International Journal of scientific research and management (IJSRM)
||Volume||3||Issue||2||Pages|| 2153-2158||2015||
Website: www.ijsrm.in ISSN (e): 2321-3418

Effect of Mobility and Different Data Traffic in Wireless Ad Hoc Network

Neha Gandotra, Dr. Vinay Awasthi
PhD Scholar, IFTM University, Moradabad
Email: nhgandotra@gmail.com
Professor , ECE Dept. UPES, Dehradun
Email: vinayddun@gmail.com

Abstract

An Ad-Hoc Network is a self-configuring network of mobile nodes connected by wireless links, to form an arbitrary topology. In this paper, we have studied the effects of various mobility models on the performance of three routing protocols AODV,OLSR and ZRP. For experiment purposes, we have considered four mobility scenarios: Random Waypoint, Group Mobility, Freeway and Manhattan models. These four Mobility Models are selected to represent possibility of practical application in future. Performance comparison has also been conducted across different data traffic. Experiment results illustrate that performance of the routing protocol varies across different mobility models.

Keywords:
Routing, OLSR, AODV, ZRP,Performance Evaluation.

1.Introduction

A Mobile Ad-Hoc Network (MANET) is a self-configuring network of mobile nodes connected by wireless links, to form an arbitrary topology. The nodes are free to move randomly. Thus the network's wireless topology may be unpredictable and may change rapidly. Minimal configuration, quick deployment and absence of a central governing authority make ad hoc networks suitable for emergency situations like natural disasters, military conflicts, emergency medical situations etc [1] [2]. Many previous studies have used Random Waypoint as reference model [3] [4]. However, in future MANETs are expected to be used in various applications with diverse topography and node configuration. Widely varying mobility characteristics are expected to have a significant impact on the performance of the routing protocols like AODV,OLSR and ZRP. The overall performance of any wireless protocol depends on the duration of interconnections between any two nodes transferring data as well on the duration of interconnections between nodes of a data path containing n-nodes. We will call these parameters averaged over entire network as “Average Connected Paths”. The mobility of the nodes affects the number of average connected paths, which in turn affect the performance of the routing algorithm. We have also studied the impact of node density on routing performance. With very sparsely populated network the number of possible connection between any two nodes is very less and hence the performance is poor. It is expected that if the node density is increased the throughput of the network shall increase, but beyond a certain level if density is increased the performance degrades in some protocol. We have also studied the effect of number of hops on the protocol performance [5] [6] [7] [8].

2. Description of Routing Protocol

A.Optimized Link State Routing (OLSR)

OLSR is a proactive routing protocol [9]. In which each node periodically broadcasts its routing table allowing each node to build a global view of the network topology. The periodic nature of the protocol creates a large amount of overhead. In order to reduce overhead it limits the number of mobile nodes that can forward network wide traffic and forthis purpose it uses *multi point relays* (MPRs) which is responsible for forwarding routing messages and optimization for controlled flooding and operations. Mobile nodes which are selected as MPRs can forward control traffic and reduces the size of control message. Each node independently elects a group of MPRs from its one hop neighbors. MPRs are chosen by a node such that it may reach each two hop neighbor via at least one MPR. The nodes that have been selected as MPRs are responsible for forwarding the control traffic generated by that node. All mobile nodes periodically broadcast a list of its MPR selectors instead of the whole list of neighbors. MPRs advertise link state information for MPR selection periodically in control messages. MPRs are also used to form a route from MN to destination node and perform route calculation. OLSR can forward packets if control traffic received from a previous hop has selected the current node as a MPR. Mobility causes route change and topology changes very frequently and topology control (TC) messages are broadcasted throughout the network. All mobile nodes maintain the routing table that contains routes to all reachable destination nodes. OLSR does not notify the source immediately after detecting a broken link and source node comes to know that route is broken when the intermediate node broadcasts its next packet.

B. Ad-hoc On-demand Distance Vector Routing (AODV)

AODV uses routing tables, with one route entry per destination where each entry stores next hops towards destination. It broadcast route request (RREQ) packets and this RREQ is uniquely identified by the sender address, destination address and request ID. If the node is either the destination node or has a route to the destination node then it returns a route reply (RREP) containing the route, to sender. AODV uses sequence numbers and node compares the destination sequence number of the RREQ with that of its route table entry this protocol either response with its own route if entry is fresh, or rebroadcasts the RREQ to its neighbors. In AODV, each node maintains a routing table which is used to store destination and next hop IP addresses as well as destination sequence numbers. And each entry in the routing table has a destination address, next hop, precursor nodes list, life time and distance to destination. Finally, after processing the RREP packet, the node forwards it toward the source. The node can later update its routing information if it discovers a better path or route.

