AN EXPOSED NODE PROBLEM BY USING REQUEST TO SEND AND CLEAR TO SEND IN TERMINAL WIRELESS NETWORK

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Abstract: -The Request-to-Send and Clear-to-Send (RTS/CTS) mechanism is widely used in wireless networks in order to transmit data from source to destination in order to reduce packet collisions (due to Hidden node) and, thus, achieve high throughput wireless network. These problems are “Exposed Node Problem”, “RTS -induced and CTS – induced Problem” and “Masked Node Problem”. Leveraging concurrent transmission is a promising way to improve through put in wireless networks. Existing MAC protocols like Carrier Sense Multiple Access (CSMA) always try to minimize the number of concurrent transmissions to avoid collision. We propose a novel coding scheme, Attachment Coding, to allow control information to be “attached” on data packet. Nodes then transmit two kinds of signals simultaneously, without degrading the effective throughput of the original data traffic. Based on Attachment Coding, we propose an Attached-RTS MAC (AR-MAC) to exploit exposed terminals for concurrent transmissions and also validate the RTS to avoid needless transmission deferment by validating the adequacy of allocated NAV. The attached control information provides accurate channel status for nodes in real time.

Keywords: RTS, CTS, AR-MAC, Exposed node problem, Terminal Wireless network.

1. Introduction

In spite of having line communication the wireless network take place all over the communication system. So Mobile Ad hoc Networks (MANETs) is in higher interest of researchers. A self-configured network with wireless connectivity is known as MANETs. A Stranded protocol IEEE 802.11 is has been use in Wireless Local Area Networks (WLANs). IEEE802.11 specifies Medium Access Control (MAC) for WLAN. In order to conflict the hidden node problem, a mechanism known as RTS/CTS handshake is often used. The RTS/CTS mechanism was initially proposed in a protocol called Multiple Access with Collision Avoidance (MACA). (CSMA/CA
communication paradigm & Desired Attached-RTS communication system: control messages and data packets are transmitting together, like false blocking CMAP deduces exposed terminals and excludes collided transmissions by consulting to a “Conflict Map”. The map is constructed online using packet loss probability, making it not such reliable under poor channel condition. Attached-RTS consists of two parts: Attachment Coding in PHY layer and Attached-RTS MAC (AR-MAC) in MAC layer. Attachment Coding attaches special designed RTS on data transmission, thus provides additional cue to authenticate current transmission. AR-MAC then guides nodes to identify exposed terminals through these authentications. The current way of implementing the RTS/CTS mechanism gives rise to situations where a large number of nodes are unable to transmit any packet. These situations can lead to network-level congestion. Therefore, the RTS/CTS mechanism fails to achieve its goal from a network point of view.

1.1 Exposed Node Problem

An exposed node is one that is within the range of sender but out of the range of receiver. These nodes cause underutilization of bandwidth. Assume that there are four nodes A, B, C, and D as shown in the dotted circle denotes their communication ranges. Let us assume that node C is communicating to node D. And suppose node B wants to transmit to node A. Node B senses the channel to be busy and could not transmit to A. Although this transmission would not cause a collision at D, but B is prevented from transmitting. The node B is an exposed node. It results in inefficient bandwidth utilization at node B. This problem is called exposed problem. Hidden and exposed problems can occur frequently in ad hoc network causing a significant degradation in the network throughput.

![Exposed Node Problem](image1)

**Fig 1: Exposed Node Problem**

1.2 Masked Node Problem

This is the case in which RTS/CTS mechanism fails to solve the hidden node problem. The reason for this situation is based on the fact that CTS sent by a node may not always be heard by its neighbor because the later might be already blocked due to any previously started transmission in its neighborhood. This is illustrated in following figures

![Masked Node Problem](image2)

