*International Journal of Applied Engineering and Technology ISSN: 2277-212X (Online)*
*An Online International Journal Available at http://www.cibtech.org/jet.htm*
*2013 Vol. 3 (3) July-September, pp.24-28/Gundalwar and Chavan*
***Research Article***

# EMPIRICAL EVALUATION OF TCP AND UDP BASED FUNDAMENTAL AD HOC NETWORK ROUTING PROTOCOLS

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## ABSTRACT
Today's network communication era is bursting of a wireless network technology. A range of such technology is witnessed with 3G, 4G of cellular network, Ad Hoc, and IEEE 802.11 based WLAN, Bluetooth, etc. Performance analysis of routing protocols used for ad hoc network is a full of zip area of research at present. The fundamental mobile ad hoc network routing protocols used are Ad hoc On-demand Distance Vector (AODV), Ad hoc On-demand Multi path Distance Vector AOMDV, Dynamic Source Routing (DSR) and Destination Sequenced Distance Vector Routing (DSDV). This study aims at the study and compares fundamental mobile ad hoc network routing protocols for observing data propagation effect over Transmission Control Protocol (TCP) and User Datagram Protocol (UDP) transport protocols. To compare the performance of routing protocols under simulation environment, we have used energy level, network throughput, end-to-end delay, packet loss ratio, and packet routing overhead as a performance metric. A simulation was carried out in NS-2 (2.35) on Ubuntu 12.04 platform.

***Key Words:*** *AODV, AOMDV, DSR, DSDV, NS-2*

## INTRODUCTION
Networking and internet has become one of the most influential forces for making communication easy and inexpensive around the globe instantly which plays a vital role in data communication network. Ad hoc networks are decentralized and self-organizing networks. Ad hoc networks can be formed instantly using mobile devices and used in situations where permanent network infrastructure is not available. Routing in ad hoc network is mainly classified into three methods: reactive, proactive and hybrid. Reactive routing method finds a route between a source and a destination only when demand arises in data transmission. Proactive routing method, on the other hand, maintain routes to all nodes in the network even including those node to which no packets are required to be sent. Hybrid routing method combines the features of both reactive and proactive methods. AODV, AOMDV, and DSR protocols are presented in brief as:

***AODV:*** AODV is a reactive routing protocol which establishes a route when a node requires sending data packets. AODV supports unicast, broadcast, and multicast. It uses four different messages such as route request RREQ, route reply RREP, route error RERR for routing purpose and Hello for detecting and monitoring links to the neighboring nodes. Routing table consists of entries for destination address, next hop address, destination sequence number, and hop count (Paul Bijan *et al.,* 2011; Perkins Charles *et al.,*)

***AOMDV:*** AOMDV is a reactive protocol used for handling multiple loop-free and breakage points in dynamic network. A node maintains the advertised hop count for each destination. A node receive duplicate route advertisement defines and altered path for the same destination. The advertised hop count does not change for the same sequence number if the maximum hop count is used. When a route advertisement is received for a destination with highest sequence number the next hop list and the advertised hop count is reinitialized. AOMDV uses two types of disjoint process: node-disjoint and link-disjoint. AOMDV controls disjoint process either node-disjoint or link-disjoint by adding a flag. Performing disjoint process results AOMDV for high overhead and latency (Amirhossein Moravejosharieh *et al.,* 2013; Marina Mahesh *et al.,* 2006; Balakrishna *et al.,* 2010)

***DSR:*** DSR allows the network to be completely self-organizing and self-configured without the need for any administration and exiting network infrastructure at uses mainly two mechanism: route discovery and route maintenance. Route discovery process is used for finding and optimum path for a communication between source and destination and route maintenance process ensures that the optimum path remains optimum and hop-free even in altering the route during transmission for change in network. RREP would only be generated if the message has reached the destination. Each node maintains node route caches that the source route. The entries in the route cache are continually updated as new routes are discovered (Ajay Kumar *et al.*, 2011; Taneja Sunil *et al.*, 2010)

***DSDV:*** DSDV is a proactive protocol. Each node maintain a routing table for each reachable destination in the form of next hop, number of hop, and the sequence number generated by destination node. DSDV determines the shortest number of hops for a route to a destination employing the Bellman-Ford algorithm. Nodes exchange their routing table periodically to utilize updated changes in network for communication with neighbor nodes. If the same sequenced number is found then the number of hops is considered (Ajay Kumar *et al.*, 2011; Amirhossein Moravejosharieh *et al.*, 2013)

