Wireless ad-hoc networks Broadcasting Protocol And Routing Characteristics

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Abstract

The mobile ad hoc network (MANET) has recently been recognized as an attractive network architecture for wireless communication. Reliable broadcast is an important operation in MANET (e.g., giving orders, searching routes, and notifying important signals). However, using a naive flooding to achieve reliable broadcasting may be very costly, causing a lot of contention, collision, and congestion, to which we refer as the broadcast storm problem A set of metrics for describing these characteristics, for example for characterizing routing scenarios in simulations, analysis, and test bed implementations. Based on these metrics, we perform a detailed simulation analysis of the routing characteristics of the three most common simulation models for generating unidirectional links in ad hoc networks: the random-power model, the two-power model, and the three-power model.

Keywords:- *Broadcast storm; Mobile ad hoc network (MANET); Mobile computing; Reliable broadcast; Wireless communication, Routing, Ad hoc networks; Mesh networks.*

WIRELESS ad-hoc NETWOK

One wireless network architecture, which has attracted a lot of attention recently is the mobile ad hoc network (MANET). A MANET consists of mobile hosts only (without base stations). Under such architecture, mobile hosts may have to communicate with others in a multi-hop manner, and thus each mobile host has to serve as a router. The challenge is that every mobile host can roam freely at any instant. Since collecting a global network topology is prohibitive, it is difficult to optimize the communication cost. MANET can be deployed quickly, and thus has applications in such as battlefields or disaster areas. Broadcasting is a fundamental operation in all kinds of networks. In MANET, since the network a group of wireless mobile hosts that wish to communicate may form an ad hoc network, forwarding packets for each other to support hosts beyond the single-hop wireless transmission range. Most routing research in wireless ad hoc networks topology is so dynamic, broadcasting could be used more frequently (in events such as giving orders, searching routes, or notifying important signals). has been based on the simplifying assumption that all wireless links in the network are bidirectional and would therefore work equally well in both directions. However, there exist a variety of circumstances in which this assumption does not hold. Unidirectional links can result from factors such as heterogeneity of receiver and transmitter hardware (leading to differing transmission ranges), power control algorithms (in which nodes vary their transmission power based on their current energy reserves), or topology control algorithms (aimed at reducing interference in the network by computing the lowest transmit power that each node needs to stay connected to the network. Routing protocols for ad hoc networks may deal with the possibility of unidirectional links in a number of ways:

- Some protocols, such as DSDV [9] or conventional distance vector routing protocols, simply do not consider the problem and thus may create routes that fail to work, causing packet losses.
- Other protocols handle the presence of unidirectional links by treating all links as if they might be unidirectional, in order to avoid the problem above, but this causes extra routing overhead. For example, DSR normally returns a ROUTE REPLY packet using the reverse of the route recorded in the ROUTE REQUEST packet, but this only works over bidirectional links; DSR alternatively can be configured to independently discover the route for returning the ROUTE REPLY, which can significantly

Increase routing overhead.

• Still other protocols detect and keep track of unidirectional links as network conditions change, and then either use them for routing or simply ignore them as in AODV Nodes using AODV attempt to learn which links to neighboring nodes are unidirectional; such a neighbor is remembered in a ‘‘blacklist’’ set, and new routes through such neighbors are ignored and not used for some time.

