

Wireless LAN for the Classroom

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Abstract:

With the world trying to go to paperless classrooms/offices the wireless classroom/office is a long overdue concept. After attending a class where the use of the wireless LAN was implemented quickly and effectively, it was important to capture the strengths and weaknesses of the wireless LAN in a classroom environment. The setup of the classroom consisted of twenty-four students each assigned a laptop with a wireless LAN card. The instructor had a laptop with a wireless LAN card and in the classroom were a network printer, an overhead projector and a wireless hub (hung near the ceiling in the corner of the room). The strengths of the wireless LAN include the ease of setup requiring no wires be run, the ease with which each student could access the network to do research, and the ease of electronic turn in of assignments. The weakness of the wireless LAN was evident when students went to print. Printing large jobs tied the network up and limited printing capability. Another weakness of the wireless LAN is the sense of knowing that the connection to the network only exists in the classroom, once the laptop is taken out of the classroom and a hub is not available the connection is lost. Security of the Wireless LAN is a challenge to the business world as it is to protecting our national security. The layered approach should be taken to protect a Wireless Network. One weakness, which occurs with wired networks too, is network outage. If a test or assignment is to be turned in and the network is not available, backup means need to be addressed. The experience I had as a student in a wireless network environment was a positive one. More classrooms and offices should use wireless LAN technology to effectively bring information to students and workers, as did the Information Resource Management College at Ft. McNair.

Wireless LAN for the Classroom

A user's perspective

Agenda

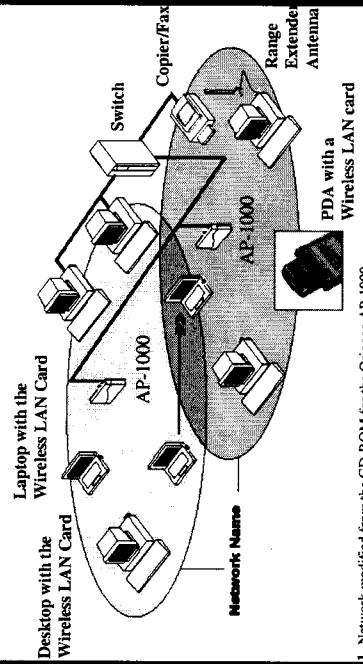
- Network Layout
- Performance Tests for Wireless Access Points
- Performance Characteristics for the Orinoco AP-1000 and the Xircom Springport
- Uses and Applications
 - Ft. McNair, Information Resource Management College
 - West Point, United States Military Academy
- Network Security
- Advantages
- Disadvantages
- Conclusion

Performance Tests for Wireless Access Points²

- **Throughput** test to determine the data-transmission speeds
- **Range** test to show how performance was affected by distance from the access point
- **Interference** test to show the affect of other devices operating in the same range (such as a microwave oven)
- **Rush Hour** test to gauge performance under busy conditions

2. Based on the article *Wireless LANs for All* printed in *Mobile Computing & Communications* August 2001

Sample Network Layout¹



1. Network modified from the CD-ROM for the Orinoco AP-1000

Performance Characteristics for the Orinoco AP-1000

R-F Frequency Band	2.4 GHz (2400-2500 MHz)		
Number of selectable sub-channels	11	13	15
Other Countries:	FCC, TI, ETSI, 13		
Modulation Technique	Direct Sequence Spread Spectrum		
Spreading	11-chip Barker Sequence		
Bit Error Rate (BER)	Better than 10 ⁻⁶		
Nominal Output Power	15 dBm		
Range (100 Bytes User Data) / Transmit Rate	High Speed 11 Mb/s	Medium Speed 5.5 Mb/s	Standard Speed 2 Mb/s
Open Office Environment	180 m (525 ft.)	270 m (885 ft.)	300 m (1300 ft.)
Semi-Open Office Environment	50 m (165 ft.)	70 m (230 ft.)	90 m (300 ft.)
Closed Office	25 m (80 ft.)	35 m (115 ft.)	40 m (130 ft.)
Receiver Sensitivity (at FER of 10^{-6})	-83 dBm	-87 dBm	-91 dBm
Delay Spread	65 ns	225 ns	400 ns
Low Speed	1 Mb/s	550 m (1750 ft.)	1 Mb/s

3- Chart from the CD-ROM for the Orinoco AP-1000

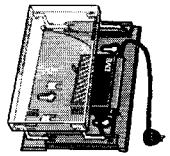
Performance Characteristics for the Xircom Springport™ Wireless Ethernet Adapter

R-F Frequency Band	2.4 GHz (2400-2483.5 MHz)		
Number of selectable channels	11	13	14
Modulation Techniques	Direct Sequence Spread Spectrum		
Typical Range	11 Mbps	1 Mbps	
Open Office Environment	90 m (1000 ft)	300 m (1000 ft)	
Closed Office	30 m (100 ft)	90 m (300 ft)	

4-Chart created from Product Specifications from the Xircom Springport Wireless Ethernet Adapter

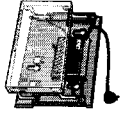
Current Uses at the Information Resource Management College

- Ft. McNair, Washington DC
 - Student Laptops with Wireless LAN access
 - Faculty and Staff using the Wireless LAN daily



Current Uses at the United States Military Academy

- West Point, New York
 - Classroom use for laptops
 - Classroom use with the Visor and the Xircom Springport or the Cassiopeia and the Orinoco Wireless LAN Card



Network Security

- The Orinoco comes in a Silver or Gold version
 - Silver: wired equivalent privacy (WEP) using a 64-bit key
 - Gold: provides enhanced security with a 128-bit key using RC4 encryption
- The Xircom supports 0,40 or 128-bit WEP encryption

Disadvantages

- Network Outage
- Connection is limited to where the AP-500/1000's are placed
- Security must be properly set up in a layered approach
- Speed

Theoretical Speeds	Test Results ⁵
Wired 100 Mbps	49.89 Mbps
10 Mbps	8.55 Mbps
Wireless 11 Mbps	5.53 Mbps

5. Based on the article *Wireless LANs for All* printed in *Mobile Computing & Communications* August 2001

Advantages

- Installation Time
- Mobility
- Easy Access to the Internet and Network
- Signal Strength Monitoring Software lets the user know if they have connection to the Wireless Access Point

Conclusion

- By setting up each Access Point on a different channel the throughput can increase versus keeping all Access Points on the same frequency
- For **security** minded classes and offices, wireless networks need layers of security to protect against eavesdropping
- Wireless networks for **educational** purposes are worthwhile to students, instructors and network administrators