International Journal on Recent and Innovation Trends in Computing and Communication
Volume: 2 Issue: 12
ISSN: 2321-8169
3951 - 3955

A Comparative Study of AODV & DSR with Varying Speed, Pause Time, and Node Density over TCP Connections in VANET

Arif Ahmad
Department of Computer Science &Engineering, Leading University, Sylhet, Bangladesh.
Email: arif.10.iut@gmail.com

Abstract:- This paper presents a comparative study of two routing protocols in vehicular ad hoc networks, popularly known as VANETs. A VANETis a special type of ad hoc network consists of moving cars referred to as nodes; provide a way to exchange any information between cars without depending on fixed infrastructure. Due to rapid topology changing and frequent disconnection makes it difficult to select suitable mobility model and routing protocols. Hence performance evaluation and comparison between routing protocols is required to understand any routing protocol as well as to develop a new routing protocol. In this research paper, the performance of two on-demand routing protocols AODV & DSR has been analyzed by means of packet delivery ratio with varying speed limit, pause time, and node density under the TCP connection.. Finally, it concludes the discussion by pointing out some open issues and possible direction of future research related to VANET routing.

Keywords:-*Routing Protocol; VANET; MANET; AODV; DSR; TCP; Packet Delivery Ratio.*

*****

1. Introduction

With the sharp increase of vehicles on roads in the recent years, driving has not stopped from being more challenging and dangerous. Roads are saturated, safety distance and reasonablespeeds are hardly respected, and drivers often lack enough attention. Without a clear signal of improvement in the near future, leading car manufacturers decided to jointly work with nationalgovernment agencies to develop solutions aimed at helping drivers on the roads by anticipating hazardous events or avoiding bad traffic areas. One of the outcomes has been a novel type of wireless access called Wireless Access for Vehicular Environment(WAVE) dedicated to vehicle-to-vehicle and vehicle-to-roadside communications. While the major objective has clearly been to improve the overall safety of vehicular traffic,promising traffic management solutions and on-board entertainment applicationsare also expected by the different bodies involved in this field.

When equipped with WAVE communication devices, cars and roadside units form a highly dynamic network called a Vehicular Ad Hoc Network (VANET), a special kind of Mobile AdHoc Networks (MANETs). While safety applications mostly need local broadcast connectivity, it is expected that some emerging scenarios (Lee, 2009) developed for intelligent transportation systems (ITS) would benefit from unicast communication over a multi-hop connectivity. Moreover, it is conceivable thatapplications that deliver contents and disseminate useful information can flourish with the support of multi-hop connectivity in VANETs.

Although countless numbers of routing protocols (Mauve, 2001; Mehran, 2004) have been developed in MANETs, many do notapply well to VANETs. VANETsrepresent a particularlychallenging class of MANETs. They are distributed, self-organizing communication networks formed by moving vehicles, and are thus characterized by very high node mobility and limited degrees of freedom in mobility patterns.

2. ROUTING PROTOCOLS

The characteristic of highly dynamic topology makes the designof efficient routing protocols for VANET is challenging. Therouting protocol of VANET can be classified into two categoriessuch as Topology based routing protocols & Position basedrouting protocols. Overall classification of VANET routingprotocols has been shown in the figure-1.