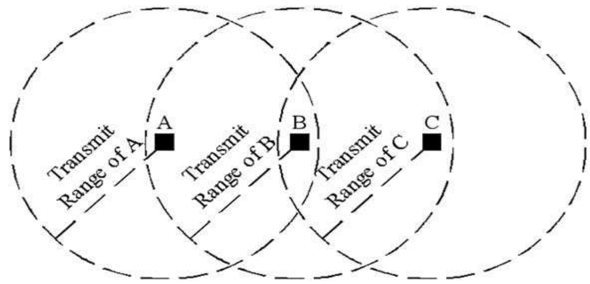
Important issues

There are several important issues in ad hoc wireless networks. Most ad hoc wireless network applications use the Industrial, Scientific and Medical (ISM) band that is free from licensing formalities. Since wireless is a tightly controlled medium, it has limited channel bandwidth that is typically much less than that of wired networks. Besides, the wireless medium is inherently error prone. Even though a radio may have sufficient channel bandwidth, factors such as multiple access, signal fading, and noise and interference can cause the effective throughput in wireless networks to be significantly lower. Since wireless nodes may be mobile, the network topology can change frequently without any predictable pattern. Usually the links between nodes would be bi-directional, but there may be cases when differences in transmission power give rise to unidirectional links, which necessitate special treatment by the Medium Access Control (MAC) protocols. Ad hoc network nodes must conserve energy as they mostly rely on batteries as their power source. The security issues should be considered in the overall network design, as it is relatively easy to eavesdrop on wireless transmission. However,
the existing routing schemes, such as distance-vector and link-state based protocols, lead to poor route convergence and low throughput for dynamic topology. Therefore, a new set of routing schemes is needed in the ad hoc wireless context

Broadcasting protocol:

The AV protocol:

A reliable broadcast protocol based on flooding (termed as AV protocol below). The source host should transmit the message through broadcast to all its 1-hop neighbors. Each receiver should return an acknowledgement to the sender, and has responsibility to broadcast the message again to all its 1-hop neighbors. If the sender does not receive an acknowledgement from any neighbor after a certain time



The PR protocol

A protocol based on a clustering structure (termed as PR protocol below). It is assumed that clusters are maintained in a regular manner by any of the earlier protocols. To broadcast, a scattering phase is taken first, where the source host uncast the message reliably to its cluster head, which will in turn uncast the message reliably along gateways to its neighboring cluster heads. Each cluster head then sends the message, through broadcast, to its cluster members. During the scattering phase, a forwarding tree (FT) is constructed. The cluster head of the source host is the root of the FT. Every host in the FT keeps its parent and children. Then a gathering phase is taken, where acknowledgements are collected by each cluster head and forwarded along the FT from leaves to the source.

Network parameters

The most commonly used methods for generating unidirectional network scenarios for use in ad hoc network simulations are based on varying the transmission range of nodes in the network, whereby the transmission range of each node (or set of nodes) is set to a fraction of the nominal transmission range. Two characteristics of these models make them attractive for use in simulations of ad hoc networks. First, the resulting scenarios are realistic, as they correspond to a potentially common situation in which the ad hoc network consists of heterogeneous devices that may have different transmitter and/or receiver capabilities. Second, the scenarios are straightforward to generate. General MAC protocols We have mostly included the single channel protocols in this sub-section. A receiver initiated MACA-BI scheme is also discussed.

The MACA protocol was proposed by Kern to overcome the hidden and exposed terminal problems in CSMA family of protocols. MACA uses two short signaling packets, similar to the AppleTalk protocol. In Fig. 1, if node a wishes to transmit to node B, it first sends an RTS packet to B, indicating the length of the data transmission that would later follow. If B receives this RTS packet, it returns a CTS packet to A that also contains the expected length of the data to be transmitted. When A receives the CTS, it immediately commences transmission of the actual data to B. The key idea of the MACA scheme is that any neighboring node that overhears an RTS packet has to defer its own transmissions until some time after the associated CTS packet would have finished, and that any node overhearing a CTS packet would defer for the length of the expected data MACA is effective because RTS and CTS packets are significantly shorter than the actual data packets, and therefore collisions among them are less expensive compared to collisions among the longer data packets. However, the RTS–CTS approach does not always solve the hidden terminal problem completely, and collisions can occur when different nodes send the RTS and the CTS packets. Let us consider an example with four nodes A, B, C and D in Fig. 3. Node A sends an RTS packet to B, and B sends a CTS packet back to A. At C, however, this CTS packet collides with an RTS packet sent by D. Therefore C has no knowledge of the subsequent data transmission from A to B. weakness of MACA is that it does not provide any acknowledgment of data transmissions at the data link layer. If a transmission fails for any reason, retransmission has to be initiated by the transport layer. This can cause significant delays

in the transmission of data. In order to overcome some of the weaknesses of MACA, Bharghavan et al. proposed MACA for Wireless (MACAW) scheme that uses a five step RTS–CTS–DS–DATA–ACK exchange. MACAW allows much faster error recovery at the data link layer by using the acknowledgment packet (ACK) that is returned from the receiving node to the sending node as soon as data reception is completed. The back off and fairness issues among active nodes were also investigated. MACAW achieves significantly higher throughput compared to MACA. It however does not fully solve the hidden and exposed terminal problems. The Floor Acquisition Multiple Access (FAMA) is another MACA based scheme that requires every transmitting station to acquire control of

