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Energy Efficient Management for Mobile Ad Hoc Networks

Abhishek Agrawal
Student, M.Tech (Electronics)
KITS, Ramtek, Nagpur (India)

Rajendra Lambodari
Student, M.Tech (Electronics)
KITS, Ramtek, Nagpur (India)

ABSTRACT
This paper describes a mobile ad hoc network (MANET), a collection of digital data terminals that can communicate with one another without any fixed networking infrastructure. Since the nodes in a MANET are mobile, the routing and power management become critical issues. However, due to the slow advancement of battery technology, battery power continues to be a constrained resource and so power management in wireless networks remains to be an important issue. Though many devices proactive and reactive routing protocols exist for MANETs the reactive dynamic source routing (DSR) protocol is considered to be an efficient protocol. In this paper it is proposed to implement overhead reduction and efficient energy management for DSR in mobile ad hoc networks.

Keywords
MANET, DSR, Energy Management, overhead reduction.

1. INTRODUCTION
The Energy is the scarcest resource for the operation of the mobile ad hoc networks. Idle energy consumption is responsible for a large portion of the overall energy consumption in the wireless interfaces of the mobile nodes. Therefore, it is crucial to energy conservation efforts that this source of energy is eliminated or reduced our goal in this research is to create a new energy conservation scheme that works on reducing idle energy consumption. This scheme works with existing routing algorithms of all categories. It is distributed in nature, and its functionality is independent of the strategy and architecture of the routing protocol. Span, a power saving technique for multi-hop ad hoc wireless networks that reduces energy consumption without significantly diminishing the capacity or connectivity of the network. Span builds on the observation that when a region of a shared-channel wireless network has a sufficient density of nodes, only a small number of them need to be on at any time to forward traffic for active connections. Span is a distributed randomized algorithm where nodes make local decisions on whether to sleep or to join forwarding backbones a coordinator. Each node bases its decision on an estimate of how many of its neighbors will benefit from it being awake and the amount of energy available to it.

2. AD HOC NETWORK
An Ad Hoc network is a collection of wireless mobile hosts forming a temporary network without the aid of any established infrastructure or centralized administration. The absence of any fixed infrastructure, such as access points, makes Ad-Hoc networks prominently different from other wireless LANs. In such an environment each node may act as a router, source and destination, and forwards packets to the next hop allowing them to reach the final destination through multiple hops. With the proliferation of portable computing platforms and small wireless devices, Ad Hoc wireless networks have received more and more attention as a means for providing data communications among devices regardless of their physical locations. The main characteristic of Ad–Hoc networks is the absence of pre-planning. The topology of the network is discovered on the fly, after the network's deployment. Thus, such a network must exchange a number of messages which are used to "set-up" various parameters in the network. Example of such parameters is the very existence of other nodes in the network, their position, information about their neighbors. A mobile ad hoc network (MANET) is a self-configuring infrastructure less network of mobile devices connected by wireless links. Ad hoc is Latin and means "for this purpose". Each device in a MANET is free to move independently in any direction, and will therefore change its links to other devices frequently. Each must forward traffic unrelated to its own use, and therefore be a router. The primary challenge in building a MANET is equipping each device to continuously maintain the information required to properly route traffic. Such networks may operate by themselves or may be connected to the larger Internet. The growth of laptops and Wi-Fi wireless networking have made MANETs a popular research topic.

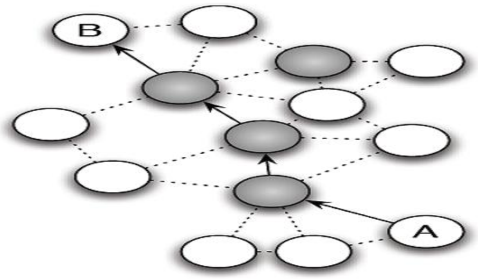

Fig 1: Span's routing backbone of coordinator nodes

3. ENERGY EFFICIENT TECHNIQUE IN MANET
The Ad hoc networks are designed to be scalable. As the network grows, various routing protocols perform differently. The amount of routing traffic increases as the network grows. An important measure of the scalability of the protocol, and thus the network, is its routing overhead. It is defined as the total number of routing packets transmitted over the network, expressed in bits per second or packets per second. Some sources of routing overhead in a network are cited in as the number of neighbors to the node and the number of hops from the source to the destination. Other causes of routing overhead are network congestion and route error packets. Mobile nodes are faced with power constraints and as such, power saving is a major factor to consider in implementation of MANET. Furthermore, radio power limitations, channel utilization and network size are considered. These factors limit the ability of nodes in a MANET to communicate directly between the source and destination. As the number of nodes increases in the network, communication between the source and destination increasingly relies on intermediate nodes. Most

routing protocols rely on their neighbors to route traffic and the increase in the number of neighbors causes even more traffic in the network due to multiplication of broadcast traffic.