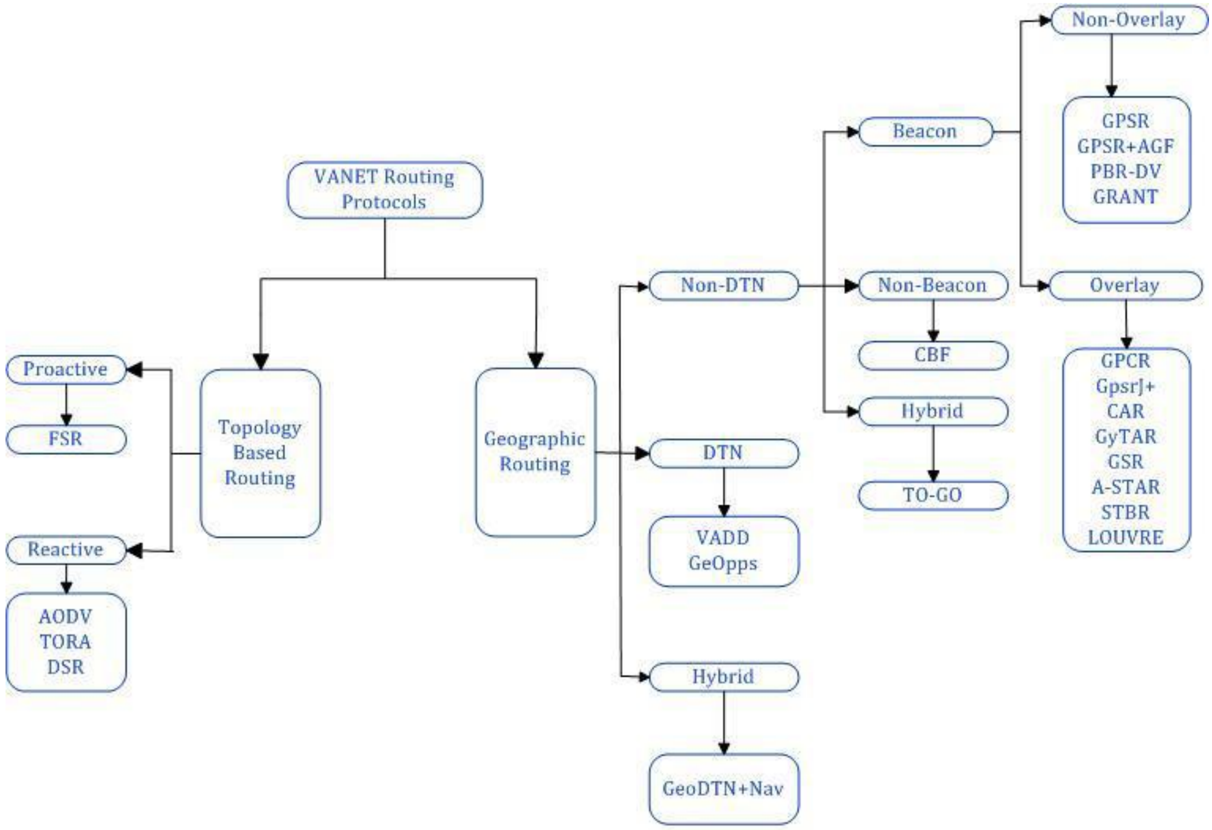


Figure-1: Unicast routing protocols in VANET

Existing unicast routing protocols ofVANET is not capable to meet every traffic scenarios. Each of them has some pros and cons. These are described in[42].For our simulation purpose we have selectedtwo on demand routing protocols AODV & DSR.

2.1 AODV

Ad Hoc on Demand Distance Vector routing protocol [9] is areactive routing protocol which establish a route when a noderequires sending data packets. It has the ability of unicast &multicast routing. It uses a destination sequence number(DestSeqNum) which makes it different from other on demandrouting protocols. It maintains routing tables, one entry perdestination and an entry is discarded if it is not used recently. Itestablishes route by using RREQ and RREP cycle. If any linkfailure occurs, it sends report and another RREQ is made.

2.2 DSR

The Dynamic Source Routing (DSR) [10] protocol utilizes source routing & maintains active routes. It has two phases route discovery & route maintenance. It does not use periodic routing message. It will generate an error message if there is any link failure. All the intermediate nodes ID are stored in the packet header of DSR. If there has multiple paths to go to the destination DSR stores multiple path of its routing information. AODV and DSR have some significant differences. In AODV when a node sends a packet to the destination then data packets only contains destination address. On the other hand in DSRwhen a node sends a packet to the destination the full routing information is carried by data packets which causes morerouting overhead than AODV.
AODV and DSR have some significant differences. InAODV when a node sends a packet to the destination thendata packets only contains destination address. On theother hand in DSR when a node sends a packet to thedestination the full routing information is carried by datapackets which causes more routing overhead than AODV.

3. Connection Types

There are several types of connection pattern in VANET. Forour simulation purpose we have used Transmission Control Protocol (TCP) connectionpattern.

TCP is a connection oriented and reliable transport protocol. To ensure reliable data transfer TCP usesacknowledgement, time outs and retransmission.Acknowledge means successful transmission of packetsfrom source to destination. If an acknowledgement is notreceived during a certain

ISSN: 2321-8169
3951 - 3955

period of time which is calledtime out then TCP transmit the data again.