***Network Design and Simulation Setup***

The network design was modeled with 35 mobile nodes placed randomly within 1800 x 900 $m^2$ network topology areas for 100 seconds of simulation run time. Channel capacity and radio propagation for each node was set. The IEEE 802.11 was used as the MAC layer protocol. The random waypoint model was used for node mobility with different speeds, pause times, transmission ranges etc. The traffic type was CBR over TCP and UDP were used with different connection rates, packet size, number of connections etc. The routing protocols AODV, AOMDV, DSDV and DSR were used for testing the experiments implemented in NS-2 (2.35) on Ubuntu 12.04 platform. Simulated network environment snapshot has been shown in the figure 1.

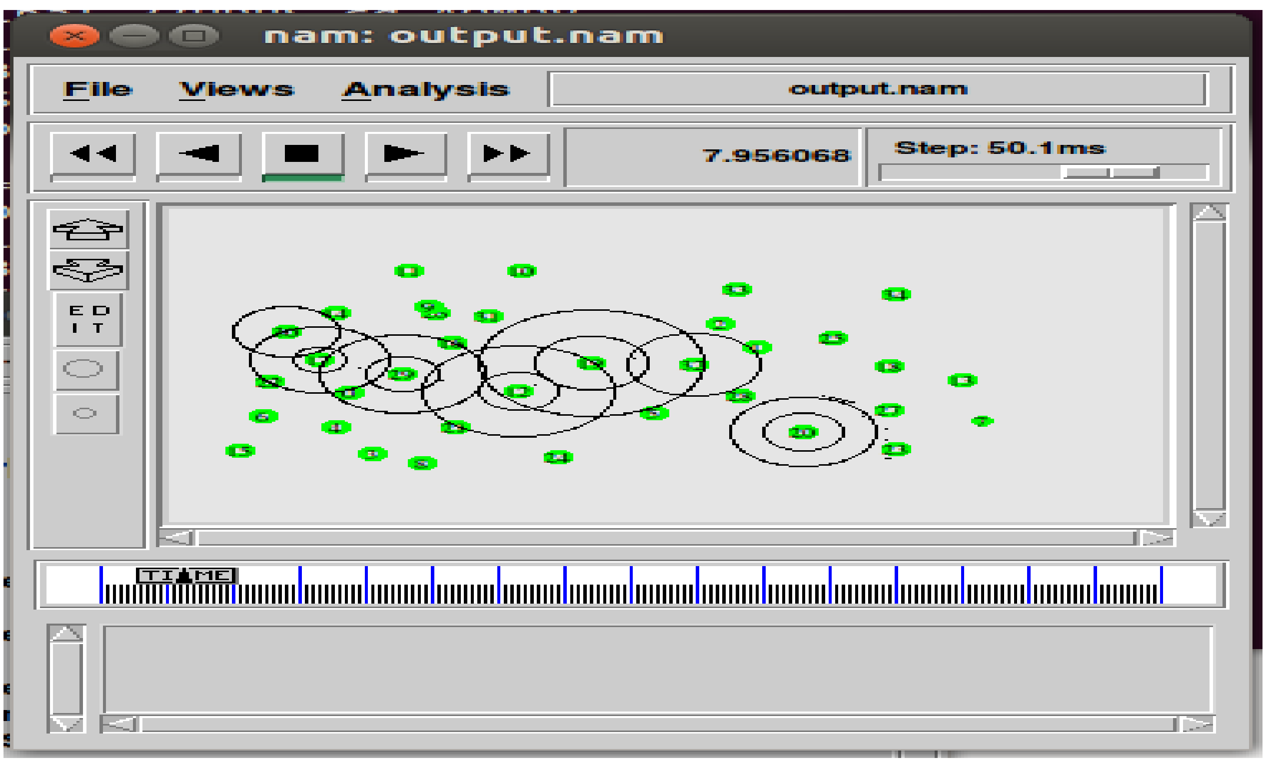


**Figure 1: Simulated network environment**

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## RESULTS AND DISCUSSION

### *Simulation Results*

To compare the performance of routing protocols under simulation environment, we have used energy level, Network throughput, End-to-end delay, packet loss ratio, and packet routing overhead as a performance metric.

