Auction Game Theory Based Adaptive Position Update Strategy for Geographic Routing In MANET

S. Shanthini
Assistant Professor
KSG College of Arts and Science, Coimbatore, India

Abstract— The Auction game based Adaptive Position Update strategy for geographic routing, which dynamically adjusts the frequency of position updates based on the mobility dynamics of the nodes and the forwarding patterns in the network. Adaptive position update is based on three simple principles: first principle is nodes whose movements are harder to predict update their positions more frequently (and vice versa), then the second principle is nodes closer to forwarding paths update their positions more frequently (and vice versa) and last principle is Forwarding nodes are selected based on distance and residual energy with bidding among the neighbors. Several experimental analyses, which is validated by NS2 simulations of a well-known geographic routing protocol, Greedy Perimeter Stateless Routing Protocol (GPSR), shows that game based Adaptive Position Update strategy for geographic routing can significantly improve the packet delivery ratio and improve the routing performance in terms of throughput in comparison with periodic beaconing and other recently proposed updating schemes. Finally give a better result in throughput and packet delivery ration by incurring a relatively smaller delay in delivering the packets. As the no. of nodes increases, this results in better packet delivery ratio of around 98%. The tradeoff between packet delivery ratio and Routing Over Head is slightly increased, The benefits of our work further confirmed by undertaking evaluations in realistic network scenarios, which account for localization error, realistic radio propagation, and sparse network.

Key words: Geographic Routing, Adaptive position update, GPSR

I. INTRODUCTION

Mobile ad hoc Network (MANET) is a type of ad hoc Network. MANET is an unstructured network that can change locations and configure itself on the fly. It enabling technologies are ubiquitous computer devices with WIFI and Medium access control (MAC). MANET is an infrastructure less network, so it`s called flat network. It has a radio communication medium using to share the information's. Every computer or devices are called nodes is and it act as a router. Nodes are in general autonomous. MANET are using limited energy and computing resources. it`s a multi-hop communication and needs support of dynamic routing protocols.

MANET routing protocol is used to discover routes between nodes. Main goal of this Routing protocol is correct and efficient route establishment between one nodes to another so that the messages may be delivered in timely manner and should be minimum of overhead and bandwidth consumption. The geographical routing is provides the most efficient and natural way to route packets comparable to other routing protocols. Minimal configuration and quick deployment make ad hoc networks suitable for emergency situations like natural or human induced disasters, military conflicts, emergency medical situation etc.

In order to facilitate communication within the network, a routing protocol is used to discover routes between nodes. The primary goal of such an ad-hoc network routing protocol is correct and efficient routing establishment between a pair of nodes so that massages may be delivered in a timely manner. Routing construction should be done with a minimum of overhead and bandwidth consumption. An Ad-hoc routing protocol is a convention or standard that controls how nodes comes to agree which way to routing packets between computing devices in a MANET. In ad-hoc networks, nodes do not have a prior knowledge of topology of network around them, they have to discover it. The basic idea is that a new node announces its presence and listens to broadcast announcements from its neighbors. The node learns about new near nodes and ways to reach them, and announces that it can also reach those nodes. As time goes on, each node knows about all other nodes and one or more ways how to reach them.

Geographic routing is attractive for networks in which nodes know their locations. Because a node only requires estimates of the locations of its immediate neighbours and of the destination node in order to forward a message. When the nodes in a network can move, a node can still maintain estimates of its neighbours' locations quite easily. But the bottleneck becomes global dissemination of information regarding the locations of moving destination nodes. As observed in prior work this bottleneck can be improved by structuring location updates. Such that distant nodes get fewer updates, and live with a fuzzier view of the destinations location without excessively compromising routs quality.

It provable Geographic routing to large mobile ad hoc networks (MANETs). While providing performance guarantees on route sub optimality due to imperfect location information. Scalability of any routing protocol demands that traffic generated by routing updates be within network. Then transport capacity obtained with a fixed communication bandwidth, bounds on which have been established. An auction game is a theoretical approach that models the situations in which bidder submit our bids to an auctioneer in order to obtain a certain object or service. The good is sold to the bidder submits the highest bid.

II. RELATED WORKS

The GPSR makes greedy forwarding decisions using only information about in the network topology. [3] GPSR scales better in per-router state than shortest-path and ad-hoc routing protocols as the number of network destinations increases. A scaling challenge as network diameter in hops and mobility increase the rate that end-to-end paths change.