C.. Zone Routing Protocol(ZRP)

In ZRP [9], the nodes have a routing zone, which defines a range (in hops) that each node is required to maintain network connectivity proactively. Therefore, for nodes within the routing zone, routes are immediately available. For nodes that lie outside the routing zone, routes are determined on-demand (i.e. reactively), and it can use any on-demand routing protocol to determine a route to the required destination. The advantage of this protocol is that it has significantly reduced the amount of communication overhead when compared to pure proactive protocols. It also has reduced the delays associated with pure reactive protocols such as DSR, by allowing routes to be discovered faster. This is because, to determine a route to a node outside the zone, the routing only has to travel to a node which lies on the boundaries (edge of the routing zone) of the required destination. Since the boundary node would proactively maintain routes to the destination.

3. Mobility Models

Different mobility models can be differentiated according to their spatial and temporal dependencies.

Spatial dependency: It is a measure of how two nodes are dependent in their motion. If two nodes are moving in same direction then they have high spatial dependency.

Temporal dependency: It is a measure of how current velocity (magnitude and direction) are related to previous velocity. Nodes having same velocity have high temporal dependency.

Given below are the descriptions of four mobility models.

A.Random Waypoint

The Random Waypoint model is the most commonly used mobility model in research community. At every instant, a node randomly chooses a destination and moves towards it with a velocity chosen randomly from a uniform distribution [0,V_max], where V_max is the maximum allowable velocity for every mobile node. After reaching the destination, the node stops for a duration defined by the 'pause time' parameter. After this duration, it again chooses a random destination and repeats the whole process until the simulation ends.

B. Random Point Group Mobility (RPGM)

Random point group mobility can be used in military battlefield communication. Here each group has a logical centre (group leader) that determines the group's motion behavior. Initially each member of the group is uniformly distributed in the neighborhood of the group leader. Subsequently, at each instant, every node has speed and direction that is derived by randomly deviating from that of the group leader.

Important Characteristics: Each node deviates from its velocity (both speed and direction) randomly from that of the leader. The movement in group mobility can be characterized as follows:

$$| V_{member} (t) | = | V_{leader} (t) | + random () * SDR * max\_speed \quad (1)$$

$$| \Theta_{member} (t) | = | \Theta_{leader} (t) | + random () * ADR * max\_angle \quad (2)$$

where $0 << ADR, SDR << 1$. SDR is the Speed Deviation Ratio and ADR is the Angle DeviationRatio. SDR and ADR are used to control the deviation of the velocity (magnitude and direction) of group members from that of the leader. Since the group leader mainly decides the mobility of group members, group mobility pattern is expected to have high spatial dependence for small values of SDR and ADR [12].

C. Freeway Mobility Model

This model emulates the motion behavior of mobile nodes on a freeway. It can be used in exchanging traffic status or tracking a vehicle on a freeway. Each mobile node is restricted to its lane on the freeway. The velocity of mobile node is temporally dependent on its previous velocity.

D. Manhattan Mobility Model

We introduce the Manhattan model to emulate the movement pattern of mobile nodes on streets. It can be useful in modeling movement in an urban area .The scenario is composed of a number of horizontal and vertical streets.

4 .PERFORMANCE METRICES

In order to compare the network performance of routing protocols,the following performance metrices are considered.The speed and the performance of the ad hoc networks depends mainly on these metrices.

A. Average End – to – End Delay

It includes the delays caused by buffering during route discovery, queuing at the interface queue, transmission delays at the MAC, propagation and transfer times.

B. Packet Delivery Ratio

The ratio of the number of data packets delivered to the destinations and the number of data packets generated by Constant bit rate sources.

C. System Throughput

It is measured as the total number of useful data (in bps) received at traffic destinations, averaged over the duration of the entire simulation.

5.SIMULATION MODEL AND RESULTS

A. Simulation Environment

Two different data traffic models are considered.

