Experiences Using IEEE 802.11b for Service Discovery

Michael S. Thompson

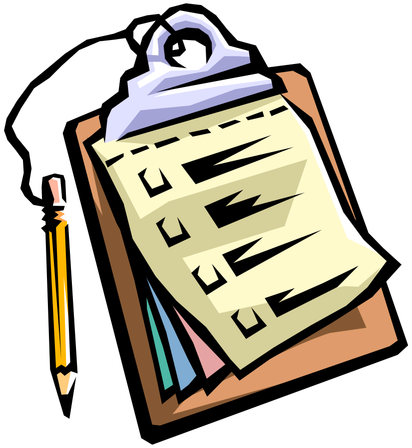
Scott F. Midkiff

{stuboy, midkiff}@vt.edu

Virginia Tech, USA

Overview

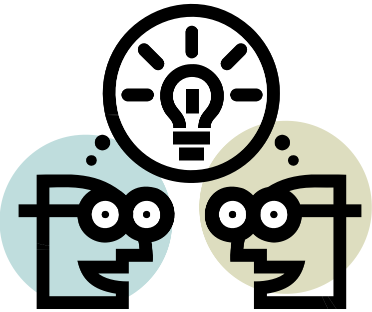
- Introduction
- Motivation
- IEEE 802.11b performance
- Low-traffic performance
- High-traffic performance
- Conclusion



Introduction

Goal:

– Present "real-world" performance data for IEEE 802.11b in ad hoc mode



Useful to:

– Anyone designing protocols or applications specifically for ad hoc IEEE 802.11b

Motivation

Purpose for conducting this work:

- Designing a service discovery solution
- Observing the pitfalls and nuances of IEEE 802.11b in ad hoc mode using unicast and multicast addressing (frames)
- Testing low and high traffic volume scenarios

Experimental Setup

Hardware:

- Compaq iPAQ 3850 (200MHz StrongARM, 64MB memory, Dual PC Card slot sleeve)
- Xircom CWE1130 IEEE 802.11b PC card

Software:

- Pocket PC 2002
- .NET Compact Framework v1 and C#
- Ethereal and Network Instruments’ Observer

Test 1: Low Traffic

Simulation of service discovery queries:

- Message generation, random (1-10secs)
- Broadcast flooding delivery
- With and without forwarding delay (0-200ms)
- Single and multihop configurations
- 1 and 30 mW transmit power
- Close proximity of nodes

