International Journal of Mechanical Engineering

An Approach to mobile ad hoc network directional routing

Salma Fauzia

[1]Electronics and Communication Engineering/Muffakham Jah College of Engineering and Technology/Osmania University/INDIA.

Abstract: Every year, more and more people use multimedia content. This causes network congestion and radio frequency saturation. Radio frequency communication has become very dominant in ad-hoc networking over the last two decades. Non-radio frequencies of the electromagnetic spectrum have always been sought after. Because FSO transceivers are directional, they offer advantages like spatial reuse, low power, and high bandwidth. Mobile ad hoc networks with free space optics may be the future for last mile connectivity, strategic network applications, and delay tolerant networking.This paper explores the method to implement directional routing in ad hoc networks. It is noted from thefindings that directional routing protocols perform better in terms of delay in a mobile setting.

Keywords: Mobile ad hoc networks, routing

1 Introduction

In transmission, directionality means being more sensitive to one direction than another. In proactive routing, each node keeps track of all reachable destinations, regardless of network conditions. Routing tables are updated regularly if the network topology changes. Proactive protocols like "OLSR" [1] and "DSDV" [2] are examples. Using reactive routing, only needed paths are discovered and updated. This type of routing protocol does not maintain all paths to the destination; instead, it creates them as needed. Data transfer will not be initiated until a route has been found by the algorithms AODV and DSR [3] and by flooding the network with packets. Because flooding the entire network with information about nodes' surroundings in order to learn routes can be inflated and unproductive, very little information about nodes' surroundings in relation to routing is maintained at each node. Choudhury et al. [4] propose an amendment to DSR [9] to address edge handoff, backoff, and neighbour node discovery. [4] Scalability of wireless mesh networks has been addressed by developing innovative methods that limit network flooding. This can be achieved by adjusting TTL [1,5], creating tiered topologies [6], using hybrid routing methods [7], using MAC backoff timers [8,9].

2 Methodology

The proposed work was divided into two parts: Because routing is influenced by the way nodes connect to one another, directional transmission becomes an important factor to consider during the process of determining the best route. The research presented here investigates the methods by which directional routing can be applied to a network of nodes moving at speeds of up to 30 metres per second. Ad hoc networks are prone to problems caused by node movement, and the reactive protocol AODV has been modified to take advantage of directionality in order to resolve these issues (MANETs). A new approach, referred to as directional-AODV, has been proposed. It is described below. In order to conduct an analysis and evaluation of the protocol, the following parameters were chosen: delay, control overhead, and packet delivery percentage. The steps involved in initialization are depicted in Figure 1. The nodes are oriented in the direction of the north compass. Neither the nodes nor the receivers can receive or send in orthogonal aligned directions [10]. The reachability and antenna range of the device sending the message determine the direction in which a request message is propagated. Angle correction is accomplished through the use of the "Multiplier angle method-MAM" [10]. If there is a deviation the angle must be corrected.