Constant Bit Rate(CBR):It is the technique used for the purpopse of measuring the rate at which the encoding of data takes place.

Variable Bit Rate(VBR):It is an ON/OFF trafficwith exponential distribution.VBR files vary the amount of output data per time segment..

Also the performance of the routing protocols is evaluated

using Qualnet simulation software. QualNet Developer is ultra high-fidelity network evaluation software that predicts wireless, wired and mixed-platform network and networking device performance. QualNet offers unmatched platform portability and interface flexibility. QualNet runs on sequential and parallel Unix, Windows, Mac OS X and Linux operating systems, and is also designed to link seamlessly with modeling/simulation applications and live networks.The simulation parameters which have been considered for the comparative analysis of routing protocols is given below in Table I.

TABLE I
SIMULATION PARAMETERS

Simulation parameters	**Values**
Dimension	500 x 500
No. Of nodes	20
No. Of connections	4
Node placement strategy	Random
Mobility model	Random waypoint, Group mobility model
Traffic source	CBR, VBR
Packet size	512 Bytes
Pause time	0.25 sec
Simulation time	100 sec
Channel frequency	2.4 Ghz
Data Rate	2 Mbps
Path loss model	Two ray model
Physical layer radio type	IEEE802.11b
MAC protocal	IEEE802.11
Antenna Model	Omni-directional

A. Results and Observations

A series of simulation experiments were conducted in the qualnet network simulator using the simulation model and performance metrices outlined in the previous sections.

The Simulation results and analysis are given below:

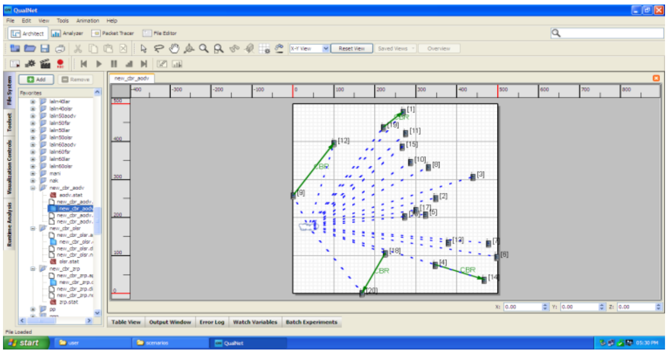

Figure:1 Simulation

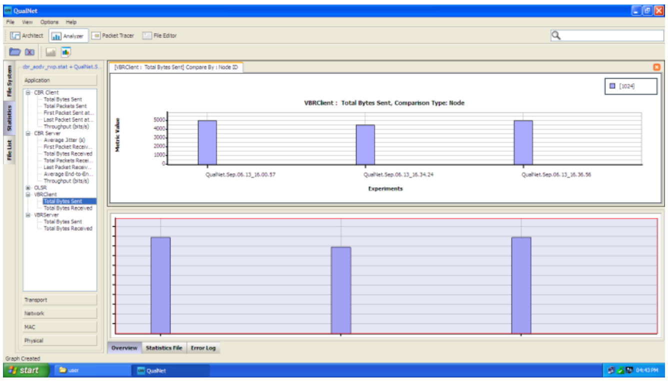

Figure:2 Analysis 1

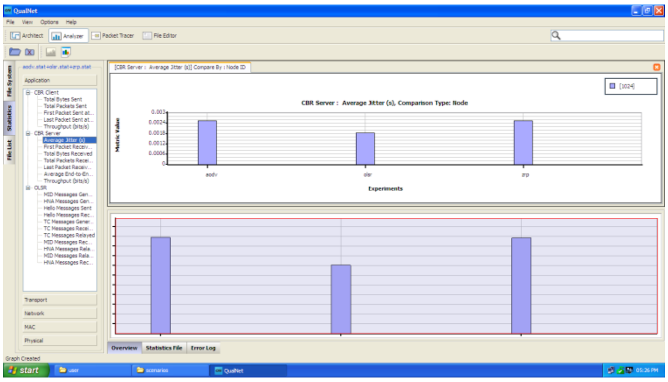

Figure:3 Analysis 2

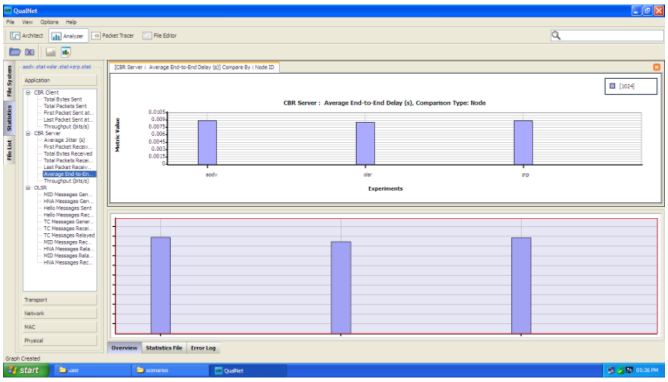

Figure:4 Analysis 3

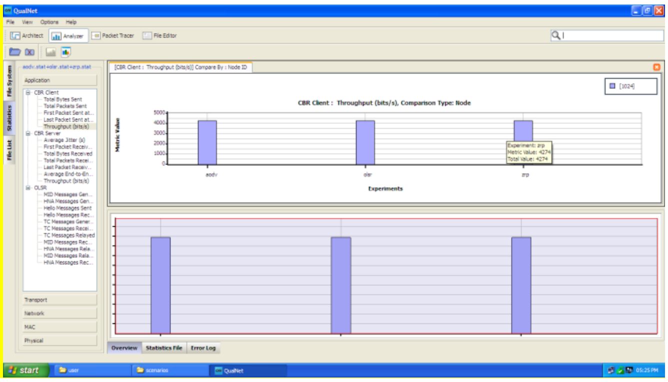

Figure:5 Analysis 4

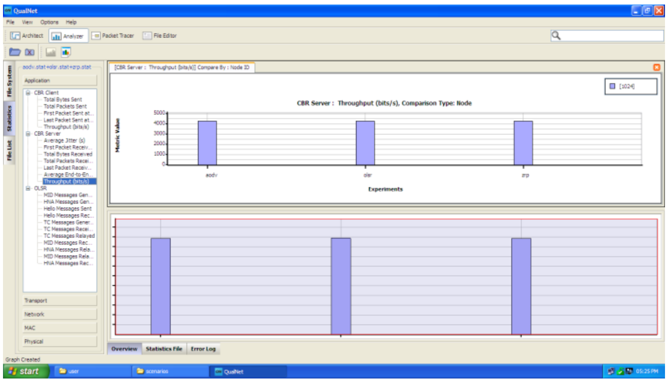

Figure:6 Analysis 5

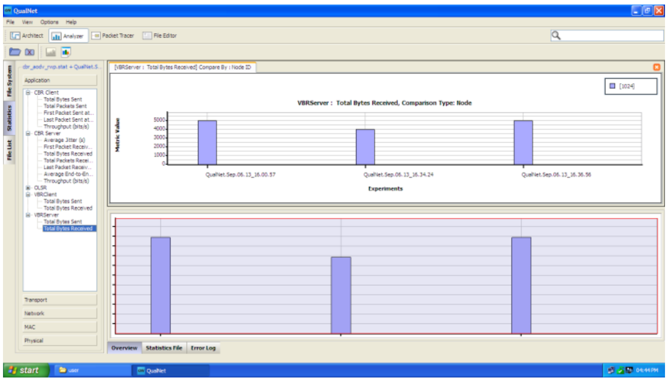

Figure:7 Analysis 6

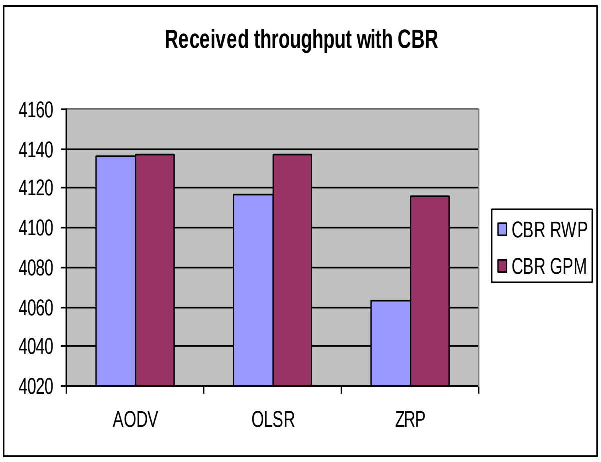

Figure:8 Throughput with CBR v/s AODV,OLSR,ZRP

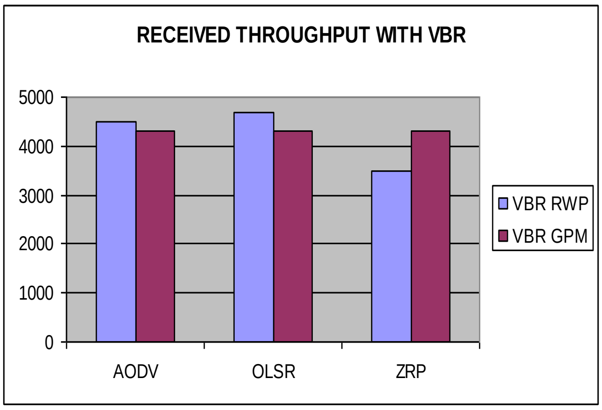

Figure:9 Throughput with VBR v/s AODV,OLSR,ZRP

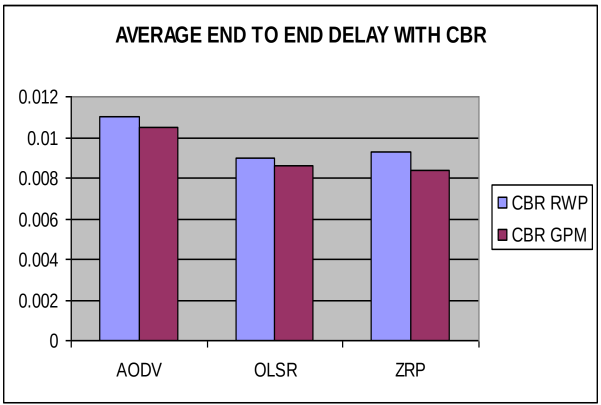

Figure:10 Throughput with CBR v/s AODV,OLSR,ZRP

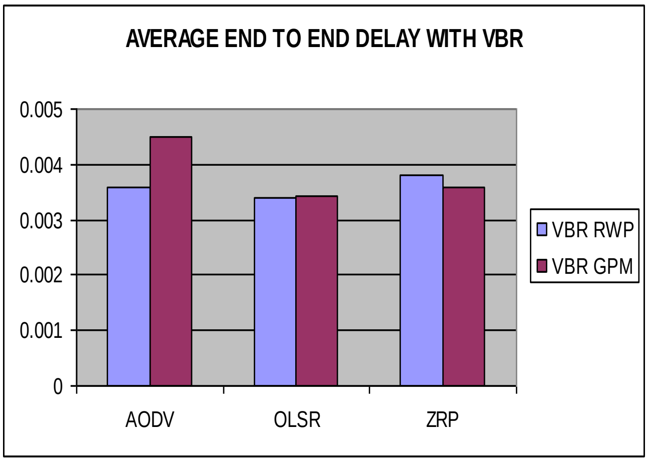

Figure:11 End to end Delay with VBR v/s AODV,OLSR,ZRP

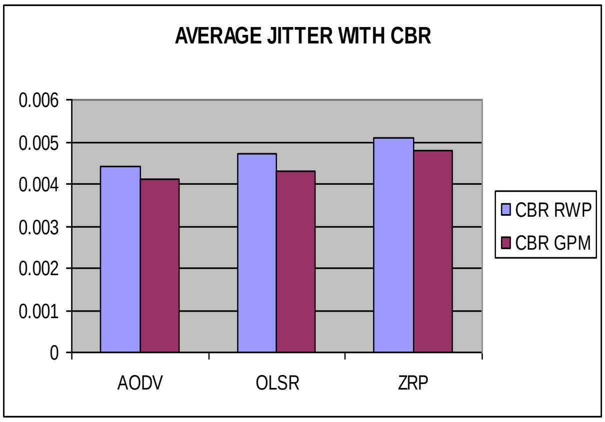

Figure:12 Average Jitter with CBR v/s AODV,OLSR,ZRP

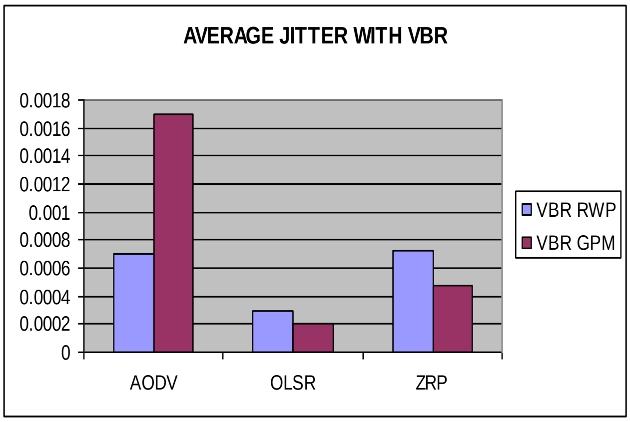

Figure:13 Average Jitter with VBR v/s AODV,OLSR,ZRP

6. Conclusions and Future Work

Empirical results illustrate that the performance of a routing protocol varies widely across different mobility models.The observation from simulation is that OLSR is best when compared to other routing protocols.Also OLSR performs well in both data traffic and mobility model.