The floor (i.e., the wireless channel) before it actually

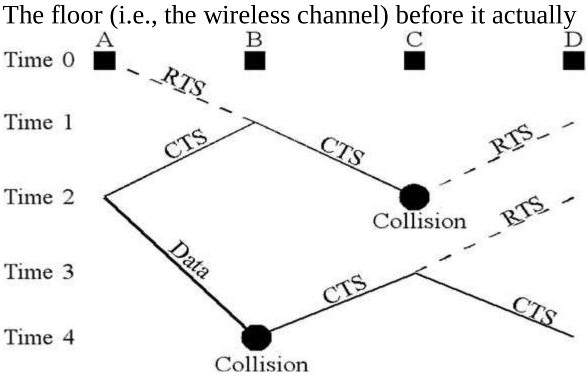
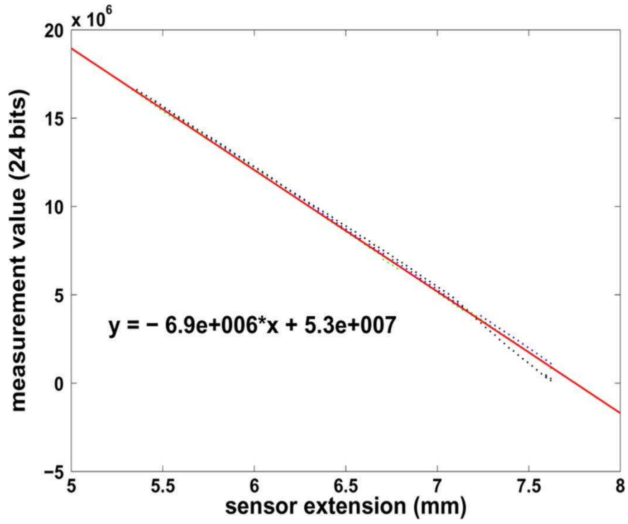
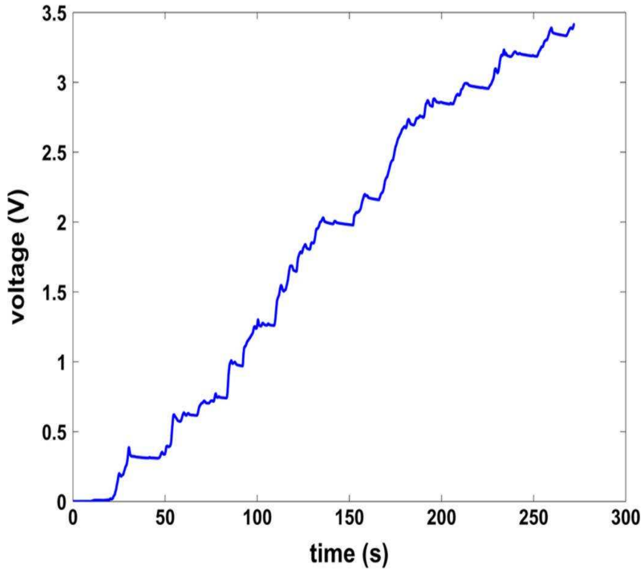


Illustration of failure of RTS–CTS mechanism in solving Hidden and Exposed terminal problemse”

Unlike MACA or MACAW, FAMA requires that collision avoidance

SIMULATION RESULT





The first field demonstration of a physically-unconstrained mobile host WSN for SHM applications The network consists of a peak strain sensor that stores its read- ings without power, a wireless sensor node and a mobile host that delivers energy to the sensor node and retrieves data from the node. The network was used to measure the peak displacement of a bridge structure after a significant loading event such as an earthquake occurs

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