***Energy level:*** AODV shows constant energy in TCP traffic, but falls down upto 50% in UDP traffic. DSR was observed for high energy utilization in UDP traffic. DSDV uses constant level energy in UDP traffic and drops insignificant in TCP traffic. AOMDV uses small and high energy in TCP traffic and UDP traffic respectively. This has been shown in the figure 2 and 3.

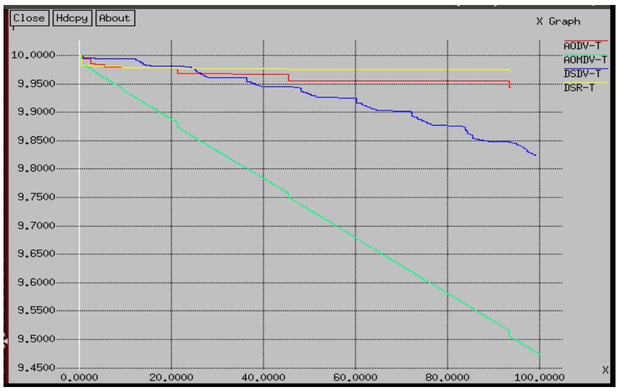


**Figure 2: Energy level in TCP**

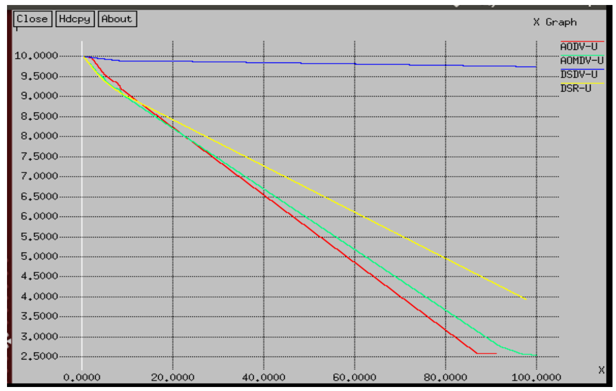


**Figure 3: Energy level in UDP**

***Network throughput:*** AODV shows medium network throughput and DSR shows high throughput in both TCP and UDP traffic. AOMDV increases network throughput linearly at end of simulation run time, followed by DSDV and DSR in TCP traffic. DSDV shows high network throughput for less number of packets size and vice versa in UDP traffic. Similarly, DSR shows low network throughput for high CBR rate and vice versa in UDP traffic. This has been shown in the figure 4 and 5.

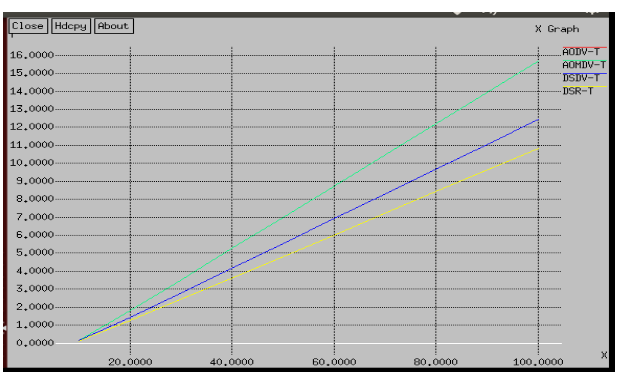


**Figure 4: Network throughput in TCP**

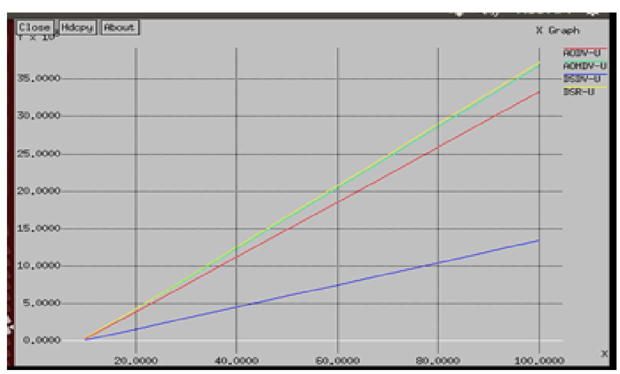


**Figure 5: Network throughput in UDP**

***End-to-end Delay:*** DSDV shows high end-to-end delay followed by AODV in TCP traffic and AOMDV and AODV has high delay in high CBR rate in UDP traffic. DSDV shows low end-to-end delay in UDP traffic. DSR and AOMDV outperforms with negligible end-to-end delay in TCP traffic. This has been shown in the figure 6 and 7.

