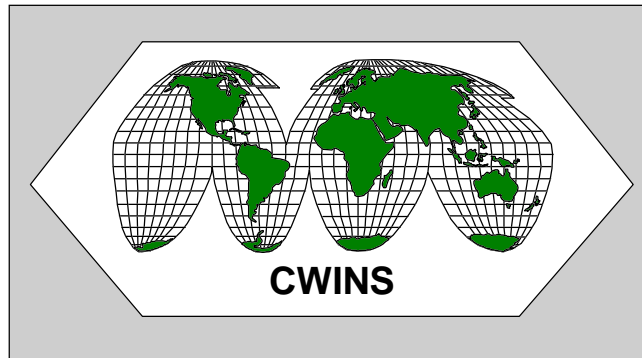# Wireless LAN Research Laboratory

CWINS

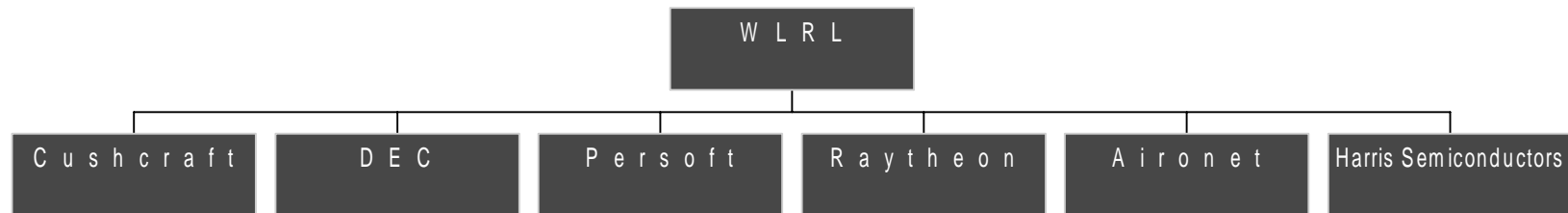## Performance Monitoring And Deployment Tools

Presented by: Prof. K. Pahlavan

Project Staff: A.Zahedi, P.Krishnamurthy, A.Falsafi, M.H. Ali, S. Bagchi, M.Dembele, J.Robinson, A.Messier

Wireless LAN Research Laboratory

Starting Date: January 1996

Current Members

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│Cushcraft││  DEC   ││Persoft ││Raytheon││Aironet ││Harris Semiconductors│
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WLRL PROJECTS in 1996

- Development of Testbed and Benchmarks
- Deployment tools

Why Testbed

- For comparitive performance evaluations of variety of technologies
- Analytical Models and Simulations do not provide realistic results
- Advantages of a Testbed
  - reflects the real environment
  - can use multivendor environment for interoperability study
  - can be configured in different ways

General Specification of NSF/WPI Testbed

- Accomodates different Software Platforms
- Multivendor Support (bridges, routers, access points,...)
- Isolated traffic subnet but Access to All Services
- Modularity
- Network Manager Capability (Monitoring and Control)

Current Specifications of the NSF/WPI Testbed

- Acess Points: DEC RoamAbout
- Router: Cisco 4500
- Bridges: Persoft, Solectek, Aironet, Wilan

