BRADLEY UNIVERSITY WIRELESS LOCAL AREA NETWORK BLOCK DIAGRAM

By

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Abstract

The purpose of this project is to design and implement a wireless LAN system for the Bradley University Electrical Engineering Department. The system is made up of an access point (AP), which connects the wired LAN with wireless peripherals. Wireless peripherals include laptops, desktops and embedded systems. The project consists of five phases: research, design and development, purchasing, implementation and testing.

Introduction

The task of this project is to implement a wireless local area network into the Bradley University Electrical and Computer Engineering department. Specifications for the network are based on the needs of the customer, the Electrical and Computer Engineering department. The department would like to be able to use this network for three major purposes: allowing network connections to portable computers, networking computers which are far away form wired ethernet jacks, and networking wireless embedded projects.

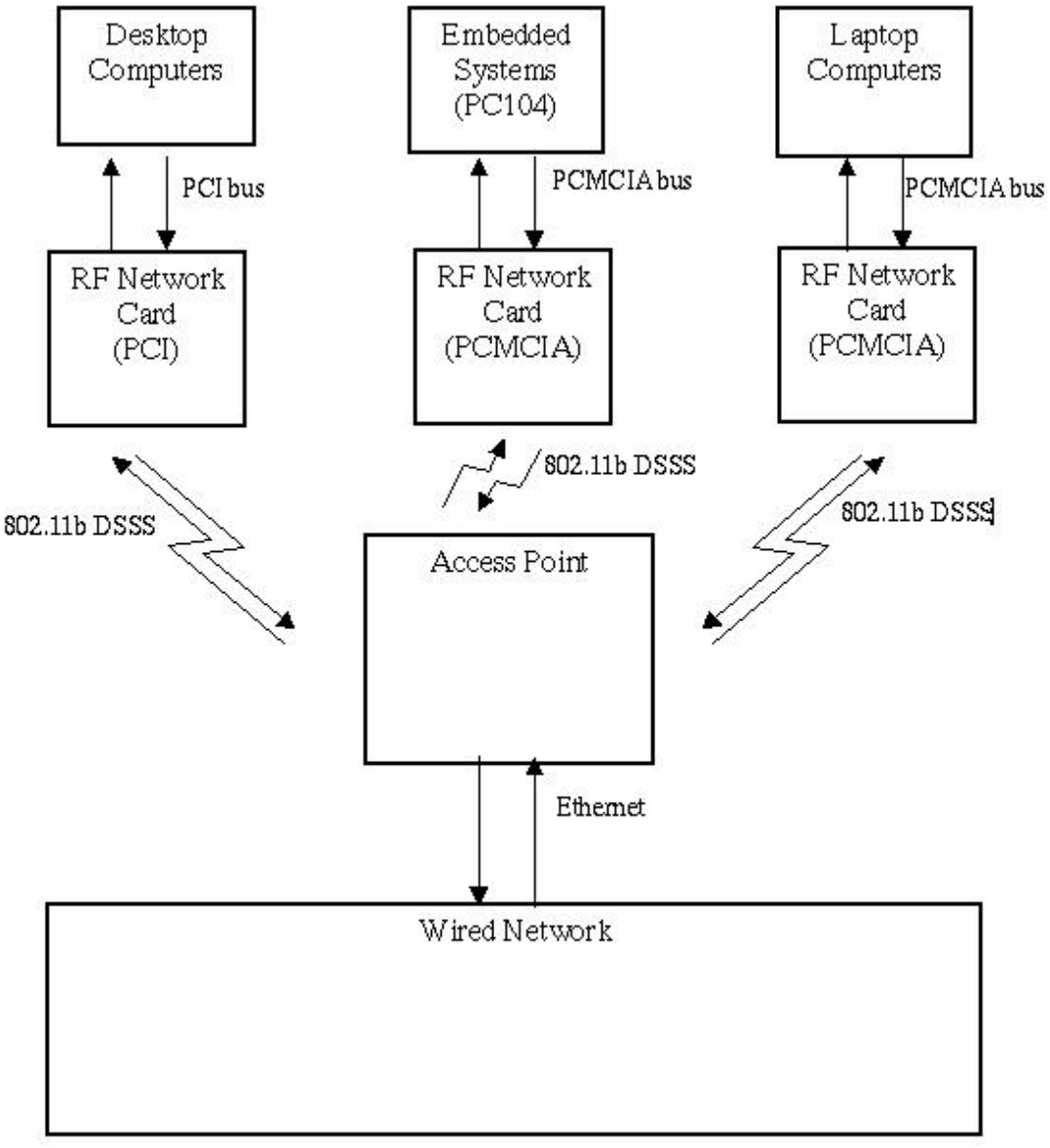
The project encompasses the following tasks.

1. Obtain information on the technology of wireless LANs, including standards.
2. Establish functional requirements and specifications of the system.
3. Identify vendors of wireless LANs, and establish criterion for selection of a vendor's product.
4. Select a vendor(s) by application of the criterion.
5. Implement the design of the wireless system.
6. Design methods to thoroughly test the system to its limits.