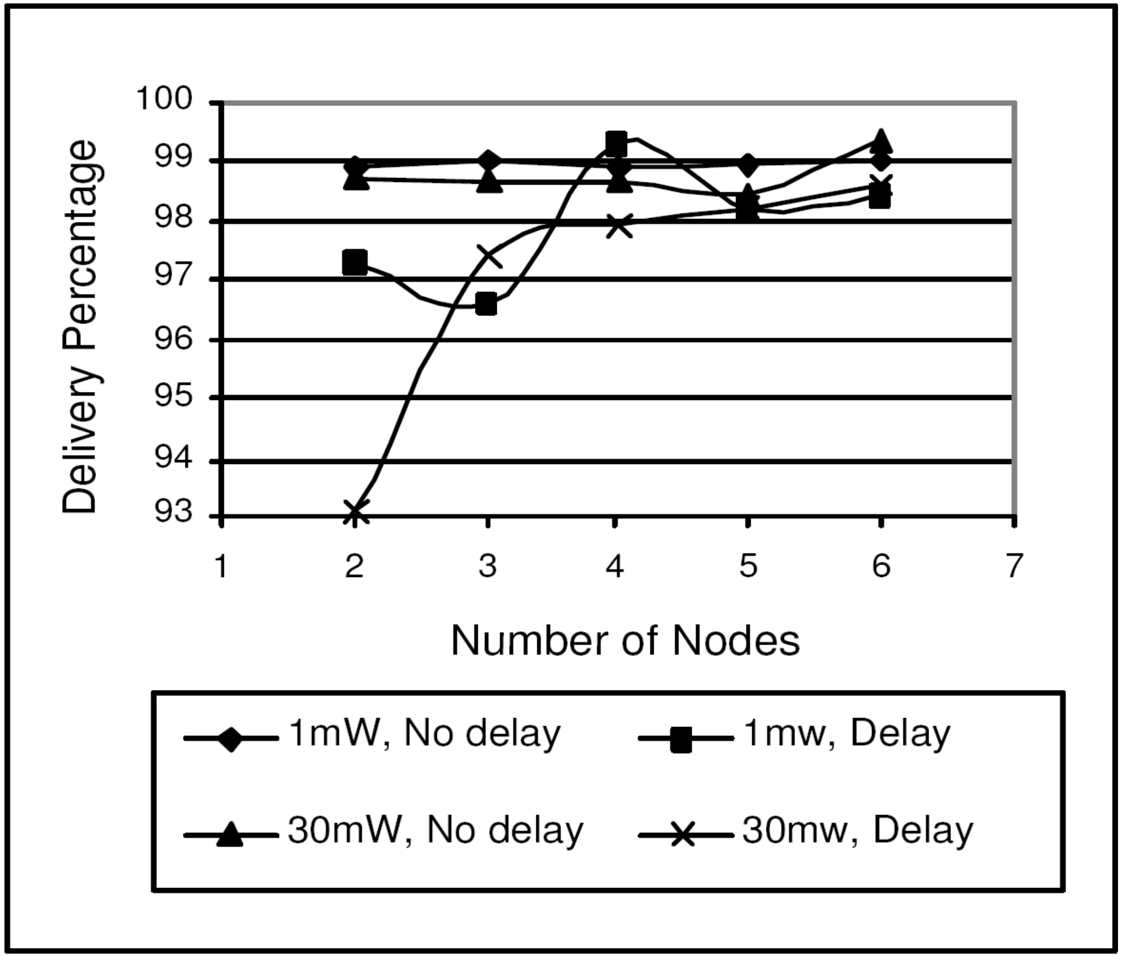
Observing: packet loss

The Results

Multicast delivery probability

With and without delay

Transmit power of 1 mW or 30 mW



Analysis

Why is there variation in the delay scenario?

- Large standard deviation between points caused by a small number of tests

Observations:

- No delay scenario, missed packets were missed by all nodes
- Delay scenario, missed packets were missed by only one node

Other Results

Using two nodes and unicast delivery, no packets were lost

A small number of multihop tests were also conducted

Multihop Results	Run1	Run 2	Run3	Average
Unique sends	417	428	413	419.33
Avg. misses / node	132.88	155.77	156	148.33
Avg. miss % / node	31.86	36.39	35.77	35.34
Avg. node degree	2.77	2.88	3.11	2.92

Analysis

Why is there variation in multicast and unicast delivery?

- IEEE 802.11b employs an ACK mechanism for unicast frames (but not multicast)

Observations:

- Neighbor degree increased across the tests, nodes did not move
- As neighbor degree *increased*, the miss percentage, also, *increased*