On utilizing characteristics of high node density and location awareness, Implicit Geographic Forwarding

(IGF), a location-aware routing protocol that is robust and work without knowledge of the existence of neighboring nodes it called as state free. [18] The limitations are communication delay, wasting precious energy, causing increased message loss. [7] The combining greedy and face routing we identify a network density range critical for any routing algorithm. Rigorous analysis of the algorithm which together with a lower bound argument shows that the algorithm is asymptotically worst-case optimal. The drawback is it not considers any security aspects. In low complexity, error-resilient geographic routing method, named Conditioned Mean Square Error Ratio (CMSER) routing, using the greedy forwarding techniques employed by algorithm such as Most Forward within Range (MFR), Maximum Expectation Progress (MEP) and Least Expected Distance (LED). [1] Then using the CMSER it gives the throughput result for higher than for other method it reduces the energy wasted on lost packets by keeping their routing paths short. But it does not have a energy efficiency and grouping or clustering in the network.

A periodic hello messaging is a widely-used scheme to obtain local link connectivity information and unnecessary hello messaging can drain batteries while mobile devices are not in use. [19] Adaptive hello messages scheme to suppress unnecessary hello messages without reduced detect ability of broken link. Then the hello interval can be enlarged without reduced detect ability of broken link. A routing protocol that makes use of location information to reduce routing overhead. [12]Beaconless Routing Protocol (BLR) goes not require nodes to broadcast periodically hello-messages with their position it's called beaconing and thus avoid all the associated drawbacks. Such as the use of scarce battery-power, interferences to an overall decrease in network performance. The limitation is proactive broadcasting of beacon messages, such as outdated neighbor tables and control packet transmissions. The Location Aided Routing(LAR) protocols performance it limit the search for a route to the so called request zone, determined based on the expected location of the destination node at the time of route discovery. Then to improve performance of reactive algorithm or to implement location based multicasting. [22] A distributed Geographic K-Anycast Routing (GKAR) protocol can efficiently route date from a source sensor to any K destinations. An Anonymous Location based Efficient Routing protocol (ALERT) is dynamically partitions the network filed into zones and randomly chooses node zones as intermediate relay nodes, which from a non-traceable anonymous route [8]. It hides the data initiator/receiver among many initiators/receivers to strengthen source and destination anonymity protection. It offers anonymity protection to sources, destination, and routes, and lower cost compared to another anonymous routing protocol. It also effectively counters intersection and timing attacks and achieves comparable routing efficiency to the geographical routing protocol. The drawback is no energy efficiency and does not have optimal routing.

An energy trading in the smart grid using game theory mechanism [25]. The energy trading decisions of a number of geographically distributed storage units it perform based on game theory. Such as PHEVs (Plug in electric vehicles) or array of batteries that are trading their stored energy. The owner can decide the maximum amount of energy to sell in a local market. So as to maximize a utility that reflects the tradeoff between revenues from energy trading and the accompanying costs. Then it using the auction game in this energy exchange market between the storage units and the smart grid elements, the price at which energy is traded is determined it also using the novel algorithm and nash equilibrium algorithm it improve average utility per storage unit. In this paper is maintaining the energy management using the double auction strategy. [6] considered how to allocate the relay node and price the source nodes using auction mechanisms, such that the revenue is maximized. Then it used the Vickery-Clarke-Groves (VCG) based auction mechanisms it taken high time complexity it is the problem so design the truthful auction mechanisms it significantly reduces the time complexity but it done this work without severely sacrificing the revenue. The truthful auction mechanism only considered the timing manner of communication between the networks. [14]A new partner selection scheme different from the renowned bidding scheme which is modeled as a single-user; multi-relay network has the source node acting as the auctioneer in the bidding process while the relays act as the bidders. Where the highest bidder goes with the goods and also shows that a relationship exists between the utility obtainable by source node and the selection of the relay node. We see that the auctioneer selects the relay that is willing to play the highest, in terms of the bid price and at the same time provides an incentive to the selected bidder for the help the latter is rendering in forwarding the source nodes to the destination node. a power trading business model with QoS constraints for wireless communication was presented using cooperative communication and game theory with the first price auction model[20]. The business model considers the bit error rate and the total delay as QoS constraints. The business model is converted into the economic profit based strategy. The designs the true protocol suite for this application quantify the true overhead coast. It improves the power efficiency, price power profit, and economic coast. The limitations are not considered the multihop scenarios with multiple source terminals in future give the multiple buyer multiple-seller auction model.