System Components

The wireless local area network (WLAN) is made up of several different subsystems. A block diagram of the system is shown in Fig.1. The inputs to the system will be desktop computers, laptop computers, and embedded systems (fixed and mobile). Each client has a wireless network card that can communicate with an access point (AP). The AP manages WLAN traffic and physically connects the wireless system to the wired local area network (LAN). The wired LAN will then send the requested information back to the access points, which will relay it to the appropriate client.

Figure 1: Block Diagram of a Wireless LAN



Modes of Operation

The system will have three modes of operation:

Op-Mode: This is the standard operating mode for operation for system operation. The mode consists of interaction between clients and one or more server. The clients are wireless devices such as laptops, desktops and telerobtics. Servers are access points that connect the clients to a wired network. Quality of communication between the clients and server depends on distance, obstructions, RF noise level and number of network traffic.

Manage Mode: This mode will be accessible to system administrators. It consists of software, which allows administrators to maintain and modify system settings. The software will most likely be located on the access point and accessed either by telnet or a web browser.

Test Mode: This mode contains the diagnostic programming that examines the performance of the overall network, along with the separate components (i.e. the AP and network card). The test mode includes measurements such as signal quality, signal strength and network load as well as instructions on how to find and troubble shoot common problems.

There are five main subsystems in the system and three modes of operation. The subsystems are the client, manager, RF network card, access point and wired network. The modes of operation are op-mode, manage mode and test mode. Table 1 lists the different subsystems and how they operate under each control mode.

Table 1: Subsystem Operations			
Subsystem	***Op-mode***	***Manage Mode***	***Test Mode***
Client	**The client computer will exchange data with its RF network card.**	**The system administrator may be able to access a configuration tool using a web browser. The client can also control the local settings of its RF network card.**	**Client's computers will be able to run a series of tests to diagnose network problems and determine best placement and data rate of the client computers and APs.**
Manager	**The manager will be a client but will also monitor various functions such as RF network traffic.**	**The system administrator can run software on his/her computer to access a network configuration tool that manages the RF network.**	**The administrator will be able to run a series of tests to evaluate the network and determine best placement and data rate of the client computers and APs.**
RF Network Card	**Exchanges data between client and the AP via 802.11b DSSS format.**	**Exchanges data between client and the AP via 802.11b DSSS format.**	**Exchanges data between client and the AP via 802.11b DSSS format.**
Access Point	**Allows the RF LAN to access the wired LAN. It will receive data from the LAN and then relay it to the appropriate client radio through RF DSSS signals. It will also check for data from clients and relay it to the LAN.**	**Will contain network management software that can be accessed by a system administrator from a web browser or commercial software.**	**Will be involved in many of the tests performed.**
Wired Network	**Allows the wireless LAN access to the Internet and the wired LAN.**	**Allows the wireless LAN access to the Internet and the wired LAN.**	**Allows the wireless LAN access to the Internet and the wired LAN.**

Specifications

The specifications for the wireless LAN are based on the needs of the Bradley University ECE department. They are as follows:

1) 20 -30 users

2) Range of 100-150 feet in a closed environment.

3) Throughput of at least 1-2Mbps

4) Secure (40-128 bit encryption)

The wireless LAN will need at least 1 AP and several network cards. The proposed AP is the Entrasys RoamAbout AP shown in Figure 2.

Figure 2: RoamAbout AP by Entrasys

Technical	
Frequency Band:	2400 - 2483.5 MHz
Number of Selectable Sub Channels Subject to local regulations:	
United States (FCC):	11
France (FR):	4
Japan (JP):	1
Other Countries (ETSI):	13
Modulation Technique:	Direct Sequence Spread Spectrum (CCK, DQPSK, DBPSK)
Spreading:	11 -chip Barker sequence
Bit Error Rate:	Better than 10-5
Media Access Protocol:	CSMA/CA (Collision Avoidance) with ACK
Interface:	PC Card Type II Extended
Data Rate:	11 Mbps (with fall back rates of 5.5, 2, and 1 Mbps) Automatic Rate Selection
	Range:
Open Environment	66m @ 11 Mbps
	91m @ 5.5 Mbps
	125m @ 2 Mbps
	171m @ 1 Mbps

Semi-open Environment	28m @ 11 Mbps
	35m @ 5.5 Mbps
	43m @ 2 Mbps
	53m @ 1 Mbps
Receiver Sensitivity	-84dBm @ 11 Mbps
	-87dBm @ 5.5 Mbps
	-90dBm @ 2 Mbps
	-93dBm @ 2 Mbps
Compatibility:	Supports Windows 95, 98, Windows NT (NDIS Miniport Driver), Windows 2000, Macintosh and Windows CE. Novell Client 3.x & 4.x

The team recommends purchasing four Wireless network cards. One of these cards will be for the telerobotics group. The other three will be for testing. Two cards will be from Lucent one of which will be for the telerobotics group. One will be from Entrasys and one will be from 3Com.

Timeline for spring semester '00

- Weeks 1&2: Design of our system. (setup not permanent)
- Week 3: Installation of the system.
- Week 4: Getting familiar with the operation of the system.
- Weeks 5 to 14: Develop modes of operation, design tests and troubleshoot the system.

References

Network Computing (www.networkcomputing.com)

Angel, Jonathan. "Look Ma, No Cables,"
Network Magazine (issue not known) : 42-52.

802.11b standard