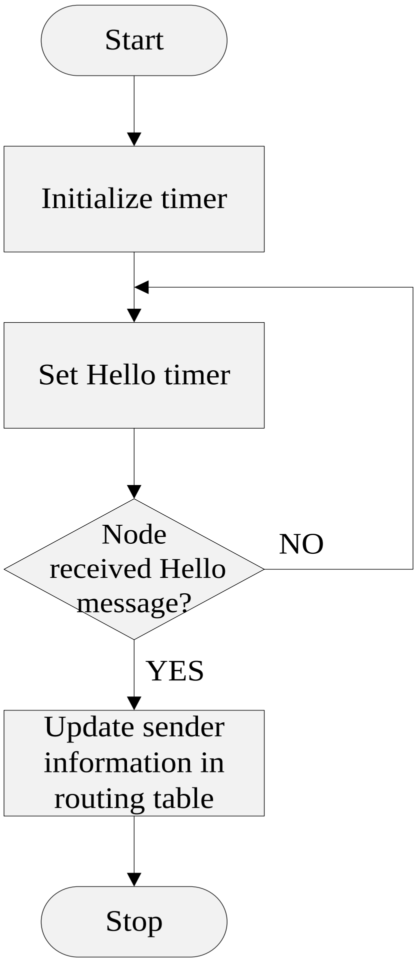

Figure 1 Flowchart of initialization

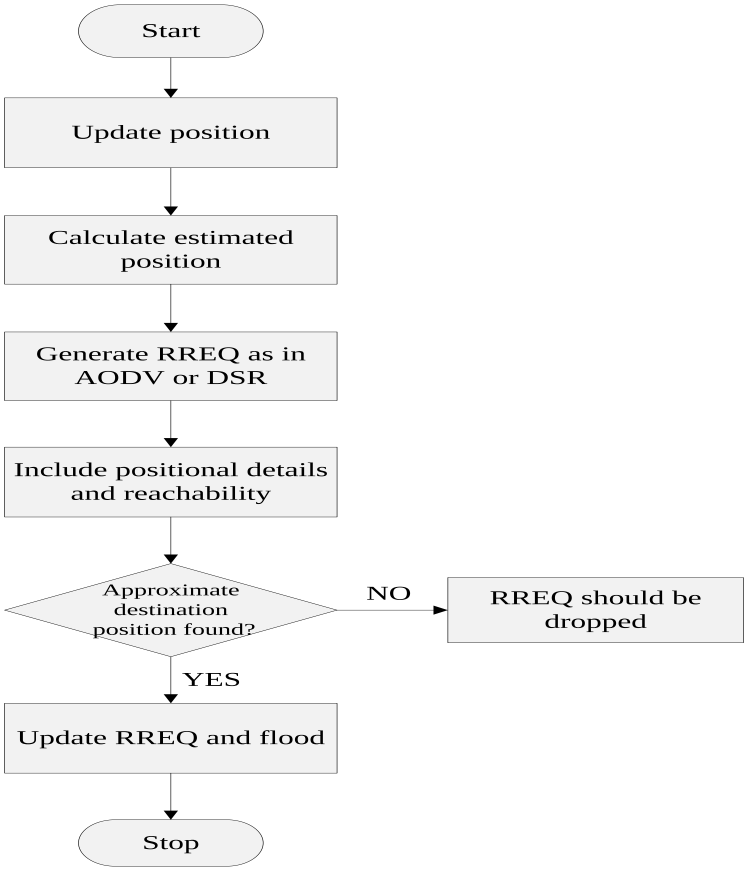

Figure 2 Flowchart for route discovery

If q is the multiplier

$$q = (X_1 - \beta)/X_2 \quad (2.1)$$

X_1 = angle closest to neighboring node

X_2 = angle of separation between nodes

Figure 2 depicts a flowchart of the route discovery process. The request message is sent after the information has been updated and includes the information about the next hop node. The forwarding of hello packets is accomplished in the manner depicted in Figure 3. As a result, information is updated at regular intervals of time as a result of this procedure. The multiplier that is used is calculated in the same way as in equation 2.1. By sending out these Hello messages, you are disseminating the most recent node position throughout the network. The procedure for generating a response is depicted in Figure 4. In this case, data is forwarded to the next hop node, which is usually the destination. A response is sent to the source node based on the request messages that have been generated. In the event of a route break caused by nodes moving away, both AODV [3] and DSR [11] send route fault messages back to the source node

