emergency services	• Search and rescue operations • Disaster recovery • Replacement of fixed infrastructure in case of environmental disasters • Policing and fire fighting • Supporting doctors and nurses in hospitals
Commercial and 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 • Networks of visitors at airports
Home and enterprise Networking	• Personal area networks (PAN), Personal networks (PN) • Networks at construction sites • Home/office wireless networking
Education	• Universities and campus settings • Virtual classrooms • Ad hoc communications during meetings or lectures.
Entertainment	• Multi-user game • Wireless P2P networking • Outdoor Internet access • 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.

Routing in MANET

"Routing is the process of information exchange from one host to the other host in a network." Routing is the mechanism of forwarding packet towards its destination using most efficient path. Efficiency of the path is measured in various metrics like, Number of hops, traffic, security, etc. In Mobile Ad-hoc network each host node acts as specialized router itself.

Different Strategies

Routing protocol for ad-hoc network can be categorized in three strategies which is shown below diagrammatically in figure2 :-

a) Flat Vs Hierarchical architecture.
b) Pro- active Vs Re- active routing protocol.
c) Hybrid protocols.

Flat Vs. Hierarchical architecture

Hierarchical network architecture topology consists of multiple layers where top layers are more seen as master of their lower layer nodes. There are cluster of nodes and one gateway node among all clusters has a duty to communicate with the gateway node in other cluster. In this schema there is a clear distribution of task. Burden of storage of network topology is on gateway nodes, where communicating different control message is dependent on cluster nodes. But this architecture breaks down when there is single node failure (Gateway node). Gateway nodes become very critical for successful operation of network. Examples include Zone-based Hierarchical Link State (ZHLS) routing protocol. Where in flat architecture there is no layering of responsibility. Each and every node does follow the same routing algorithm as any other node in the network.

Proactive Vs Reactive routing protocol in MANET

Proactive routing protocol

In proactive routing scheme every node continuously maintains complete routing information of the network. This is achieved by flooding network periodically with network status information to find out any possible change in network topology. Current routing protocol like Link State Routing (LSR) protocol (open shortest path first) and the Distance Vector Routing Protocol (Bellman-Ford algorithm) are not suitable to be used in mobile environment.

Destination Sequenced Distance Vector routing protocol (DSDV) and Wireless routing protocols were proposed to eliminate counting to infinity and looping problems of the distributed Bellman-Ford Algorithm.

Examples of Proactive Routing Protocols are:

a) Global State Routing (GSR).
b) Hierarchical State Routing (HSR).
c) Destination Sequenced Distance Vector Routing (DSDV).

Reactive routing protocol

Every node in this routing protocol maintains information of only active paths to the destination nodes. A route search is needed for every new destination therefore the communication overhead is reduced at the expense of delay to search the route. Rapidly changing wireless network topology may break active route and cause subsequent route search

Examples of reactive protocols are:

a) Ad hoc On-demand Distance Vector Routing (AODV).
b) Dynamic Source Routing (DSR).
c) Location Aided Routing (LAR).
d) Temporally Ordered Routing Algorithm (TORA).

Hybrid routing protocols in MANET

There exist a number of routing protocols of globally reactive and locally proactive states. Hybrid routing algorithm is ideal for Zone Based Routing Protocol (ZRP)

Advantage: proactive Vs reactive

Proactive protocols: Routes are readily available when there is any requirement to send packet to any other mobile node in the network. Quick response to Application program. Reactive protocols: These are bandwidth efficient protocols. Routes are discovered on demand basis. Less Network communication overhead is required in this protocol. Disadvantage: proactive Vs reactive Proactive protocols: These maintain the complete network graph in current state, where it is not required to send packets to all those nodes. Consumes lots of network resources to maintain up-to-date status of network graph. “A frequent system-wide broadcast limits the size of ad-hoc network that can effectively use DSDV because the control message overhead grows as O (n2).”
Reactive protocols: These have very high response time as route is needed to be discovered on demand, when there is some packet to be send to new destination which does not lie on active path.