- Network Manager   HP OpenView
- PCMCIA Wireless LAN cards

                                   DEC RoamAbout
                                   FHSS/DSSS
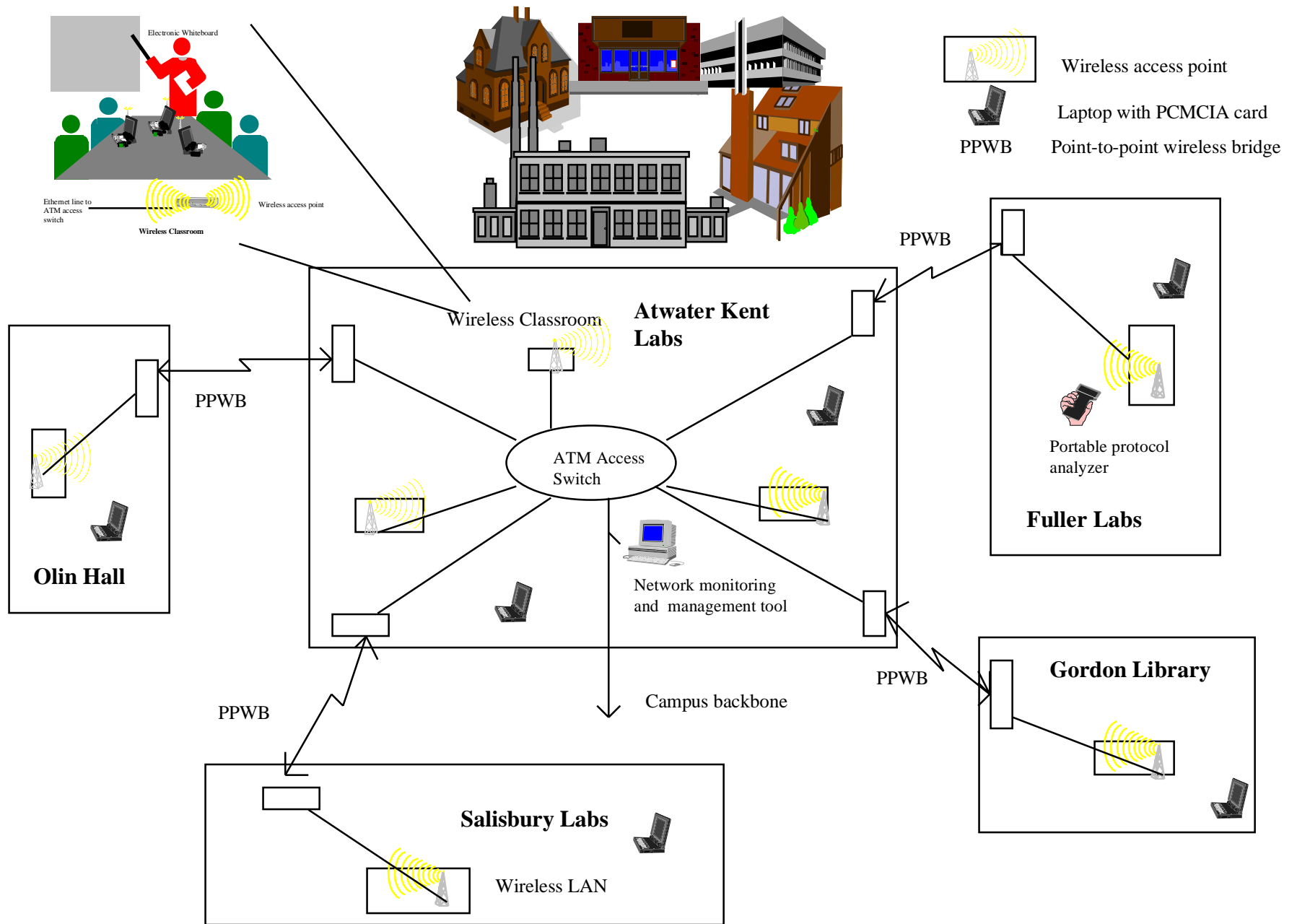
Figure 1: Wireless Campus Testbed - Network Architecture

Available Benchmarks: General Purpose

- Ziff-Davis Benchmark Operation (Netbench)
  - Novell based throughput measurement
- HP Netperf
  - Request/response (latency) tests for TCP and UDP with API
- US Army Ballastic Research Lab TTCP
  - Transport layer throughput measurement