III. DESIGN AND IMPLEMENTATION

A. Adaptive Position Update:

In this Module we start keeping following assumptions. All nodes are aware of their own position and velocity, all links are bidirectional. The beacon updates include the current location and velocity of the nodes and Data packets can piggyback position and velocity updates. All one-hop neighbours operate in the promiscuous mode and hence can overhear the data packets. Upon initialization, each node broadcasts a beacon informing its neighbours about its presence and its current location and velocity. Following this, in most geographic routing protocols such as GPSR, each node periodically broadcasts its current location information. The position information received from neighbouring beacons is stored at each node. Based on the position updates received from its neighbors, each node continuously updates its local topology, which is represented as a neighbor list. Only those nodes from the neighbor list are considered as possible candidates for data

forwarding. Thus, the beacons play an important part in maintaining an accurate representation of the local topology. Instead of periodic beaconing, APU adapts the beacon update intervals to the mobility dynamics of the nodes and the amount of data being forwarded in the neighborhood of the nodes. APU employs two mutually exclusive beacon triggering rules to sort its neighbors.

B. Auction Game Based Forwarding:

This module implements auction game based data forwarding logic which is a massively parallelizable algorithm for the classical decision making problem. The algorithm operates like an auction whereby unassigned persons bid simultaneously for objects thereby raising their prices. Once all bids are in, objects are awarded to the highest bidder. The algorithm can also be interpreted as a Jacobi like relaxation method for solving a dual problem. Its (sequential) worst case complexity, for a particular implementation that uses scaling, is O(NAlog(NC)) where N is the number of persons, A is the number of pairs of persons and objects that can be assigned to each other, and C is the maximum absolute object value. Computational results show that, for large problems, the algorithm is competitive with existing methods even without the benefit of parallelism. When executed on a parallel processing, the algorithm exhibits substantial speed up.

Algorithm: Finding shortest best neighbors
//Initialize
Input:
FDi: Forwarding Node Destination,
NL: Neighbor-List, I: Next-Hop-Node = NULL,
Max_wt: Maximum-Weight = 0,
CNL:Candidate-Neighbor-List = NULL.
Output:
I: Next-Hop-Node
// Update neighbor list
FOR(i=0 to i< NL.count)
FDi ←NL.count
IF(max_wt>FDi)
CNL← CNL+FDi
END IF
END FOR
//Forwarding strategy
FOR (j=0 to j<CNL.count)
Wt ← α*REj+β*progj
IF(wtj<best)
I ← best
END If
END FOR
Return NH

IV. PERFORMANCE EVALUATION

Then by varying the number of nodes, speed and traffics patterns the performance analysis is done. We have used results from 50 different combinations of simulations; such as end-to-end delay, throughput, etc., as shown below are analyzed.

A. Delay Vs Nodes:

Network delay is an important design and performance characteristic of a computer network or telecommunications network. The delay of a network specifies how long it takes for a bit of data to travel across the network from one node or endpoint to another. It is typically measured in multiples or fractions of seconds. Delay may differ slightly, depending on the location of the specific pair of communicating nodes. Although users only care about the total delay of a network, engineers need to perform precise measurements. Thus, engineers usually report both the maximum and average delay, and they divide the delay into several parts:

- Processing delay - time routers take to process the packet header
- Queuing delay - time the packet spends in routing queues
- Transmission delay - time it takes to push the packet's bits onto the link
- Propagation delay - time for a signal to reach its destination

There is a certain minimum level of delay that will be experienced due to the time it takes to transmit a packet serially through a link. Onto this is added a more variable level of delay due to network congestion. IP network delays can range from just a few milliseconds to several hundred milliseconds.