2. REACTIVE ROUTING PROTOCOL

Reactive routing protocols are more popular set of routing algorithms for mobile computation because of their low bandwidth consumption. So consider the DSR protocol.

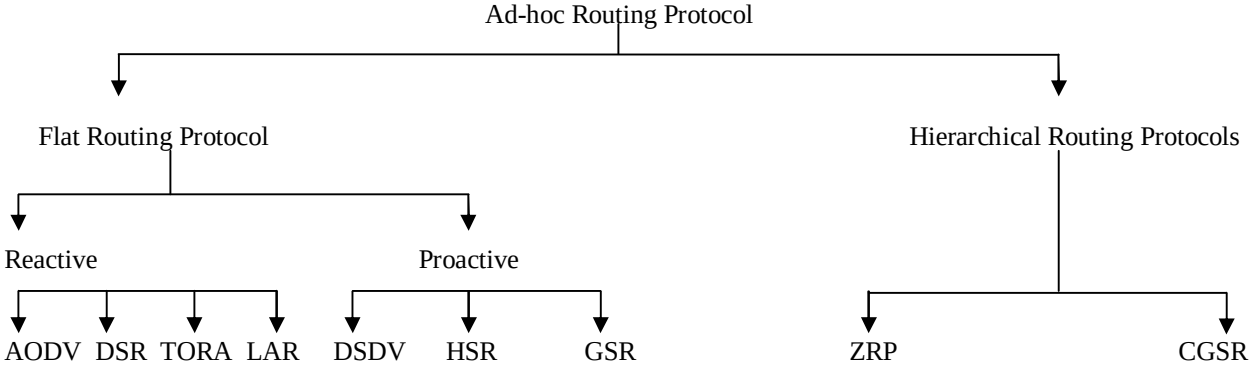

Figure2 Classification of Ad-hoc Routing Protocol

DSR

Dynamic Source Routing (DSR) is an Ad Hoc routing protocol which is based on the theory of source-based routing rather than table-based. It accumulates address of each device during route discovery. It also accumulates path information cached by nodes. They have high overheads for long path. All routing information is maintained or update at mobile nodes. Each route-request carries a sequence no. generated by source. It prevents loop formation. This protocol is source-initiated rather than hop-by-hop. Source routing is a routing technique in which the sender of a packet determines the complete sequence of nodes through which to forwarding "hop" by the address of the next node to which to transmit the packet on its way to the destination node.

The protocol is self-possessed of the two main mechanisms of "Route Discovery" and "Route Maintenance", which work together to allow nodes to discover and maintain routes to arbitrary destinations in the ad hoc network. An optimum path for a communication between a source node and target node is determined by Route Discovery process. Route request (Figure3) have unique id number. Route Maintenance confirms that the communication path remains optimum and loop-free rendering the change in network conditions, even if this requires altering the route during a transmission. Route Reply (Figure4) would only be generated if the message has reached the projected destination node.

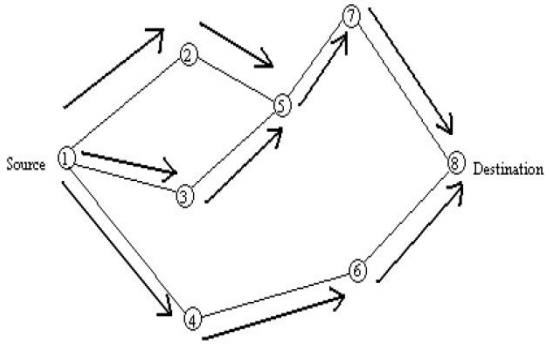

Figure3 Propagation of Request (PREQ) Packet

To return the Route Reply, the destination node must have a route to the source node. If the route is in the route cache of target node, the route would be used. Otherwise, the node will reverse the route based on the route record in the Route Reply message header. The major dissimilarity between this and other on-demand routing protocols is that it is beacon-less and hence it does not have need of periodic Hello packet transmission which are used by a node to inform its neighbors of its presence. The fundamental approach of this protocol during route creation phase is to launch a route by flooding route request packets in the network. The destination node, on getting a route request packet, responds by transmission a route reply packet back to the source which carries the route traversed by route request packet received.