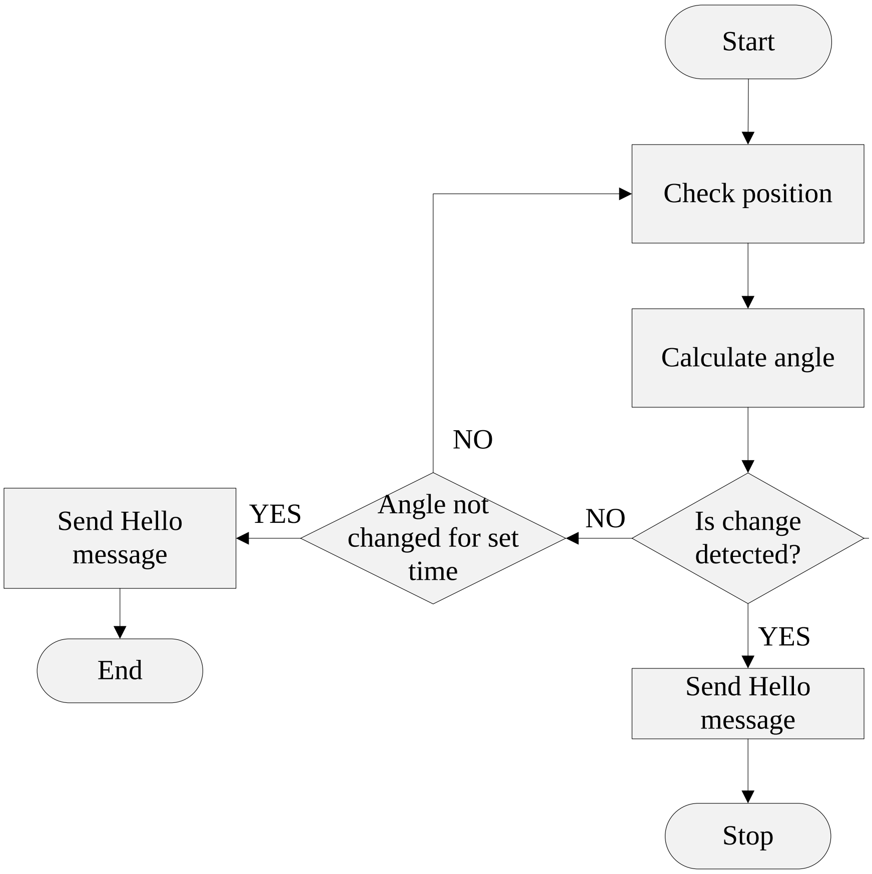

Figure 3 Flowchart for Hello packet forwarding

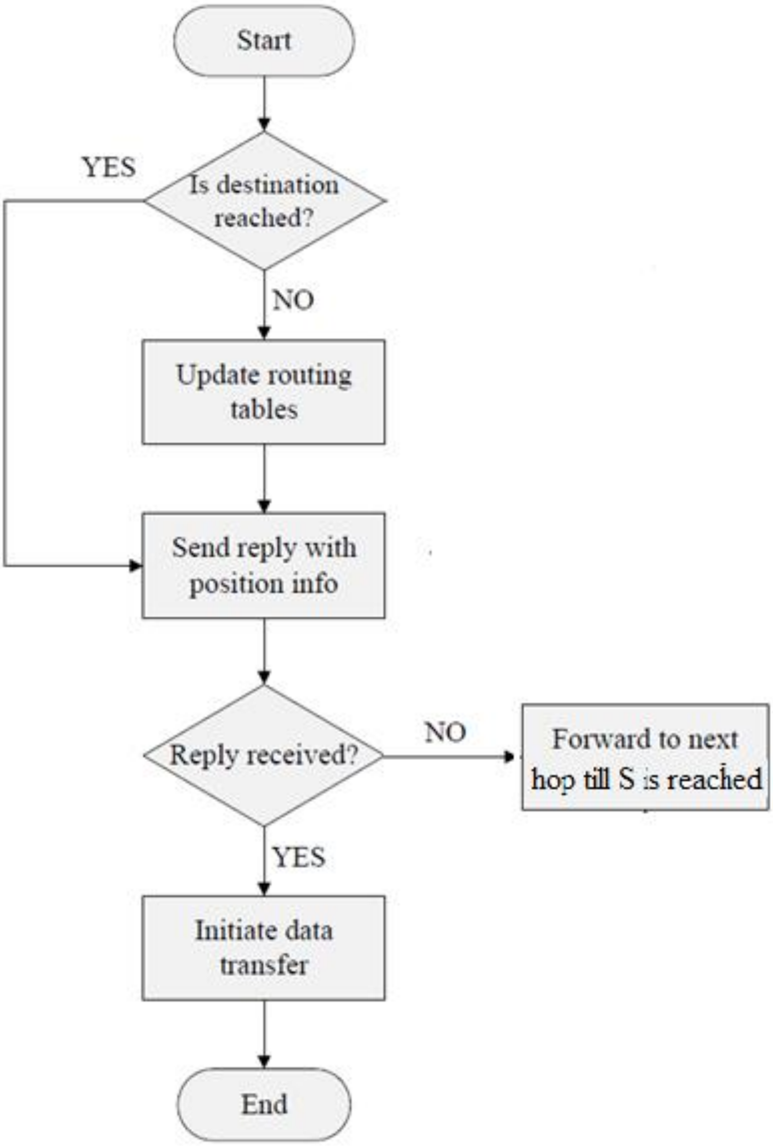

Figure 4 Flowchart for RREP generation

3. Results and Performance Evaluation

Directed-AODV and other modified routing protocols are contrasted with conventional routing protocols like DSR and DSDV in this section. DSDV is a forward-thinking protocol. It was decided to simulate mobile nodes using the random waypoint mobility model because of its accuracy in simulating unsystematic movement. The simulation used 30 nodes, moved at a speed of 30 m/s, and lasted 20 seconds because that was the specified timeframe for the model's model. The simulation parameters used are listed in Tables 2 and 3.