**Fig 2: Masked Node Problem**

First, node B starts sending data to node A. During this transmission node C is blocked. If node E sends data to node D at the same time then node C will not be able to hear CTS of node D. Node C is masked to data transmission of node D. Meanwhile, if data transmission of node B ends then node C is free to do any transmission. This may cause collision at node D. If node C starts its communication with node B then after some time node D may interrupt this transmission. Now node D will be masked node.
2. Survey related work
Utilizing exposed terminals for concurrent transmission is considered to be a promising way to increase throughput. Judd observes that in a high load wireless network, different clients connect to different routers can often result in exposed terminals, indicating that exposed terminals should be well leveraged. CMAP proposes a “conflict Map” to deduce exposed terminals. A special header/trailer is designed for receivers to figure out interferers and allow exposed terminals to transmit concurrently. However, its packets are required comparable length for header/trailer decoding. Also, interferers are decided by loss probabilities. Unlike CAMP, Attached-RTS supports variable length packets. It can also identify exposed terminals fast and accurate using Attachment sense. Recently, PHY layer techniques have been utilized to assist MAC layer protocol. the author utilize PHY layer ACK to reduce the overhead of traditional link layer ACK., PHY layer RTS/CTS is proposed for multi-round leader election and address hidden terminal problem. Attached-RTS similarly shares the idea of PHY signaling, but differs from the above approaches that it enables PHY layer control messages to be transmitted simultaneously and harmlessly with data traffic. Moreover, it utilizes this cost-effective control message to solve exposed terminal problems. Another approach to combine different coding schemes into one transmission is Hierarchical modulation, where base layer and enhancement-layer symbols are synchronously overplayed. Unlike Hierarchical modulation, which uses modulation constellation to provide different types of QoS in digital TV broadcast, Attached-RTS utilizes IC to achieve the broader goal of enabling control information to be “attached” on data transmission for cost-effective coordination. Handling exposed terminal problem is one of its application scenarios. Side channel and jamming both add jamming signals on other users’ packets, in this way they can provide access request for certain authority in centralized networks. Attached-RTS, however, simply attaches control information on one’s own data packets. Therefore, it can provide flexible PHY layer information for higher layer protocol, which is more applicable and reliable.

2.1 System specification

- **Hardware requirements**
  - Processor: Pentium dual core
  - Processor Speed: 800 MHz
  - RAM: 1 GB
  - Hard Disk Drive: 80 GB
  - Monitor: 14 inch

- **Software requirements**
  - Operating System: Windows 7
  - Language: JAVA
  - Tool: Easy Eclipse
  - Java Development toolkit: JDK 1.6

3. Proposed system
In this section, we describe the overall architecture in an Attachment Coding enabled communication system. Attachment Coding is built on top of OFDM based system. The primer for OFDM modulation is in the supplemental files. Here we demonstrate the detailed design of Attachment Coding, which includes two components: (1) Attachment modulation and demodulation, and (2) Attachment cancelation and data recovery.
3.1 Attachment Modulation/Demodulation

For Attachment modulation/demodulation, in order to avoid interference with each other, each attached signal should have a bandwidth narrow enough to be included into a single subcarrier even with frequency offset. Illustrates the main idea that attaching narrow-band signals on data symbols. As a payoff, the capacity of Attachment is small. However, this capacity will be acceptable since Attachment for control message can be compressed simple and efficient. Physical layer signaling with Binary Amplitude Modulation (BAM) is a good example. One attached signal on a particular subcarrier can represent certain information. To detect an attached signal on a particular subcarrier we adopt a simple but efficient scheme based on energy detection. According to energy distribution, high-throughput transmissions and white noise spread their energy over the spectrum, while narrow-band attached signal has relatively high energy levels. Therefore, when we detect relatively high level energy on a particular subcarrier, we can assume that there is an attached signal on that subcarrier. After detecting the attached signals node can obtain corresponding control messages.
4. AR-MAC Protocol
To demonstrate the effectiveness of Attachment Coding, we present a cross-layer design, AR-MAC. AR-MAC builds on top of Attachment Coding, which aims to solve exposed terminal problem in distributed wireless networks. First, we give an overview and design challenges of AR-MAC. Detailed modules are then presented to see how we address these challenges. Finally, we talk about some points related to AR-MAC design.

4.1 AR-MAC Overview
To identify whether a node is exposed terminal or not in a distributed network, we need two kinds of information: 1) the ongoing sender-receiver pairs, and 2) the neighborhood information within two-hop collision domain. As illustrated in nodes can be characterized into two types: Current Sender-Receiver pair (CR-CS pair) and Intended Sender-Receiver pair (IS-IR pair). Suppose an Intended Sender (IS) Bob has some packets to transmit, he should guarantee that his Intended Receiver (IR) Alice or Lucy is available and other Current Receivers (CRs) like Coral will not be interfered by his transmission. Based on the above observation, we propose AR-MAC, which utilizes Attachment Coding and neighborhood list to provide the above two information, including the ongoing transmission on air, and the two-hop neighborhood list. Without loss of generality, we assume that the interference and reception range are equal. To obtain the information of current transmissions, each sender modulates its transmission information into Attachments (A-RTS) (like who are the sender and receiver for this transmission). To obtain the information of two-hop neighborhood, nodes can periodically broadcasting their one-hop neighborhood list in their vicinity, either broadcasting stand-alone packets for the list, or piggybacking the list with routing beacons. The design principle of AR-MAC is simple and efficient. However, there remains several implementation challenges when bring AR-MAC into practice. First, Attachment cannot carry too much information due to its limited bandwidth. Thus the format of ARTS should be designed efficiently. Second, distributed networks are always unsynchronized with variable-length packet. Thus it is difficult for a node to obtain A-RTS whenever it needs. Last, any strategy that tries to utilize exposed terminals has to handle ACK collision with other data transmissions, and data transmissions can also collide with themselves. These collisions should be treated carefully to increase PRR.