Future study should be conducted to compare protocols in low mobility environment, where routes do not break to too often. Proactive protocols may give better performance for near stable environment. Performance of other routing protocol can be evaluated over various mobility models taking in to consideration number of average connected paths to gain greater insights into the relationship between them. Designing scenarios which depict real world applications more accurately can be designed through in-depth study of the application.

References

[1] S. Corson and J. Macker, Mobile Ad hoc Networking (MANET): Routing Protocol Performance Issues and Evaluation Considerations, RFC: 2501, January 1999.

[2] Carlo Kopp, “Ad Hoc Networking”, Systems Journal, pp 33-40, 1999.

[3] Guolong Lin, Guevara Noubir and Rajmohan Rajaraman, "Mobility Models for Ad hoc Network Simulation", In Proceedings of IEEE INFOCOM 2004, Volume 1, pp. 7-11, 2004.

[4] Tracy Camp, Jeff Boleng and Vanessa Davies, “A Survey of Mobility Models for Ad Hoc Network” Special issue on Mobile Ad Hoc Networking: Research, Trends and Applications, vol. 2, no. 5, pp. 483-502, 2002.

[5] F. Bai and A. Helmy, "The IMPORTANT Framework for Analyzing and Modeling the Impact of Mobility in Wireless Adhoc Networks", in Wireless Ad Hoc and Sensor Networks, Kluwer Academic Publishers, 2004.

[6] F. Bai, A. Helmy, “A Survey of Mobility Modeling and Analysis in Wireless Adhoc Networks” in Wireless Ad Hoc and Sensor Networks, Kluwer Academic Publishers, 2004.