Following are the types of energy consumption that have been identified:

1) Energy consumed while sending a packet.
2) Energy consumed while receiving a packet.
3) Energy consumed while in idle mode.

Energy consumed while in sleep mode which occurs when the wireless interface of the Mobile node is turned off. It should be noted that the energy consumed during sending a packet is the largest source of energy consumption of all modes. This is followed by the energy consumption during receiving a packet. Despite the fact that while in idle mode the node does not actually handle data communication operations, it was found that the wireless interface consumes a considerable amount of energy nevertheless. This amount approaches the amount that is consumed in the receive operation. Idle energy is a wasted energy that should be eliminated or reduced through energy-efficient schemes. Through energy consumption measurements studies, experiments have also been conducted to determine the power consumption patterns in the different active modes. In some experiments, the instantaneous power consumption per communication mode, e.g. send, receive, idle and sleep modes, has been measured. For example, the cases of unicast and broadcast are considered to have different costs. This has been explained based on the fact that unicast operations in IEEE 802.11 involve the exchange of control packets between the sending and receiving nodes while broadcast operations do not involve such an exchange. However, these studies did not directly address cases of repeated resending of control packets that may happen due to glitches in the transmission operations over the wireless communication channels. It has been shown [4] that energy consumed in the retransmit operations is responsible for a considerable amount of energy consumption. Since this case cannot be avoided with the use of energy-efficient algorithms, especially in the transition between node wakeup and sleep times, using the model described by may introduce some inaccuracies.

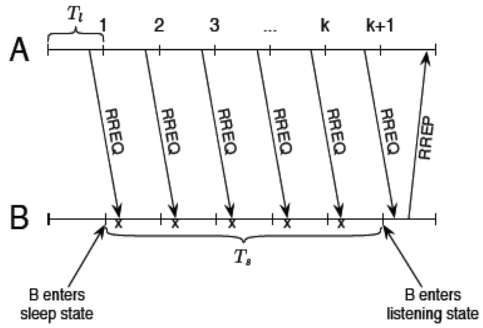

Fig 2: BECA imposed retransmissions

4. METHODLOGY

In this implementation we are looking for the solution for the problem mentioned above with the help of different kind of methodologies (algorithms).

Algorithm for overhead reduction:

In the Algorithm for overhead reduction [2] the following are the steps.

Step 1: Source broadcasts Route Request packets which are heard by nodes within the coverage area

Step 2: The neighboring nodes re-broadcast the route request.

Step 3: Destination sends Route Reply only to the first received Route Request.

Step 4: Source address, destination address and previous node addresses are stored during route reply.

Step 5: The data packet contains only source & destination addresses in its header.

Step 6: When the data packet travels from source to destination, through intermediate nodes, for re-broadcasting of data packet, the node verifies source and destination addresses in its cache. If it is present, the data packets are forwarded, otherwise it is rejected.

Step 7: After re-broadcasting the data packet, acknowledgement will be sent to the previous node.

5. SIMULATION RESULTS

The protocol AODV under nomadic condition have been designed and simulated in network simulator (NS2). The simulation results are shown in fig.3.

Simulation area 500m x 500m.

Super nodes 27.