4. Performance Metrics & Network Parameters

For network simulation, there are several performancemetrics which is used to evaluate the performance. Insimulation purpose we have used three performancemetrics.

4.1 Packet Delivery Ratio (PDR)

Packet delivery ratio is the ratio of number of packetsreceived at the destination to the number of packets sentfrom the source. The performance is better when packetdelivery ratio is high.

4.2 Average end-to-end delay

This is the average time delay for data packets from thesource node to the destination node. To find out the end-to-end delay the difference of packet sent and receivedtime was stored and then dividing the total time differenceover the total number of packet received gave the averageend-to-end delay for the received packets. Theperformance is better when packet end-to-end delay is low.

4.3 Loss Packet Ratio (LPR)

Loss Packet Ratio is the ratio of the number of packetsthat never reached the destination to the number of packetsoriginated by the source.

5. Implementation & Simulation Results

For simulation purpose we used random waypoint mobilitymodel. Network Simulator NS-2.34[11, 12] has been used. Tomeasure the performance of AODV and DSR we used samescenario for both protocols. Because of both protocols uniquebehavior the resultant output differ.

The performance of AODV & DSR has been analyzed withvarying speed time 5m/s to 25m/s for number of nodes 30, 60,90, 120, 150 under TCP & CBR connection. We measure thepacket delivery ratio, loss packet ratio & average end-to-enddelay of AODV and DSR and the simulated output has shownby using graphs.

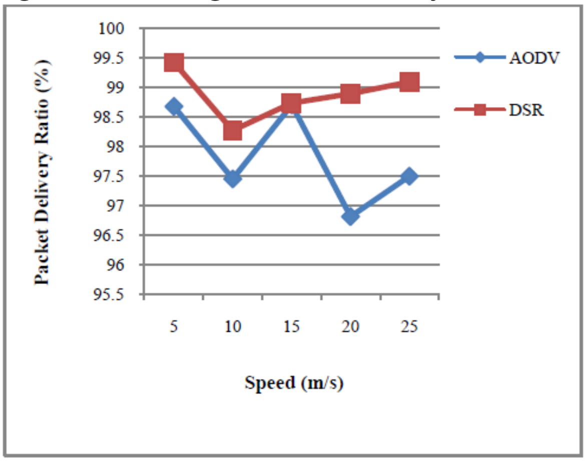


Fig 2: PDR of 30 nodes against speed

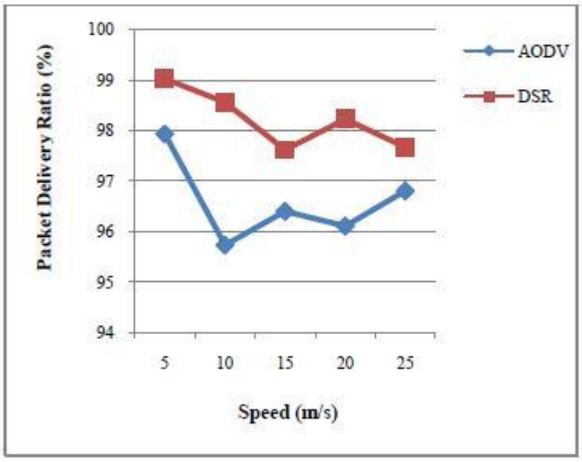
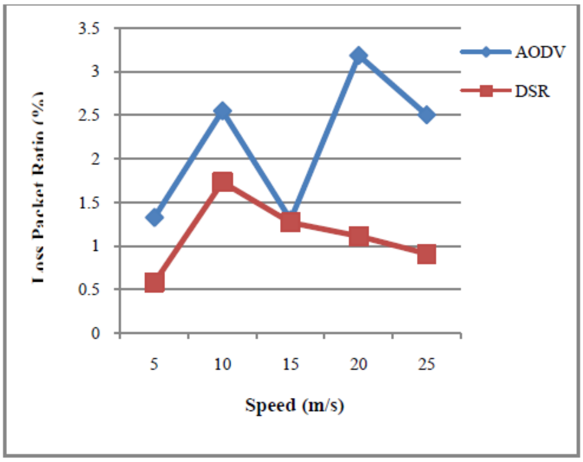
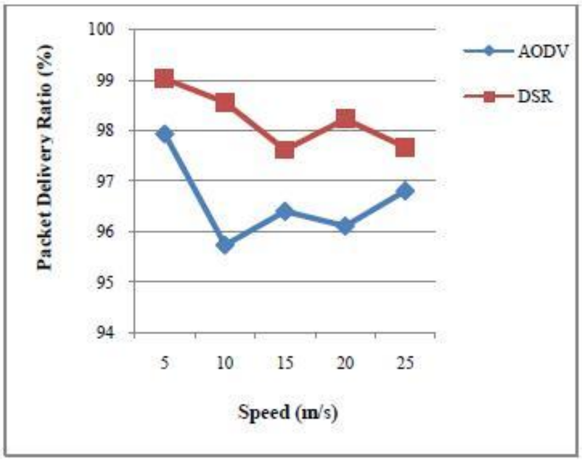