[7] F. Bai, G. Bhaskara and A. Helmy," Building the Blocks of Protocol Design and Analysis -- Challenges and Lessons Learned from Case Studies on Mobile Adhoc Routing and Micro-Mobility Protocols", ACM Computer Communication Review, Vol.34, No.3, pp.57-70, 2004.

[8] F. Bai, N. Sadagopan and A. Helmy, "IMPORTANT: A framework to systematically analyze the Impact of Mobility on Performance of Routing protocols for Adhoc Networks, IEEE INFOCOM, pp. 825-835, 2003.

[9] Charles E Perkins and Pravin Bhagwat, “Highly Dynamic Destination Sequenced Distance Vector Routing (DSDV) for Mobile Computers”, SIGCOMM 94, pp. 234-244, 1994.

[10] David B. Johnson, David A. Maltz, Yih-Chun Hu, The Dynamic Source Routing (DSR) Protocol for Mobile Ad Hoc Networks.draft-ietf-manet-dsr-10.txt, July 2004

[11] David B. Johnson and David A. Maltz. “Dynamic Source Routing in Ad Hoc Wireless Networks”. In *Mobile Computing*, edited by Tomasz Imielinski and

Hank Korth, Chapter 5, pages 153-181, Kluwer Academic Publishers, 1996.

[12] Biao Zhou, Kaixin Xu and Mario Gerla, “Group and Swarm Mobility Models for Ad Hoc Network Scenarios Using Virtual Tracks, In Proceedings of MILCOM’2004, Volume 1, pp. 289- 294, 1994.

[13] User Manual for IMPORTANT Mobility Tool Generator in NS-2 Simulator. http://nile.usc.edu/important/software.htm , Release Date February 2004

[14] Mobility Generator (version 1.0) from the site, http://nile.usc.edu/important/software.htm, February 2004