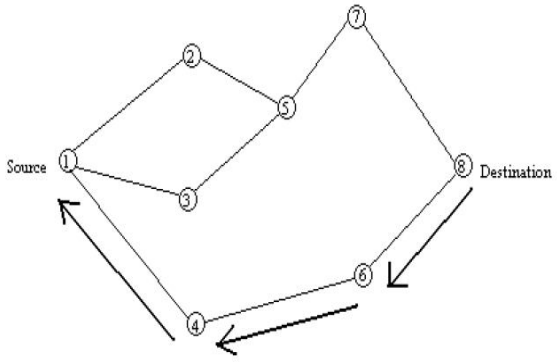

Figure4 Path taken by the Route Reply (RREP) packet

To return the route reply, destination node must have a route to the source node. If route is in destination nodes route cached, the route would be used. A node maintenance route cache containing the source routes that it is aware of. The node updates entries in the route cache as and when it learns about new route.

DSR uses two types of packets for route maintenance: - Route error packet & Acknowledgement

In event of fatal transmission, the route maintenance phase is initiated whereby the route error packets are generated at a node. Whenever the data link layer detects a link disconnection, a ROUTE_ERROR packet is sent backward to the source in order to maintain the route information. After receiving the ROUTE_ERROR packet, the source node initiates another route discovery operation. Additionally, all routes containing the broken link should be removed from the route caches of the immediate nodes when the ROUTE_ERROR packet is transmitted to the source. The error nous hop will be removed from the node route cache, all node have hop are truncated at that point. Acknowledgement packets are used to verify the correct operation of route links. It also include passive acknowledgement in which a node hears the next hop from packet along the route.

Advantages

- Reactive approach which eliminates the need to periodically flood the networks.
- Intermediate node utilizes the route cache information efficiently to reduce control overheads.
- It designed to restrict the bandwidth consumed by control packets.

Disadvantages

- Route maintenance does not locally maintain breakage link.
- State route cache information could also result in inconsistencies during route reconstruction phase.
- Connection setup delay is higher then in table-driven approach.
- Protocol good for static environment.
- Routing overheads directly proportional to path length.

3. PERFORMANCE MERTICS OF DSR

The following performance metrics are conferred:

Routing Overhead: Average routing overhead is the total number of routing packets separated by total number of delivered data packets. This metric delivers an indication of the extra bandwidth consumed by overhead to deliver data traffic. It is critical as the size of routing packets may vary. The routing overhead describes how many routing packets for route discovery and route maintenance need to be sent in order to propagate the CBR packets.

Packet Delivery Ratio/ Packet Delivery: Throughput and Packet delivery ratio is calculated by dividing the Number of packets received by the destination through the number of packets originated. It specifies the packet loss rate, which limits the maximum throughput of the network. The better the delivery ratio, the more complete and correct is the routing protocol.

Average End-To-End Delay: Average End-to-End delay (seconds) is the average time it takes a data packet to reach the destination. This metric is calculated by subtracting "time at which first packet was transmitted by source" from "time at which first data packet arrived to destination". This includes all possible delays affected by buffering during route discovery latency, queuing at the interface queue, retransmission delays at the MAC, Propagation and transfer times.

Packet Loss/Drop: Packet loss describes an error condition in which data packets appear to be transmitted correctly at one end of a connection, but never attain at the other. There might be different explanations like corrupted packets will be dropped by nodes; the link/route between nodes is not working, insufficient bandwidth, etc.