Fig 3: PDR of 90 nodes against speed





ISSN: 2321-8169
3951 - 3955

Fig 4: LPR of 30 nodes against speed

Fig 5: LPR of 90 nodes against speed

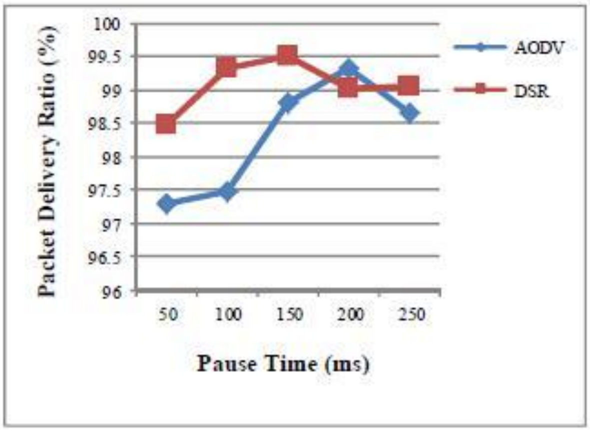


Fig 6: PDR of 30 nodes against pause time

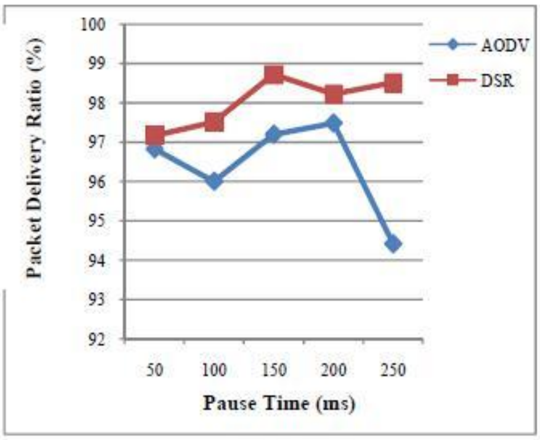


Fig 7: PDR of 90 nodes against pause time

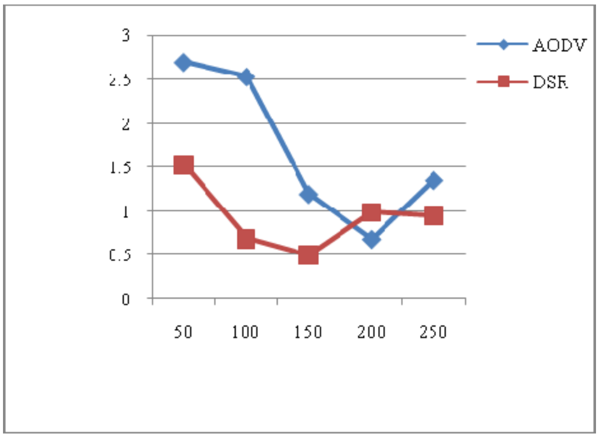


Fig 8: LPR of 30 nodes against pause time

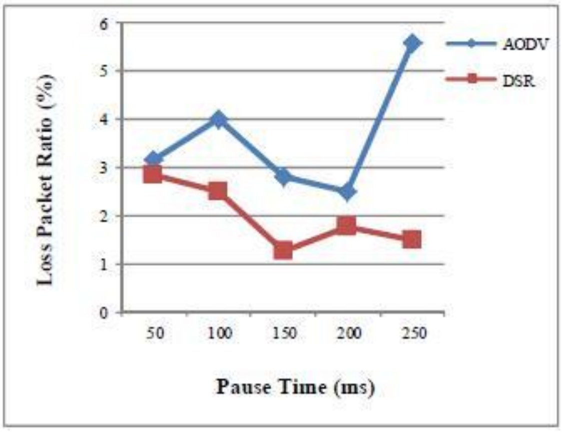


Fig 9: LPR of 90 nodes against pause time

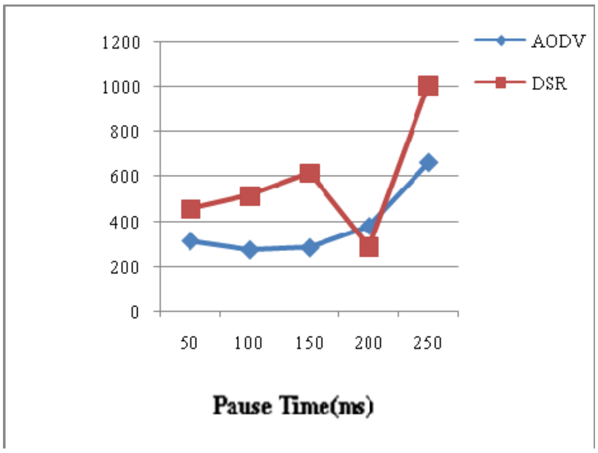


Fig 10: Avg.E-2-E delay of 30 nodes against pause time

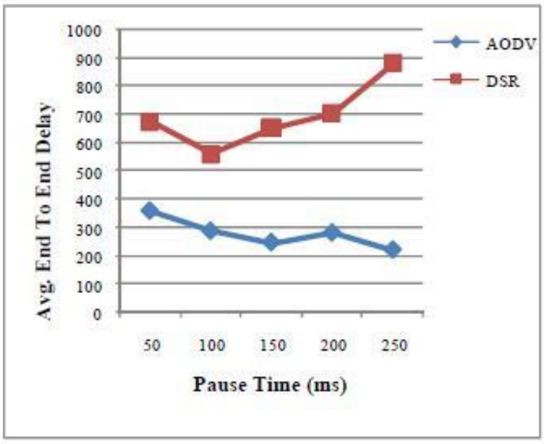


Fig 10: Avg.E-2-E delay of 90 nodes against pause time

6. Conclusion

There is a plethora of VANET routing protocols. Most are designed to handle a special condition or a special problem.Despite the special condition orproblem that these routing protocols are considering or addressing, there is no agreed-upon standard or benchmark to validate their performance. The benchmark not only includes a standard routing protocol, but also a simulation environment.

This paper illustrates the differences between AODV and DSR based on TCP connection with various network parameters. In our analysis we have given our decision based on the graphs. This will definitely help to understand the performance of these two routing protocol. The performance of these two routing protocol shows some differences in low and high node density.The performance measurementof AODV and DSR will help for further development of theseprotocols in future.