Available Benchmarks: Special Purpose

- CWINS Proprietary Benchmarker suitable for:
    - Interoperability test
    - TCP/IP oriented
    - Easy to use Graphical User Interface
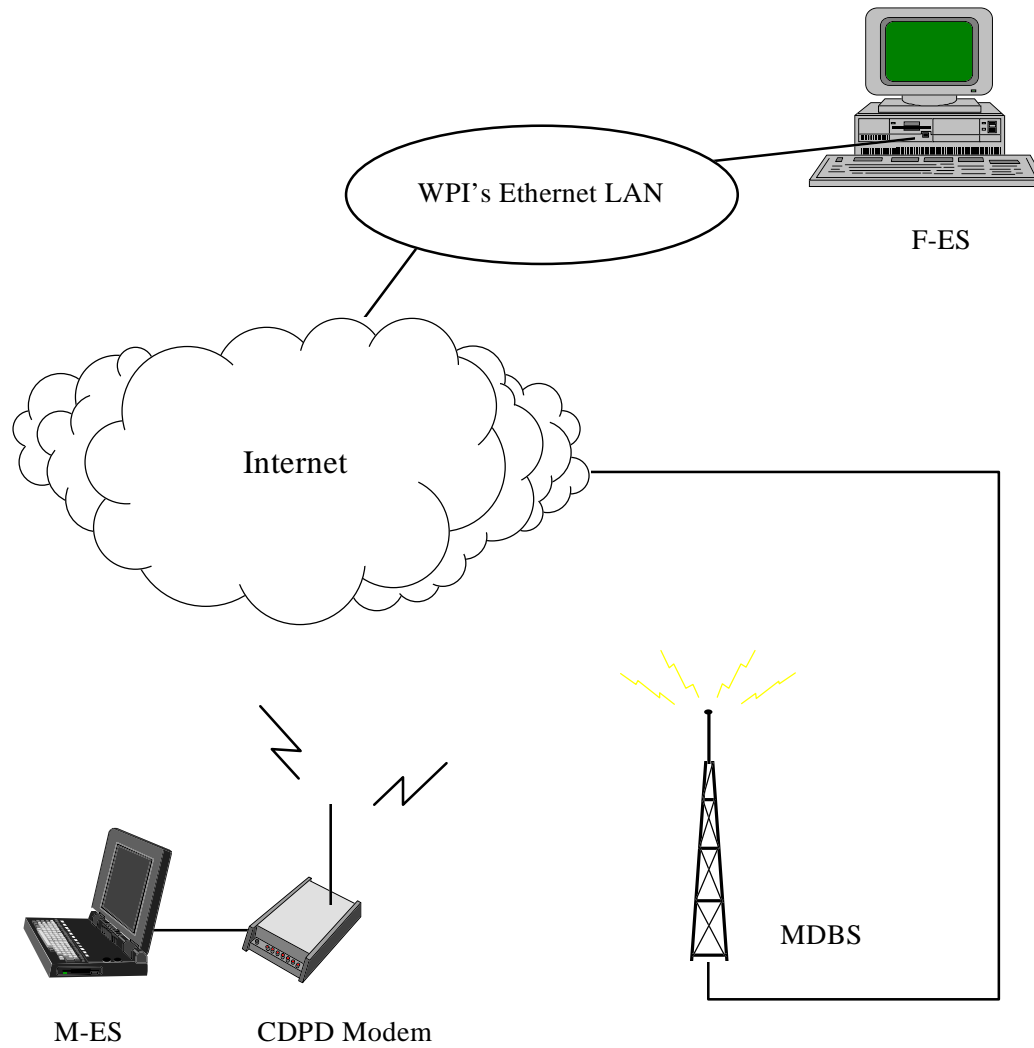   - Accomodate multiple platform (Unix workstations, PCs, Windows)
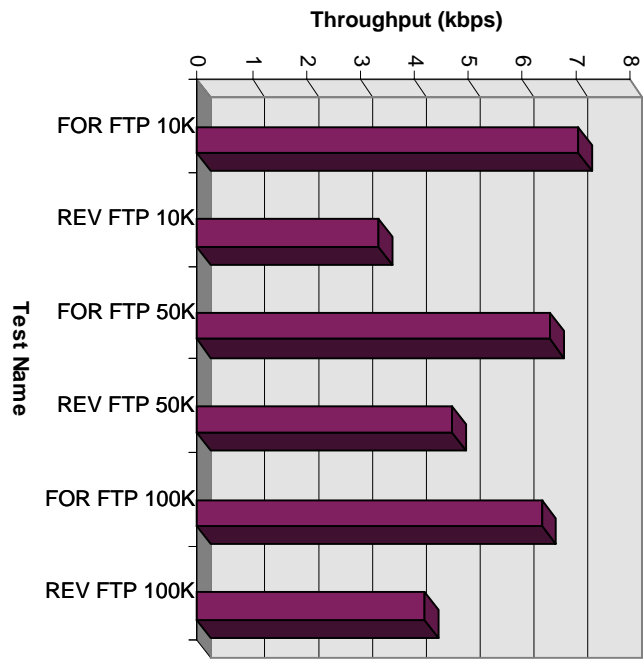
CWINS Wireless Benchmark

CDPD Configuration

WPI's Ethernet LAN

F-ES

Internet

MDBS

M-ES   CDPD Modem

Throughput (kbps)

FTP Test (No Traffic)

Test Name

Test Name	Throughput (kbps)
FOR FTP 10K	~7
REV FTP 10K	~3
FOR FTP 50K	~6.5
REV FTP 50K	~5
FOR FTP 100K	~6.5
REV FTP 100K	~4.5

Axis scale: 0, 1, 2, 3, 4, 5, 6, 7, 8

FTP Tests (Reverse Channel Traffic)

Throughput (kbps)

Test Name

- FOR FTP 10K
- REV FTP 10K
- FOR FTP 50K
- REV FTP 50K
- FOR FTP 100K
- REV FTP 100K

Legend:
- NO TRAFFIC
- TRAFFIC

FTP Tests (Forward Channel Traffic)

Throughput (kbps)