Latency Rate: When source node sends a data packet towards destination node, it takes some time to deliver and this time is called latency rate/delay or transmission time.

Normalized routing load: The number of routing packets transmitted per data packet delivered at the destination. Each hop-wise transmission of a routing packet is counted as one transmission.

Throughput: The throughput is defined as the total amount of data a receiver receives from the sender divided by the time it takes for the receiver to get the last packet. The throughput is measured in bits per second (bit/s or bps).

Now in table 2,show the throughput (kbps) of DSR which is analyze by survey:

Table2 Throughput of DSR

S.No.	Number of Nodes	Throughput
1	3 nodes	533.68
2	4 nodes	567.35
3	5 nodes	544.98
4	6 nodes	520.10
5	22 nodes	142.64
6	100 nodes	662.49

4. CONCLUSION

In this section, the performance of DSR was analyzed and compares it with QoS aware DSR. Ns-2 simulator was used to conduct extensive experiments. The simulation was performed on a small sample set of 3, 4,6,22 and 100 nodes and compares these routing algorithms on behalf of performance evaluation parameter or performance metrics throughput. The simulation results of throughput over number of nodes of DSR protocol was find out by using some commands in Ns2. DSR protocol uses source routing and route cache. Hence, DSR was preferable for moderate traffic with moderate mobility. DSR throughput decreases with increase in the network size or number of nodes. So it was concluded that the DSR protocol good for the mobility of nodes less than 25. Because overheads increases with increases the number of nodes due to packet header increases.

5. REFERENCES

[1] Amit Shrivastava, **Overview of Routing Protocols in MANET's and Enhancements in Reactive Protocols**.

[2] Anil Rawat **Enhanced DSR for MANET with Improved Secured Route Discovery and QoS**, International Journal of Network Security, Vol.5, No.2, PP.158–166, Sept. 2007.

[3] A. K. Gupta and H. Sadawarti, **Secure Routing Techniques for MANETs**, *International Journal of Computer Theory and Engineering"*, vol. 1 no. 4, pp. 456-460, October 2009.

[4] A. K. Gupta and H. Sadawarti, **Review of various Routing Protocols for MANETs**, *International Journal of Computer Theory and Engineering"*, vol. 1 no. 3, pp. 251-259, November 2011.

[5] Anuj K. Gupta, Member, IACSIT, **Performance analysis of AODV, DSR & TORA Routing Protocols**, IACSIT International Journal of Engineering and Technology, Vol.2, No.2, ISSN: 1793-8236, April 2010.

[6] Dhananjay Bisen, **Effect of Pause Time on DSR, AODV and DYMO Routing Protocols in MANET**, International Journal of Information Technology and Knowledge Management, vol. Special 1, no. 8, November 20,2009.

[7] Md.Masud Parvez, **Improved Comparative Analysis of Mobile Ad-hoc Network**, International Journal of

Emerging Technology and Advanced Engineering (ISSN 2250-2459), Volume 2, Issue 8, pp.205-211, August 2012.
[8] Network Simulator, http://www.isi.edu/nsnam/ns.
[9] Sangeeta Biswal, **Study of DSR Routing Protocol in Mobile Adhoc Network**, *International Conference on Information and Network Technology*, vol.4, pp.131-135, 2011.
[10] Singh Ajay Vikram, **Quality of Service aware Dynamic Source Routing Protocol in Ad hoc Networks: Proposal, Analysis and Comparison**, Computer Engineering and Intelligent Systems, vol.2, no.4, pp.211-221, 2011.
[11] Sharmin Sultana **Enhanced-DSR: A New Approach to Improve Performance of DSR Algorithm,** International Journal of Computer Science and Information Technology, Volume 2, Number 2, April 2010.
[12] Vivek Kumar, **Simulation and comparison of AODV &DSR Routing Protocols**, National conference on Emerging principles and practices of computer science and information Technology, July 2009.