4.2 RTS Sense
RTS sense initiates a normal contention for data transmission opportunity. Instead of carrier sense in CSMA that detects carrier waves before trying to send, RTS sense simply listens to A-RTS signals attached on carrier waves. RTS sense contains two parts: RTS attachment and channel access decision.

4.3 RTS Attachment
To modulate the current transmission information into A-RTS, a specialized hash format is adopted. Each A-RTS contains the hash values of the corresponding sender/receiver’s IDs. We utilize this hash function due to two reasons. First, different nodes should have exclusive subcarriers for their A-RTSs to avoid interference with each other. However, since the number of subcarriers is limited, it is difficult to allocate different subcarriers to different nodes in a decentralized manner. Second, it is impossible to modulate the whole MAC address into A-RTS frame due to high bandwidth cost. Therefore, we only use hash value to represent each node. Specifically, the whole subcarriers are split into sender/receiver band. In each band, a membership vector of n subcarriers is used to represent sender/receiver information. This hash format guarantees A-RTS to be modulated into only one OFDM symbol (256-point FFT in AR-MAC).

4.4 Collision Resolution
Collision may happen after a packet has been transmitted, such as ACK colliding with data transmission or data transmissions colliding among themselves. Collision resolution employs two strategies to reduce these collisions: Dedicated ACK and Fast Retransmission.

4.5 RTS Validation
RTS validation is a method which avoids needless transmission deferment by validating the adequacy of allocated NAV. In the RTS validation, any deferring its new transmission by NAV checks DATA transmission corresponding to the NAV to carrier sensing after RTS Defer time (RTS Defer time equals CTS transmission time + 2× SIFS periods). According to the result of carrier sensing, if no carrier is detected, the cancels the NAV and it returns to idle state. Otherwise, the node keeps its transmission deferment in order to avoid collision with ongoing transmission.
Screen Shorts Node A

Attached-RTS: – Node A

- Select File
- File Path: D:\Project\workspace\Efficient\Reuse\Dbase.java
- File Size: 2735
- Receiving File:
  ```java
  package Reuse;
  import java.sql.*;
  public class Dbase {
      static ResultSet rst;
      static String s,nam,pas,cur_pit, cur_col;
      static int port,a;
      public static String selectdetail(String
  ```

- Select Destination: NodeB
**Node A Request - Node B**

![Node A Request - Node B Image]

**Response from Node B**

![Response from Node B Image]
Sending to Node B

Encoding
**Received Node B**

![Received Node B Image]

**Decoding Data**

![Decoding Data Image]
Node C

![Attached-RTS: - Node C](image)

Node D

![Attached-RTS: - Node D](image)
5. Conclusion
In this paper, “AN EXPOSED NODE PROBLEM BY USING RTS AND CTS IN TERMINAL WIRELESS NETWORK” In this paper, to propose a novel Attachment Coding scheme to attach control information on data traffic. This coding scheme enables data transmission along with control transmission, without degrading the throughput for original data traffic. We propose a novel Attachment Coding scheme to attach control information on data traffic. To illustrate the effectiveness of Attachment Coding, we propose Attached-RTS, which includes PHY layer Attachment Coding and MAC layer AR-MAC, to fully utilize exposed terminals for concurrent transmissions. We implement Attachment Coding on GNU Radio tested to verify its feasibility. We also conduct extensive simulations to evaluate the performance of Attached-RTS, which show that compared with 802.11 CSMA Attached-RTS can achieve 200% improvement in exposed terminal configurations. By exploiting exposed terminal opportunities, Attached-RTS also achieves 180% performance gain in ad hoc networks.

6. Future Enhancement

Thus estimating CSI and choose the subcarriers that with the best channel quality to dedicated ACK. When the network operates, we recheck CSI after each certain period, and reassign the best ones for dedicated ACK. This adaptive manner alleviates the effect of narrow-band fading to some extent. More sophisticated approaches are left as future work to increase the packet reception rate.

REFERENCES