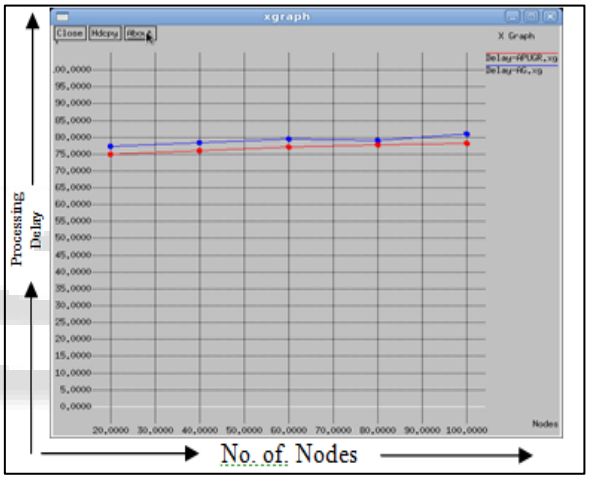

Fig. 1: Delay Vs No. of. Nodes

The figure1 showed no. of Nodes Vs Processing Delay with respect to APUGR and AG_APUGR. Sender sending 100 nodes, APUGR delivered the packets in 78sec delay but AG_APUGR delivered 80sec delay [10^-6 Sec]. It is little bet delay increasing compared to an existing system. Because every forwarding node calculate the distance use the AG_APUGR to find the next shortest node so it have a delay.

B. Throughput Vs Nodes:

The throughput is usually measured in bits per second (bit/s or bps), and sometimes in data packets per second or data packets per time slot. The system throughput or aggregate throughput is the sum of the data rates that are delivered to all terminals in a network. The throughput can be analyzed mathematically by means of queuing theory, where the load in packets per time unit is denoted arrival rate λ, and the throughput in packets per time unit is denoted departure rate μ.

$$\text{Throughput} = \frac{\text{Total no.of succesfull packets delivered}}{\text{Total time taken}}$$

Throughput is calculate by the total no.of succesfull packets delivery and it into the total time taken to delivered the packets. So our throughput value is 86.44%.

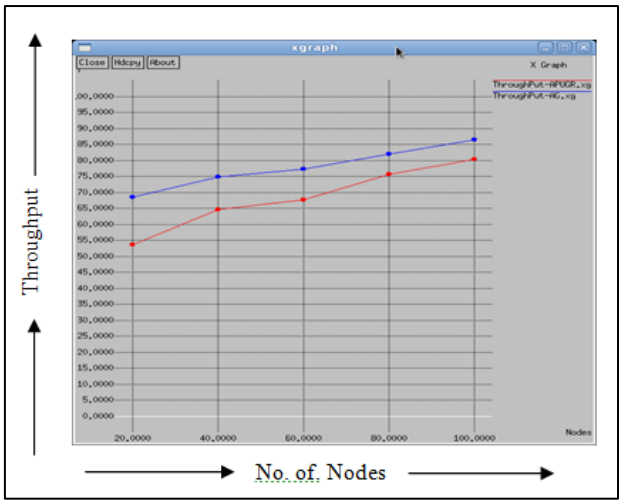

Fig. 2: Throughput Vs No. of. Nodes

The figure2 showed no. of Nodes Vs Throughput with respect to to APUGR and AG_APUGR. Our proposed system AG_APUGR is increasing the throughput level compared to an existing system. Sender sending 100 nodes, APUGR 80% of throughput but AG_APUGR 86%of throughput. It is increasing the network performance compared to an existing system.

C. Packet Delivery Ratio (Pdr) Vs Nodes:

Packet delivery ratio is defined as the ratio of data packets received by the destinations to those generated by the sources. This performance metric gives us an idea of how well the protocol is performing in terms of packet delivery at different speeds using different traffic models. Mathematically, we can define as,

$$\text{PDR} = \frac{\text{Total no.of succesfull packets recived}}{\text{Total no.of packets sent}}$$

Packet Delivery Ratio is calculated by total no.of successful packets received it divied into the total no.of packect sent. In our packet delivery ration is 98% of packects sucesfully received

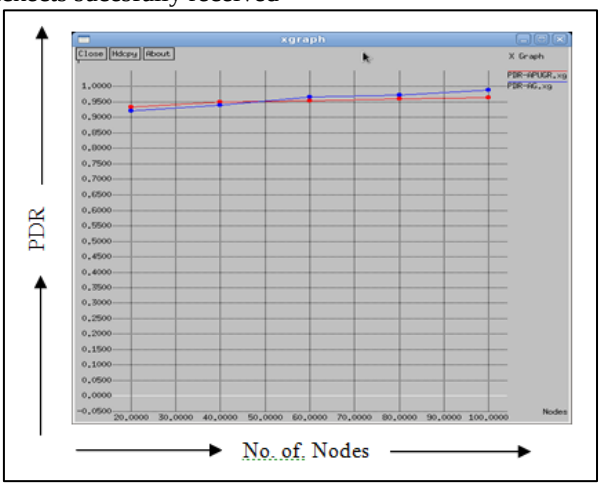

Fig. 3: Packet Deliver Ratio Vs No. of. Nodes

The figure3 showed no. of Nodes Vs Packet Deliver Ratio in respect with to APUGR and AG_APUGR. Our proposed system AG_APUGR is increasing the Packet deliver ratio compared to an existing system. Sender sending 100 packets, APUGR delivered in successful packets delivered in 96% but AG_APUGR delivered 99%. It is increasing the Packet deliver ratio compared to an existing system. Because every forwarding to their best neighbor node so it`s accurately sending to the destination.