Table 1 Simulation Parameters

PARAMETER	VALUE
Number of Nodes	30
Simulation Time	20 seconds
Pause Time	1.5 seconds
Network Range	1400 m*1400 m
Transmission Range	250 m (NS-2.34 Default)
Traffic Type	CBR
Packet Size	512 bytes
Packet Rate	4 packets/sec
Maximum Speed	30 m/s
Queue Length	50
Simulator	NS 2.34
Mobility Model	Random Waypoint
Antenna Type	Omnidirectional

Table 2 Delay for different protocols

Serial No.	Routing Protocol	Delay (s)
1	DAODV	0.046
2	AODV	0.266
3	DDSR	0.016
4	DSR	0.042
5	DSDV	2.0

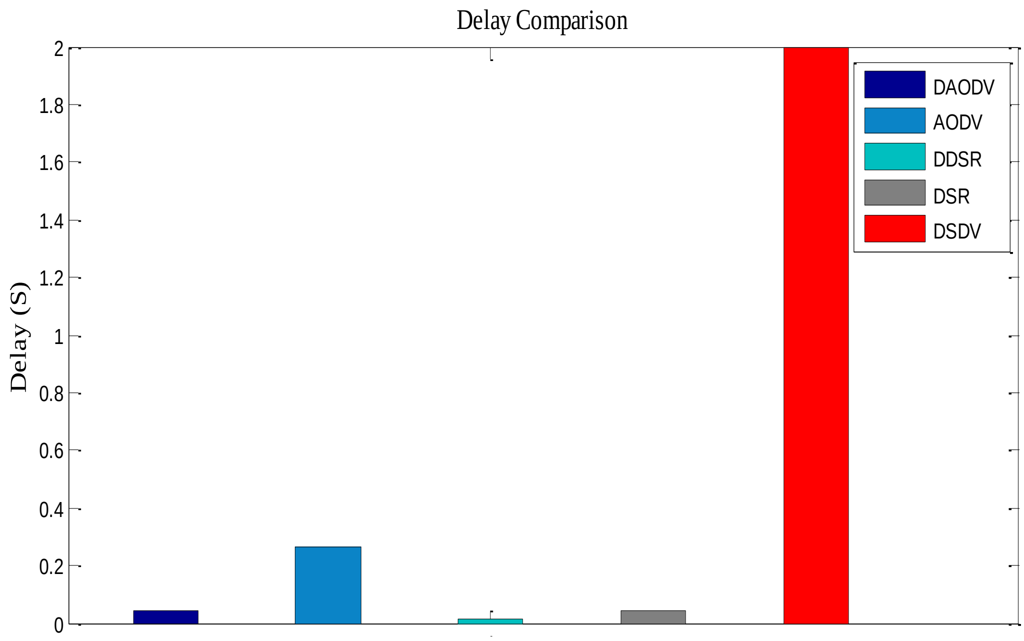

Figure 5 Graph of Delay comparison

When comparing DSDV to other protocols, there is a significant delay because DSDV advertises new routes at regular intervals when the topology changes (Figure 5). The Directional-AODV protocol performs significantly better in terms of delay when compared to the basic AODV protocol. The basic AODV protocol has a delay of 0.266 seconds, while the directional-AODV protocol has a delay of 0.046 seconds. This is due to frequent link rectification and calculation of the angle of direction in which data must be transmitted, which reduces the time a packet must wait before being transmitted.

In terms of delay, the directional-DSR protocol and the basic DSR protocol are 0.016 s and 0.042 s, respectively. This is due to the fact that the Directional DSR protocol performs well in a MANET environment due to the dynamic way in which packets are sent to their destinations.

When compared to the other protocols, Directional-AODV has a high level of overhead due to the high frequency of link failure rectification (calculation of node position is more frequent). When the route is not discovered, the AODV resends the request. Figure 6 depicts the performance in terms of the number of overhead packets that were sent. When compared to the Directional-AODV, the AODV performs better in the mobile environment.