7. References

[1] Cheng, P.-C., Weng, J.-T., Tung, L.-C., Lee, K. C., Gerla M., and Härri J. (2008), "GeoDTN+NAV: A Hybrid Geographic and DTN Routing with Navigation Assistance in Urban Vehicular Networks," Proceedings of the 1st International Symposium on Vehicular Computing Systems (ISVCS'08), Dublin, Irland, July 2008.

[2] Davis, J., Fagg, A. and Levine, B. (2001), “Wearable computers as packet transport mechanisms in highly-partitioned ad-hoc networks.”

[3] Flury, R. and Wattenhofer, R. (2006), "MLS: an efficient location service for mobile ad hoc networks." In MobiHoc ’06: Proceedings of the 7th ACM international symposium on Mobile ad hoc networking and computing, pages 226–237, New York, NY, USA, 2006.

[4] Forderer, D (2005). “Street-Topology Based Routing.” Master’s thesis, University of Mannheim, May 2005.

[5] Franz W., Eberhardt R., and Luckenbach T., "FleetNet - Internet on the Road," Proc. 8th World Congress on Intelligent Transportation Systems, Sydney, Australia, Oct. 2001.

[6] F¨ußler, H., Mauve, M., Hartenstein, H., Käsemann, M., Vollmer, D., “Location-Based Routing for Vehicular Ad Hoc Networks,” Mobile Computing and Communication Review, Vol 1, Number 2, 2002. F¨ußler, H., Hannes, H., J¨org, W., Martin, M., Wolfgang, E. (2004), “Contention-Based Forwarding for Street Scenarios,” Proceedings of the 1st International Workshop in Intelligent Transportation (WIT 2004), pages 155–160, Hamburg, Germany, March 2004.