D. Routing Overhead Vs Nodes:

In the context of computers, communication overhead is those bits of data that must be sent to convey information about, for example, where the information originated and where it is being sent to, how it is to be routed, timestamps, or any other information that is not actually the "payload" representing the actual content to be communicated.

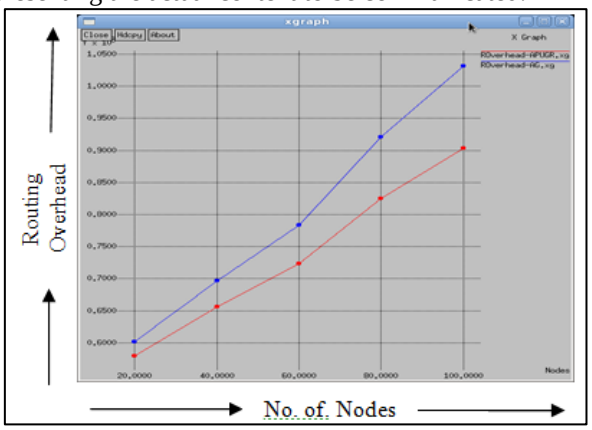

Fig. 4: Routing overhead Vs No. of. Nodes

The above figure4 showed no. of Nodes Vs Routing Over Head in respect with to APUGR and AG_APUGR. It is also increasing a little bet routing over head, because every time you sending a packet it is update the routing table. So it has small routing over head compared to an existing system.

The series of simulation results were carried out to evaluate the efficiency of the proposed model for the Geographic Routing. This project presents the results obtained from actual simulation runs.

V. CONCLUSION

This project had has developed using an Auction Game Based forwarding algorithm with Adaptive Position Update for GPSR, referred to as Adaptive Position Update Geographic routing using Auction Game. It considers both the progress made towards the destination as well as the residual energy available at the neighboring nodes of a forwarding node before choosing the next hop towards the destination. Simulation results illustrate that auction game possess better throughput and packet delivery ration by incurring a relatively smaller delay in delivering the packets. As the no. of nodes increases, this results in better Packet Delivery Ratio of around 98%. The tradeoff between Packet Delivery Ratio and Routing Over Head is slightly improved while considering the other routing protocols such as GPSR. Auction game attempts to fairly utilize the nodes by taking into consideration the residual energy available at the nodes before deciding the next hop node. As a result, a single node that always lies on the path of maximum progress need not be repeatedly chosen, which may be the case with GPSR, especially in networks of low node mobility and low or moderate network density. Auction game fairly rotates the data forwarding load to all the nodes in the neighborhood, thus incurring a relatively lower Unfairness Index compared to GPSR. Thus, auction game is a valuable addition to the literature of position-based MANET routing protocols.

In future, the scholars can look into the performance of GPSR and Adaptive Position Update Geographic routing using Auction Game theory under different location service schemes and consider the impact of the location update overhead as well as the inaccuracy in location prediction and estimation on the performance of these two routing protocols. Then also reduce the routing over head and delay of packet delivery. Further they could also look into scenarios where the performance GPSR and auction game under different MANET mobility models as well as under different models for unidirectional links.