The packet delivery percentage of the Directional-AODV protocol is 64.98 percent, but the basic AODV protocol performs admirably in the mobile environment, providing a packet delivery percentage of 98.77 percent. This is due to the fact that when an end-to-end path cannot be established due to the directional nature of transmissions, there are more packet drops than usual. Directional-DSR has a packet delivery percentage of 62 percent. The DSDV protocol fails to send packets to the destination through intermediate nodes when the node moves. (Figure 7).

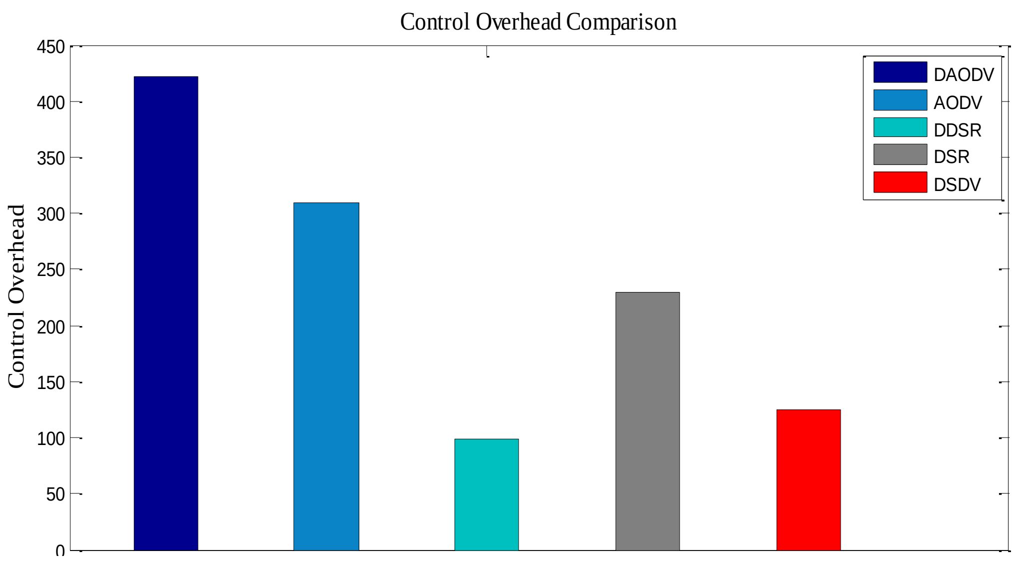

Figure 6 Graph of Overhead comparison

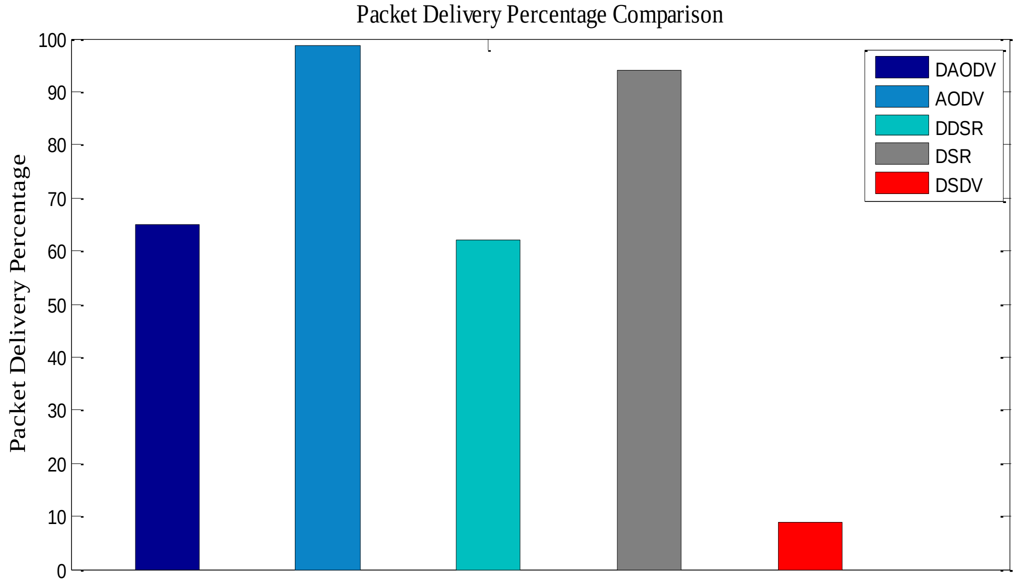

Figure 7 Graph of Packet Delivery Percentage comparison

4 Conclusions

This paper described a modified-on-demand routing protocol, referred to as the AODV routing protocol, that was designed to handle directional communications. A delay of 0.016s was observed for the Directional-DSR protocol, 0.042s for the DSR protocol, and 0.046s for the Directional-AODV protocol, compared to a delay of 0.266s for the AODV protocol. Comparing the two modifications, Directional-AODV and Directional-DSR, the number of packets delivered to the destination is less for both modifications than it is for the traditional protocols, AODV and DSR. AODV has less control overhead than Directional-AODV, but the latter has a higher control overhead. The discussion in this chapter serves as the foundation for developing routing protocols (specifically, AODV) that can reduce the amount of control information that flows through a network while simultaneously attempting to improve other network parameters such as the number of hops, the percentage of packets delivered, and the control overhead. On the basis of the findings it can be concluded that AODV does not choose optimal paths in mesh topology, despite the fact that its delays are less than those of the other two protocols. This result can be used to test and design methodologies to improve the number of packets delivered to the destination, the number of hops, and other network metrics related to routing by incorporating Quality of Service (QoS) into the routing process.

References

