

# SC546 Fall 2002 Project

- MIDTERM REPORT -

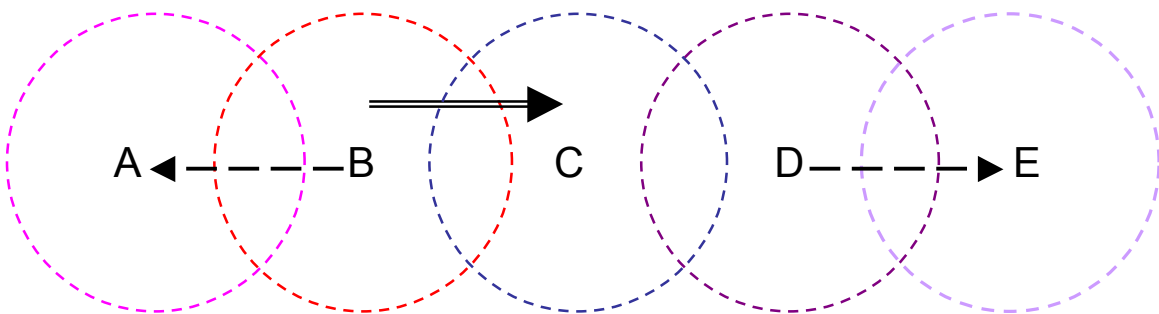
Title: *Simulation of Collision Avoidance Algorithms  
for Ad Hoc Wireless LANs*

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### Project Description:

In IEEE's proposed standard for wireless LANs, which is called as IEEE 802.11, there are two different modes to configure a network: Ad-hoc and Infrastructure. In this project, we concentrate on the Ad-hoc network. In the Ad-hoc network, there is no specific structure of the network and no fixed points. So every node is able to communicate with other nodes. In order to avoid DATA packet collisions, IEEE 802.11 Ad-hoc Network employs a mechanism known as RTS-CTS handshaking scheme. The main idea of RTS-CTS is that all nodes hears the RTS or CTS packets and will defer their transmission appropriately.

Radio networks have a problem called “Hidden / Exposed node” due to their specific nature: Collisions cannot be detected at the sending stations. This scenario is explained in Figure 1: When node B sends a DATA packet to node C, Node D does not sense any carrier and is allowed to transmit data. However, any transmission from D to C would be destroyed. On the other hand, node A senses a busy channel and is prohibited



### Figure 1 Hidden/Exposed node problem in Ad Hoc Wireless LANs

from any transmitting. Moreover, if B and A try to send data D and E respectively, the C node between B and D cannot decode any packet from B and D. This case is not DATA collision, but it can be a collision with DATA or an ACK packet. In this case, node C is called as a deaf node [1]. Deaf nodes are another problem in Ad Hoc wireless LAN. Deaf nodes are neighboring nodes which are unable to receive the RTS and CTS correctly due to other on-going transmission nearby.

In this project, we are going to simulate this situation that has problems like hidden/ exposed/ deaf nodes and then detect these nodes. As a simulation tool, we choose the Network Simulator (ns-2) because it has clear documentations and has some examples for wireless LANs.

The Network Simulator 'ns' is a discrete event simulator targeted at networking research. The ns provides substantial support for simulation of TCP, routing, and multicast protocols over wired and wireless networks. The basic wireless model in ns consists of MobileNode at the core, with additional supporting features that allows simulations of multi-hop ad-hoc networks, wireless LANs etc. A MobileNode is the basic node object with added functionalities of a wireless and mobile node like ability to move within a given topology, ability to receive and transmit signals to and from a wireless channel etc.

A major difference between them, though, is that a MobileNode is not connected by means of Links to other nodes or mobilenodes. The ns package contains several examples: *simple-wireless.tcl* for 2-node wireless scenario, *wireless1.tcl* and *wireless2.tcl* for mixed (wired & wireless, mobile & non-mobile) multiple LANs. For our simulation of CA (collision avoidance) algorithms, we are going to use these codes as a start point.

### Expected Results

1. Programs for Ad Hoc wireless LAN environments (Tcl file for the ns-2)
2. Simulation results
  - a. Fraction of DATA packet collisions using the ns-2
  - b. Delay time when DATA packet is sent using the Network Simulator.
  - c. Throughput of IEEE 802.11 wireless LAN network

### Time Line

Week 1 & 2 (~Oct. 11 <sup>th</sup> )	Surveys on <ul style="list-style-type: none"><li>- IEEE 802.11 Ad-hoc Wireless LAN</li><li>- Network Simulator</li></ul>
Week 3 (~Oct. 18 <sup>th</sup> )	Wireless LAN simulation using ns-2
Week 4 (~Oct. 23 <sup>rd</sup> )	Writing the Midterm Report
Week 5 & 6 (~Nov. 8 <sup>th</sup> )	Making our network using ns-2
Week 7 & 8 (~Nov. 22 <sup>nd</sup> )	Analysis wireless LANs using ns-2
Week 9 (~Nov. 29 <sup>th</sup> )	Debug/ More simulations
Week 10~(~Dec. 4 <sup>th</sup> )	Creating web-pages Preparation for Presentation

### References

- [1] Saikat Ray, David Starobinski, Jeffrey B. Carrunthers, “The Deaf Node Problem in Ad Hoc Wireless LANs”
- [2] The Network Simulator – ns-2, <http://www.isi.edu/nsnam/ns/>
- [3] Tutorial for the Network Simulator “ns”, <http://www.isi.edu/nsnam/ns/tutorial/ns.html>
- [4] The IEEE 802.11 Wireless LAN Standard