REFERENCES

[1] Ana Maria Popescu, Naveed Salman, and Andrew H. Kemp, "Geographic Routing Resilient to Location Errors", IEEE Wireless Communications Letters, Vol. 2, No. 2, April 2013
[2] Andrew S. Tanenbaum, "Mobile ad Hoc Networks (MANETs) Are Not A Fundamentally Flawed Architecture", Vol. 11 January 14, 2005.
[3] Brad Karp, "GPSR: Greedy Perimeter Stateless Routing for Wireless Networks", Harvard University, 2000
[4] Carlos de Morais, P. Agrawal, "Mobile Ad Hoc Networking", 2003.
[5] Carlos t. Calafate, Mobile ad hoc networks", Inernation conference on information networking 2009.
[6] Dejun Yang, Xi Fang, and Guoliang Xue, "Truthful Auction for Cooperative Communications with Revenue Maximization", U.S. National Science Foundation (NFS), 2010.
[7] Fabian Kuhn, Roger Wattenhofer, Aaron Zollinger, "Worst Case Optimal and Average Case Efficient Geometric AdHoc Routing", ETH Zurich, Switerland-2004
[8] Haiying Shen and Lianyu Zhao, "ALERT: An Anonymous Location-Based Efficient Routing Protocol in MANETs", IEEE Transactions on Mobile Computing, Vol. 12, No. 6, June 2013
[9] J. Feigenbaum, C. Papadimitriour, R. Sami, S. Shenker, "A BGP based mechanism for lower-cost routing", Procesding of the 21st annual symposium on principles of distributed computing, ACM, 2002, PP. 173-182.
[10] J.drechsel, "Selected Topics in cooperative game theory", Springer-verlag Barlin Heidelberg 2010.
[11] Karim El Defrawy and Gene Tsudik, "PRISM: Privacy-friendly Routing In Suspicious MANETs", University of California, Defence Publication 2007.
[12] Marc Heissenbuttel and Torsten Braun, "Beacon-Less Routing Algorithm for Mobile Ad-Hoc Networks", University of Bern, Switzerland, 2004.
[13] Ms. Shruti M Shah and Mr. Amit Patel, "Enhance AODV Routing Protocol in TCP and CBR Traffic", International Journal of Engineering Development and Research, Vol. 2, Issue. 1, 2014, Pages 172-176.
[14] Oluseye A. Adeleke* and Mohd. F. M. Salleh, " Relay selection mechanism for user cooperation networks using a game-theoretic approach", Journal of electrical and Electronics Engineering Research, Vol. 5(3), September, 2013.
[15] Paul Meeneghan & Declan Delaney, "An introduction to NS, Nam and OTcl scripting", National University of Ireland, 2005.
[16] Q. Chen, S.S. Kanhere, and M. Hassan, "Mobility and Traffic Adaptive Position Update for Geographic routing," Technical Report UNSW-CSE-TR-1002, School of Computer Science and Eng., Univ. of New South Wales, doc/papers/UNSW/1002.pdf, 2010.
[17] Sandeep Bajaj, Lee Breslau, Deborah Estrin, Kevin Fall, Sally Floyd, Padma Haldar, Mark Handley, Ahmed Helmy, John Heidemann, Polly Huang, Satish Kumar, Steven McCanne, Reza Rejaie, Puneet Sharma, Kannan Varadhan, Ya Xu, Haobo Yu, and Daniel Zappala, Improving Simulation for Network Research, Technical Report 99-702, University of Southern California, March, 1999.
[18] Sang Son John A. Stankovic, "IGF: A State-Free Robust Communication protocol for Wireless Sensor Networks", University of Virginia, 2004.
[19] Seon Yeong Han and Dongman Lee, "An Adaptive Hello Messaging Scheme for Neighbor Discovery in On-Demand MANET Routing Protocols", IEEE Communications Letters, Vol. 17, No. 5, May 2013.
[20] Sithamparanathan Kandeepan, Sudharman K. Jayaweera, and Riccardo Fedrizzi, "Power-Trading in Wireless Communications: A Cooperative Networking Business Model", U.S. National Science Foundation (NFS), Feb 2012
[21] Teerawat Issariyakul, "Introduction to network simulator NS@", Springer Science 2009.
[22] Xiumin Wang, Jianping Wang,Kejie Lu and Yinlong Xu, "GKAR: A Novel Geographic K-Anycast Routing for Wireless Sensor Networks", IEEE Transactions on Parallel and Distributed System, Vol. 24, No. 5, May 2013
[23] Young-Bae Ko and Nitin H. Vaidya, "Location-Aided Routing (LAR) in mobile ad hoc networks", Texas A&M Uniersity, USA-2000
[24] Yue Wang MobilTec Lab, CUHK "A Tutorial of 802.11 Implementation in ns-2", 2004.
[25] Yunpeng Wang, Walid Saad, Zhu Han, H. Vincent poor, and Tamer Basar, " A Game-Theoretic Approach to Energy Trading in the Smart Grid", U.S. Air Force office of Scientific Research (AFOSR), Oct 2013.