[7] Gabriel, K. R. and Sokal, R (1969), “A new statistical approach to geographic variation analysis.” 18 Systematic Zoology, pages 231–268, 1969.

[8] Giordano S., et al., “Position based routing algorithms for ad hoc networks: A taxonomy,” in Ad Hoc Wireless Networking, X. Cheng, X. Huang and D.Z. Du (eds.), Kluwer, December 2003.

[9] Helbing, D., Hennecke, A., Shvetsov, V., Treiber, M. (2002), “Micro- and Macrosimulation of Freeway Traffic,” Mathematical and Computer Modelling, vol. 35, no. 5/6, pp. 517-547, 2002.

[10] Naumov, V., Baumann, R., Gross, T. (2006), “An evaluation of Inter-Vehicle Ad Hoc Networks Based on Realistic Vehicular Traces,” Proc. ACM MobiHoc’06 Conf., May, 2006.

[11] Naumov, V., Gross, T.R. (2007), "Connectivity-Aware Routing (CAR) in Vehicular Ad-hoc Networks," INFOCOM 2007. 26th IEEE International Conference on Computer Communications. IEEE , vol., no., pp.1919-1927, 6-12 May, 2007.

[12] Park, V.D., Corson, M.S. (1997), “A highly adaptive distributed routing algorithm for mobile wireless networks,” INFOCOM '97. Sixteenth Annual Joint Conference of the IEEE Computer and Communications Societies. Proceedings IEEE , vol.3, no., pp.1405-1413 vol.3, 7-12 Apr 1997.

[13] Pei, G., Gerla, M., and Chen, T.-W. (2000), “Fisheye State Routing: A Routing Scheme for Ad Hoc Wireless Networks,” Proc. ICC 2000, New Orleans, LA, June 2000.

[14] Seet, B.-C., Liu, G., Lee, B.-S., Foh, C. H., Wong, K. J., Lee, K.-K. (2004), “A-STAR: A Mobile Ad Hoc Routing Strategy for Metropolis Vehicular Communications.” NETWORKING 2004, 989-999.

[15] Toussaint, G. (1980), “The relative neighborhood graph of a finite planar set.” Pattern Recognition, 12:231–268, 1980.

[16] Perkins, C. E. and Royer, E. M. (1999), “Ad-Hoc On-Demand Distance Vector Routing,” Proc. IEEE WMCSA ’99, New Orleans, LA, Feb. 1999, pp. 90–100.

[17] Reichardt D., Miglietta M., Moretti L., Morsink P., and Schulz W.,“CarTALK 2000 – safe and comfortable driving based upon inter-vehicle-communication,” in Proc. IEEE IV’02. http://www.cartalk2000.net, Jun 2002, pp. 545–550.

[18] Schnaufer, S., Effelsberg, W. (2008), "Position-based unicast routing for city scenarios," World of Wireless, Mobile and Multimedia Networks, 2008. WoWMoM 2008. 2008 International Symposium on a , vol., no., pp.1-8, 23-26 June 2008.

[19] Stojemnovic, I., “Position-Based Routing in Ad Hoc Networks”, in IEEE Communication Magazine, July 2004.

[20] Yamada, S. “The strategy and deployment for VICS,” IEEE Communication, vol. 34, no. 10, pp. 94-97, 1996.

[21] Yu, Y., Lu, G.-H., and Z.-L. Zhang (2004). "Enhancing location service scalability with highgrade. Mobile Ad-hoc and Sensor Systems," 2004 IEEE International Conference on, pages 164–173, 25-27 Oct. 2004.

[22] Zhao, J.; Cao, G. (2006), "VADD: Vehicle-Assisted Data Delivery in Vehicular Ad Hoc Networks," INFOCOM 2006. 25th IEEE International Conference on Computer Communications. Proceedings, vol., no., pp.1-12, April 2006.

[23] Bijan Paul, Md. Ibrahim, Md. Abu NaserBikas; “VANET Routing Protocols: Pros and Cons”; International Journal of Computer Applications (0975 – 8887), Volume 20–No.3, April 2011.