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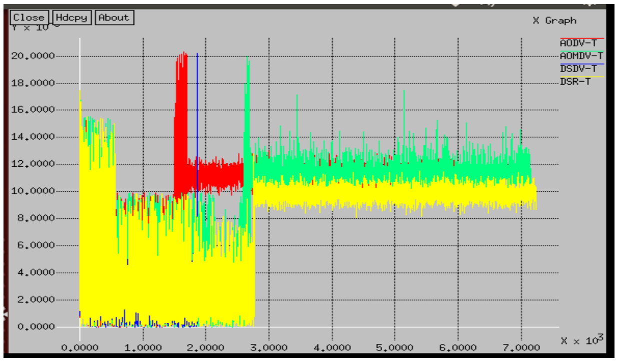


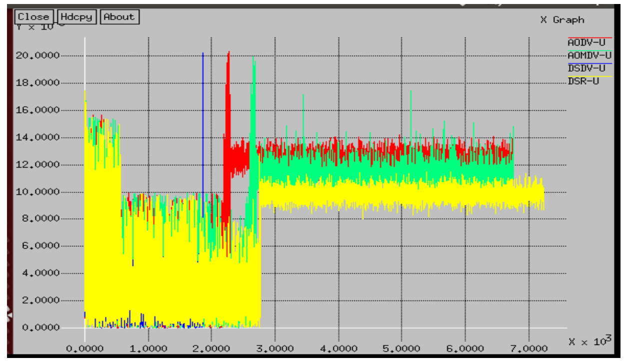
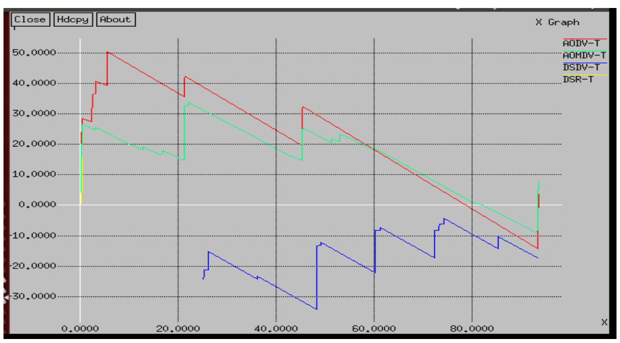




**Figure 6: End-to-end delay in TCP** **Figure 7: End-to-end delay in UDP**

***Packets loss ratio:*** AODV followed by AOMDV shows high loss of packets in TCP traffic. DSR shows high loss of packets at the start of simulation run time in both TCP and UDP traffic. AODV followed by AOMDV rise initially high and stabilizes to constant in low packet sizes and linear in high packet size in UDP traffic. DSDV shows negligible loss of packets in UDP. This has been shown in the figure 8 and 9.



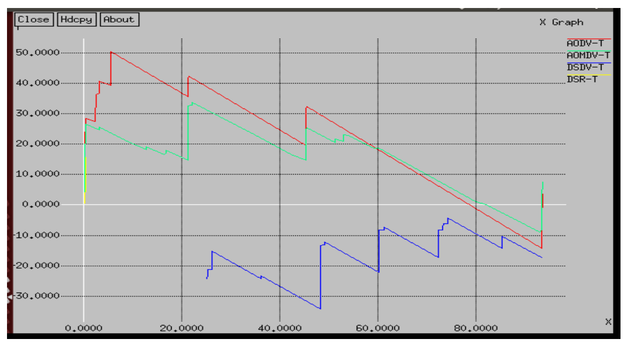
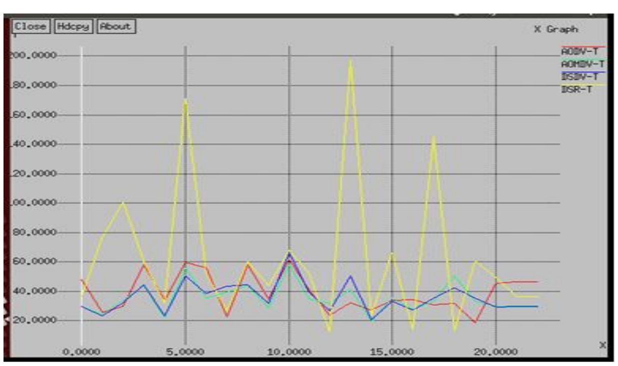




**Figure 8: Packet loss ratio in TCP** **Figure 9: Packet loss ratio in UDP**

***Packet routing overhead:*** High spikes was observed for DSR while low spikes over the simulation run time for AODV, AOMDV and DSDV in TCP traffic. AODV showed high spikes for high packet size and CBR rate. DSDV showed negligible packet routing overhead whereas DSR showed high spikes in low packet size and CBR rate in UDP traffic. This has been shown in the figure 10 and 11.



