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A Novel Method for Opportunistic Energy Efficient Protocol in Mobile Ad-Hoc Network : A Review

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ABSTRACT: Wireless network especially mobile ad-hoc network (MANET) are facing two challenges beyond tradition random network model - opportunistic links with random nature due to fading and dynamic channel access, and dynamic network topology. Due to mobility and time varying nature Energy aware design and evolution of network protocol requires knowledge of the energy consumption behaviour of actual wireless interface. In this paper we proposed scalable broadcast scheme based on reducing the number of forwarding nodes and the transmitting range. Simulation shows our scheme uses the least energy and consumes less bandwidth.

KEYWORDS: MANET, epidemic broadcast, energy consumption.

I. INTRODUCTION

Mobile ad-hoc network (MANET) is a self organising network composed of mobile devices like smart phones, tablet, PCs. In Mobile ad hoc network information propagation relies on local ad-hoc connection that emerge opportunistically as mobile devices move and meet each other. Such ad-hoc connection is determined by two major factors: dynamic topology and channel randomness. The dynamic topology of mobile ad-hoc network often resembles the topology of human network, in the sense that mobility of nodes in a MANET is not only similar to, but often governed by the movement of their human owners. Broadcasting a message to all nodes in a network is one of primal and mandatory techniques in wireless ad-hoc and sensor network. Recent advantages in technology have provided portable computers with wireless interfaces that allow networked communication among mobile users.

Epidemic routing algorithm has been proposed as a fast and reliable approach to broadcast information in MANET. On the other hand unlike the spreading of epidemic disease in human networks, the information propagation scheme in MANET can often be carefully designed. In addition to varying networks topology, channel randomness also has a significant impact on information broadcasting MANET. The failure of traditional routing protocols and the similarity between MANETs and human networks epidemic routing algorithm have been proposed as an efficient and reliable approach to disseminate information in MANET.

This paper presents an energy efficient broadcast scheme for Mobile ad-hoc network to address the aforementioned challenges. The design of the broadcast scheme is based on in-depth analysis of the advantages and inadequacies of the widely used epidemic broadcast scheme is proposed and motivated by the analysis of the information dissemination process using the SIR scheme

II. RELATED WORK

An ad hoc network is a group of mobile, wireless hosts which cooperatively form a network independently of any fixed infrastructure. The multi-hop routing problem in ad hoc networks has been widely studied in terms of bandwidth utilization, but energy consumption has received less attention. It is sometimes (incorrectly) assumed that bandwidth utilization and energy consumption are roughly synonymous. Recently, there has been some study of energy-aware ad hoc routing protocols, particularly for distributed sensor networks. We believe that energy-aware design and evaluation of network protocols for the ad hoc networking environment requires practical knowledge of the energy consumption

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behaviour of actual wireless devices. Epidemic broadcast scheme are popularly used for information in MANET. An epidemic model is suitable for investigating how fast the message is disseminated in the network. The information dissemination process using a susceptible infectious epidemic scheme, where every node carries the received information and forwards it to all nodes coming into the radio range. The SI epidemic scheme is a reliable but costly scheme due to lack of a proper mechanism to stop the transmission.

A Susceptible-Infectious-Recovered (SIR) routing algorithm

Consider a basic stochastic SIR epidemic routing algorithm where a piece of information starts to broadcast from a source node. Note that the source node can be any node in the network without affecting the results, because of the homogeneous and stationary Poisson distribution of the nodes. By analogy to the way a disease spreads in a human network, a node in the MANET can be in any of the three states S, I, R: A node that has never received the information from the source is in the state of susceptible (S), in which the node can accept incoming transmissions if such opportunity arises. A susceptible node goes into the state of infected and infectious (I) immediately after it has received a copy of the information. The node in state I will keep transmitting the information, i.e. remain infectious, for a certain time period τ , which is referred to as the active period. After the active period the node enters into the state of recovered and immune (R). A node in state R will stop transmitting the information to other nodes and will also ignore all future transmissions of the same information from other nodes. Note that the state S resembles the situation that a node cannot broadcast a piece of information before receiving it. The reason for the transition from state S to I is that every node acts as a relay that starts to forward an information after receiving it.

Further, the transition from state I to R after a certain time period is a reflection that in reality a wireless device will not keep re-transmitting the same information indefinitely; doing otherwise would result in a huge waste of resources such as network bandwidth and device battery. The SIR epidemic scheme postulates that nodes need to keep transmitting for a prescribed time period before recovery (i.e. stopping the transmission); nevertheless a long continuous transmitting period required by the scheme can be difficult or costly to implement in reality. Then in a conference version of this work, we took shadowing effect into account and proposed the opportunistic broadcast scheme. This paper takes a further step by taking fast fading effect into consideration and investigating the optimal design for the opportunistic broadcast scheme that minimizes the resource consumption.