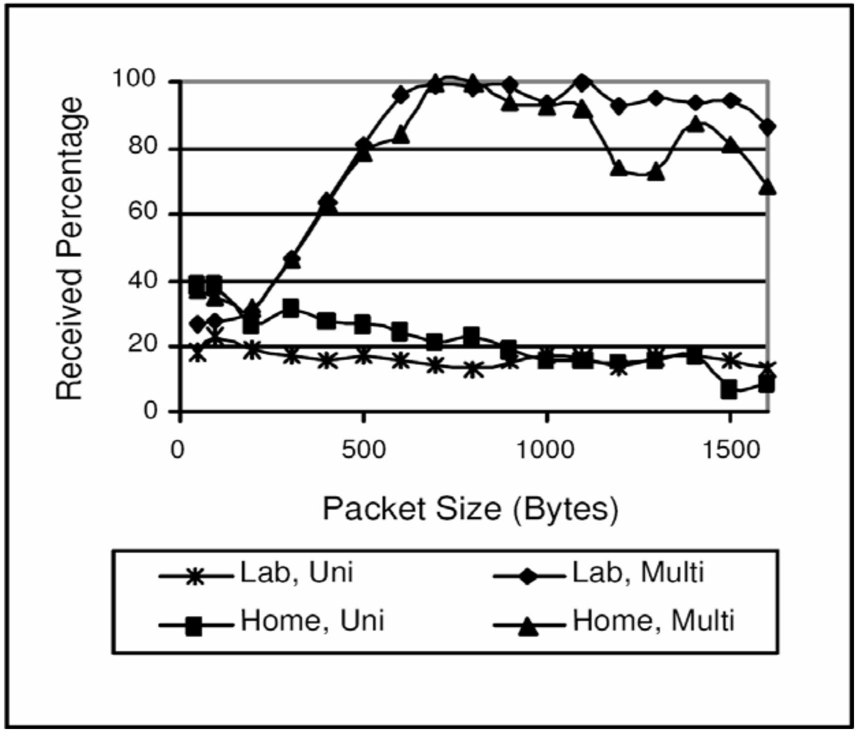
Test 2: High Traffic

Intrigued by the low traffic results, we wanted to see the performance in high traffic environments.

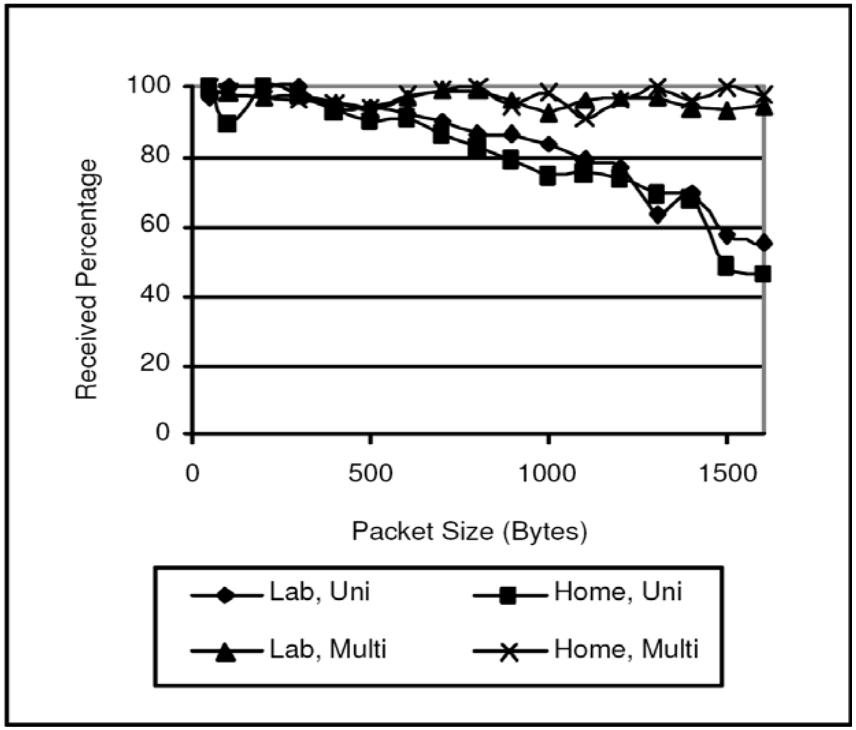
- Traffic generator to send packets with little or no delay to a traffic sink
- Packet size varied from 50 bytes and 100 bytes to 1600 bytes in 100-byte intervals
- Interpacket delay of 0, 1, and 2 ms
- High and low interference environments

Results

Percent of Packets Received (Multicast & Unicast)



No Delay



1ms Delay

Analysis

Unicast:

- IEEE 802.11 MAC acknowledgements cause loss

Multicast:

- High loss for smaller packets
- Likely due to hardware resource limitations

2 ms delay scenario showed no loss difference between multicast and unicast

Conclusion

Observed IEEE 802.11b performance in:

- A low traffic scenario with varying transmit power and forwarding delay
- A low traffic, multihop scenario
- A high traffic scenario comparing unicast and multicast performance

Conclusion: IEEE 802.11b offers different levels of delivery probability based on the deliver type

Questions? Thanks!