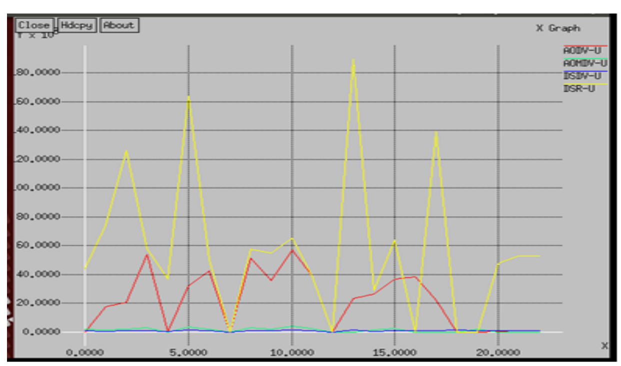




**Figure 10: Packet routing overhead in TCP** **Figure 11: Packet routing overhead in UDP**

***Simulation Analysis***

Less energy is required by used routing protocols except DSDV in TCP traffic. High network throughput was observed in UDP traffic with linear increasing order till end of simulation run time. Low end-to-end delay in large simulation run time, whereas high end-to-end delay in less simulation run time was recorded for TCP and UDP traffic respectively. High packet loss in decreasing order for less simulation run time was noted for TCP traffic, whereas low packet loss in either increasing order or constant in large simulation run time for TCP was seen. Packet routing overhead was observed in both TCP and UDP traffic at fairly equal in beginning of the simulation run time only.

***Conclusion***

This paper evaluated the performances of AODV, AOMDV, DSR and DSDV routing protocols using NS-2 Simulator. Energy level, Network throughput, End-to-end delay, packet loss ratio, and packet routing overhead are used as a performance metric. AODV outperforms in energy conservation for both TCP and UDP traffic. AOMDV and AODV outperform in network throughput for TCP and UDP traffic respectively. Network throughput rise was 98% in UDP over TCP traffic. DSDV shows low end-to-end delay, negligible loss of packets and routing overhead in UDP traffic.

**ACKNOWLEDGEMENT**

The authors are thankful to Dr. S. J. Sharma, Director, Inter Institutional Computer Center (IICC), RTM Nagpur University, Nagpur (MS), INDIA for his valuable guidance and support.

**REFERENCES**

**Ajay Kumar and Ashwani Kumar Singla (2011).** Performance evaluation of manet routing protocols on the basis of tcp traffic pattern. *International Journal of Information Technology Convergence and Services* **1**(5) 41-48.

**Amirhossein Moravejosharieh, Hero Modares, Rosli Salleh and Ehsan Mostajeran (2013).** Performance Analysis of AODV, AOMDV, DSR, DSDV Routing Protocols in Vehicular Ad Hoc Network. *Research Journal of Recent Sciences* **2**(7) 66-73.

**Marina Mahesh K, and Das Samir R. (2006).** Ad hoc on-demand multipath distance vector routing. *Journal of Wireless Communications and Mobile Computing* **6** 969–988.

**Paul Bijan, Md. Ibrahim and Md. Abu Naser Bikas (2011).** Experimental Analysis of AODV & DSR over TCP & CBR Connections with Varying Speed and Node Density in VANET. *International Journal of Computer Applications* **24**(4) 0975 – 8887.

**Perkins Charles E and Elizabeth M Royer (No date).** *Ad hoc On Demand Distance Vector Routing* [Online]. Available: http://www.comp.nus.edu.sg/~bleong/geographic/related/perkins99aodv.pdf.

**Balakrishna R, Rajeswar Rao U and Geethanjali NN (2010).** Performance issues on AODV and AOMDV for MANETS. *International Journal of Computer Science and Information Technologies* **1**(2) 38-43.

**Taneja Sunil, Ashwani Kush and Makkar Amandeep (2010).** Experimental Analysis of DSR, AODV using Speed and Pause time. *International Journal of Innovation, Management and Technology* **1**(5) 453-458.