[1]. T. Clausen and P. Jacquet. OLSR RFC 3626, October 2003. http://ietf.org/rfc/rfc3626.txt.

[2]. C. Perkins and P. Bhagwat, "Highly Dynamic Destination Sequenced Distance-Vector Routing (DSDV) for Mobile Computers," Proceedings of ACM SIGCOMM, pages 234-244, 1994

[3]. C. Perkins and E. M. Royer, "Ad hoc On-Demand Distance Vector Routing," Proceedings of the 2nd IEEE Workshop on Mobile Computing Systems and Applications, New Orleans, LA, February 1999, pp. 90-100.

[4]. R. R. Choudhury, X. Yang, R. Ramanathan, and Nitin Vaidya. "Using directional antennas for medium access control in ad hoc networks." In Proceedings of ACM MobiCom'02, September 2002.

[5]. BBN Technologies," Hazy Sighted Link State (HSLS) Routing: A Scalable Link State Algorithm", http://www.cuwireless.net/downloads/HSLS.pdf.

[6]. W. T. Tsai, C. V. Ramamurthy, W. K. Tsai, O. Nishiguchi, "An Adaptive Hierarchical Routing Protocol." IEEE Transactions on Computers, v.38 n.8, p.1059-1075, August 1989.

[7]. Z. Haas, J. Pearlman, P. Samar, The Zone Routing Protocol (ZRP) for Ad Hoc Networks, IETF Internet Draft, draft-ietf-manet-zone-zrp-04.txt, July 2002.

[8]. Self-selective Routing for Wireless Ad hoc Networks Proc. IEEE Int. Conf. Wireless and Mobile Computing, Networking and Communications WiMob 2005, Vol. 3, Montreal, Canada, Aug. 2005, pp. 57-64

[9]. Self-healing routing: a study in efficiency and resiliency of data delivery in wireless sensor networks K. Wasilewski, J. Branch, M. Lisee and B.K. Szymanski Proc. Conference on Unattended Ground, Sea, and Air Sensor Technologies and Applications, SPIE Symposium on Defense & Security, Orlando, FL, April 2007.

[10]. B. Cheng, M. Yuksel, S. Kalyanaraman, "Orthogonal Rendezvous Routing Protocol for Wireless Mesh Networks," Proceedings of IEEE International Conference on Network Protocols (ICNP), pages 106-115, Santa Barbara, CA, November 2006.

[11]. D. Johnson, D. Maltz, J. Broch, "DSR: The Dynamic Source Routing Protocol for Multi-Hop Wireless Ad Hoc Networks," Ad Hoc Networking, edited by Charles E. Perkins, Chapter 5, pp. 139-172, Addison-Wesley, 2001.

[12]. M. Bilgi, "Multi-transceiver free-space-optical structures for mobile Ad Hoc networks," Ph.D. dissertation, Dept. Comput. Sci. Eng., University of Nevada, Reno, NV, USA, 2010.