B Broadcast Scheme

Suppose that a piece of information is broadcast from an arbitrary node. Once a node receives the information for the first time, it becomes infectious. The infectious node holds the information for a fixed amount of time τ_s (called the sleep time interval) followed by a random amount of time τ_r (to be described in the next paragraph), then re-transmits the information (to all nodes directly connected to the infectious node) once. Such a sleep-active cycle repeats for a fixed number of times, denoted by a positive integer β, after which the node recovers. A recovered node stops transmitting the information and will ignore all future transmissions of the same information. The information dissemination process naturally stops (i.e. reaches the steady state) when there is no infectious node in the network; and the nodes that have received the information are referred to as the informed nodes. It is obvious that the fraction of informed nodes is a key performance metric of information dissemination in a given network. Animation of an information dissemination process is available on Note that the time interval between two consecutive transmissions is determined by two additive components: a pre-designated sleep time interval τ_s and a random time interval τ_r.

The pre-designated waiting period τ_s is chosen to allow sufficient time (e.g. $V\tau_s \geq 2r_0$) for a node to move away from the location of its previous broadcast, thereby reducing redundant transmission to the same nodes. The random time interval τ_r introduces randomness in the transmitting time instants, which can reduce collisions and contention between nodes caused by simultaneous transmissions. Further, τ_r also reflects the channel access time in some practical scenarios. For example, using carrier sense multiple access (CSMA), if a node finds the channel busy at the end of the pre-designated sleep time interval τ_s, then the node needs to wait a random time interval (viz. random back-off time) for the next transmission opportunity. We include τ_r in our broadcast scheme to introduce flexibility in determining the transmitting time of each infectious node, so that a node can transmit at its convenience (e.g. when the node using CSMA senses the channel idle) in a decentralized manner while the performance of broadcast in the whole network (e.g. measured by the fraction of informed nodes) is still guaranteed. These features are valuable for a MANET subject to dynamic topology and channel randomness. In view of these features, the above scheme is referred to as an energy-efficient broadcast scheme.

C Energy and Bandwidth Efficiency

The time spent on transmitting packet of unit size over a single hop is a constantT_t. Therefore the energy consumed in transmitting a packet is$T_t P_t$,denoted via a single constant $E_1 = T_t p_t$. Similarly, denote by constant $E_2$the energy consumed when receiving a packet at a single node. Denote by random variable D_i the node degree of a randomly chosen node at a random time instant. Then the sum of the energy consumption for a randomly chosen node broadcasting a packet and the energy consumed by all its neighbours in receiving the packet is evidently $E_1 + D_i E_2$. Therefore by combining the energy consumption at a single node, including energy consumed by other nodes in receiving its packet, by a constant $E_c = E_1 + \mathbb{E}[D_i]E_2$. The overall energy consumption is directly related to the number of transmissions and equals to the number of transmissions times E_c.

Each transmission occupies (e.g. using CSMA) the frequency band in an area whose expected size is A_c, then the expected size of the area where the frequency band is occupied by an infectious node during its β transmissions is βAc. Therefore, the consumption of bandwidth is also an increasing function of the number of transmissions. Therefore, to save energy and bandwidth, we need to reduce the number of transmissions β. To meet a pre-designated broadcast performance objective, measured by the percolation probability and expected fraction of informed nodes, a certain number of transmissions are required, the reliance of the energy and bandwidth consumption on the number of transmissions β.

By using the following ratio measure the energy and bandwidth efficiency of the proposed broadcast scheme:

$$\mathcal{Y} \triangleq \frac{\mathcal{R}_0}{\beta}$$

III. CONCLUSION

In this paper, A novel methods for opportunistic energy efficient protocol in mobile ad-hoc network are categorized on the basis of their information dissemination process and their advantages/ disadvantages of each method are discussed. The information dissemination process using a Susceptible- Infectious (SI) epidemic scheme, where every node carries the received information and forwards it to all nodes coming into the radio range is studied. The SI epidemic scheme is a reliable but costly scheme due to a lack of a proper mechanism to stop the transmission. Considering a Susceptible-Infectious-Recovered (SIR) epidemic scheme is the information dissemination process in a MANET. The SIR epidemic scheme postulates that nodes need to keep transmitting for a prescribed time period before recovery (i.e. stopping the transmission); nevertheless a long continuous transmitting period required by the scheme can be difficult or costly to implement in reality. Then in a conference version of this work, the shadowing effect taken into account and proposed the opportunistic broadcast scheme. a further step taken in this paper by taking fast fading effect into consideration and investigating the optimal design for the opportunistic broadcast scheme that minimizes the resource consumption.

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BIOGRAPHY

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