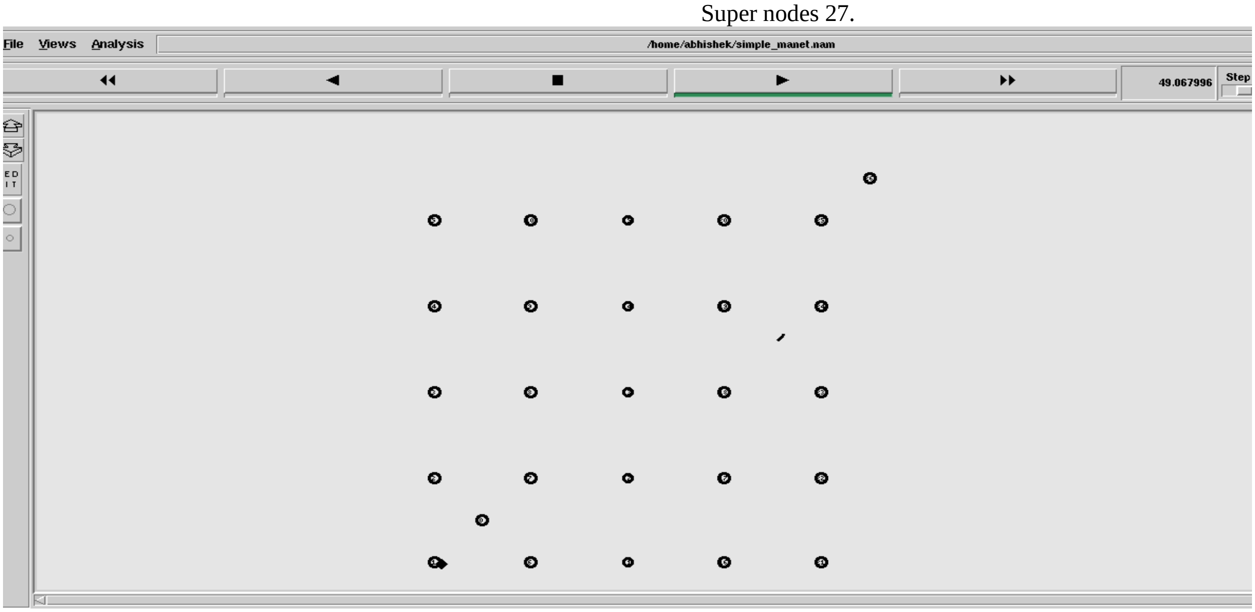

Fig 3: MANET Simulation

6. CONCLUSION

The Span a distributed coordination technique for multi-hop ad hoc wireless networks that reduces energy consumption without significantly diminishing the capacity or connectivity of the network. The validity of the architecture will be verified by comparing the results with NS2 simulation results. Energy models widely used in analyzing and devising ad hoc protocols were discussed. The sources of energy consumption that pertain to communications in ad hoc network were shown to exist in four main modes of operation: transmitting, receiving, idle and sleep modes.

7. REFERENCES

[1] Mads Daro Kristensen, Niels Olof Bouvin, “Energy Efficient MANET Routing Using a combination of Span and BECA/AFECA”, Journal of NETWORKS, VOL. 3, March 2008.

[2] M.Tamilarasi, S.Chandramathi, T.G Palanivelu, “Efficient Energy Management for mobile Ad Hoc Networks”, Department of Electronics and communication Engineering, Pondicherry Engineering college, Pondicherry, India.

[3] Arulanandam K., Dr.Parthasarathy B., “A New energy level efficiency issues in MANET”, International Journal of Reviews in computing, 2009 IJRIC.

[4] Benjie Che, Kyle Jamieson, Hari Balakrishnan, Robert Morrisn, “Span: An Energy Efficient Coordination Algorithm for Topology Maintenance in Ad Hoc Wireless Networks”, Computer science Massachusetts Institute of Technology Cambridge, Massachusetts.

[5] Yu-Chee Tseng, Chih-Shun Hsu, Ten- Yueng Hsieh Jamieson,“Power saving protocols for IEEE 802.11-Based Multi-hop ad hoc networks”, 2002 IEEE.

[6] Hu-Zhou, Suresh Singh Tseng, Chih-Shun Hsu, Ten-Yueng Hsieh Jamieson, “Content based Milticast (CBM) in Ad hoc Networks”, Department of ECE, Oregon state University Corvallis.

[7] Pariza Kamboj, Ashok K. Sharma, “Energy efficient Milticast routing protocol for MANET with minimum control overhead”, International Journal of Computer Applications (0975 – 8887), Volume 8– No.7, October 2010.

[8] Niranjan kumar Ray, Ashok kumar turuk, “Energy efficient techniques for wireless Ad hoc network”, Proceedings of International Joint conference on Information & Communication Technology, IJCICT 2010.