8
7
6
5
4
3
2
1
0

FOR FTP 10K   REV FTP 10K   FOR FTP 50K   REV FTP 50K

Test Name

NO TRAFFIC
TRAFFIC
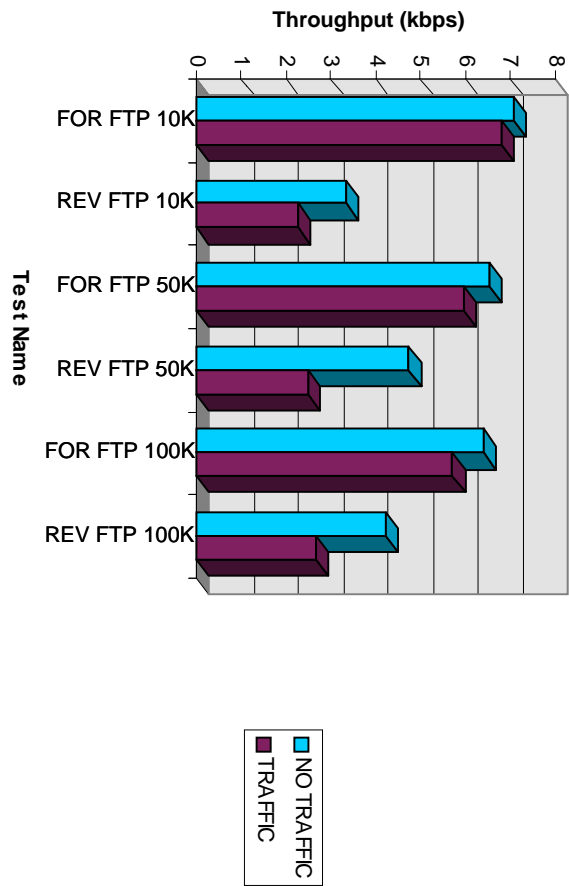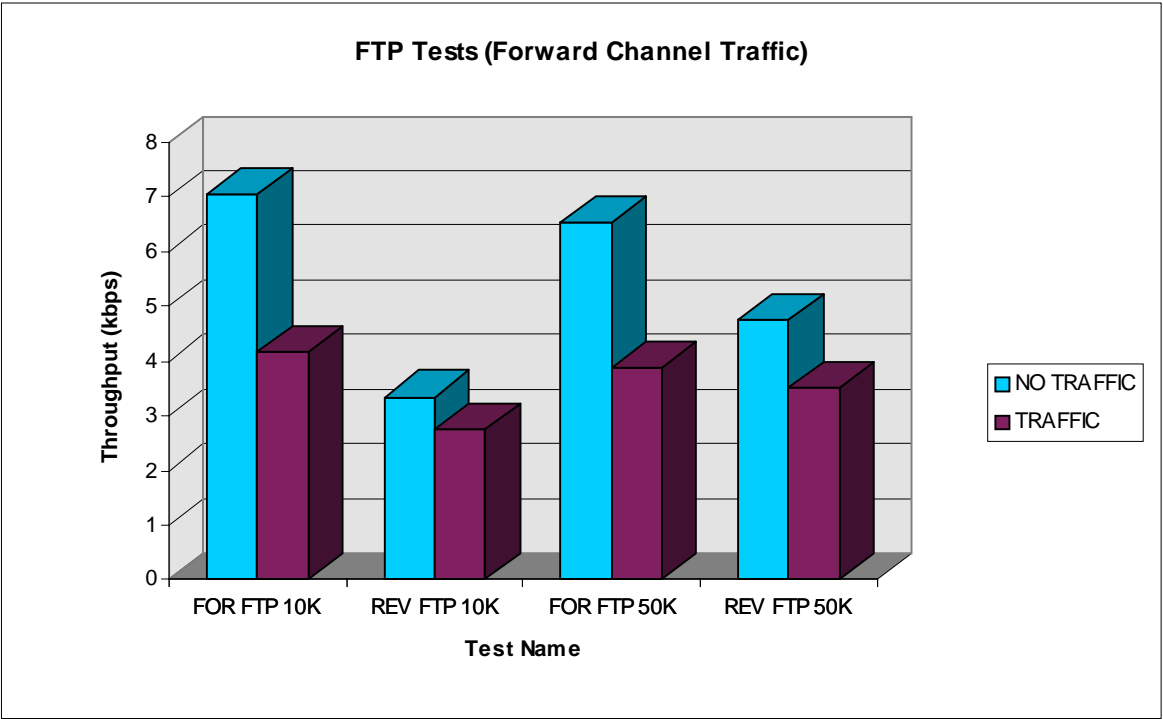
Tools for Deployment of Wireless LANs
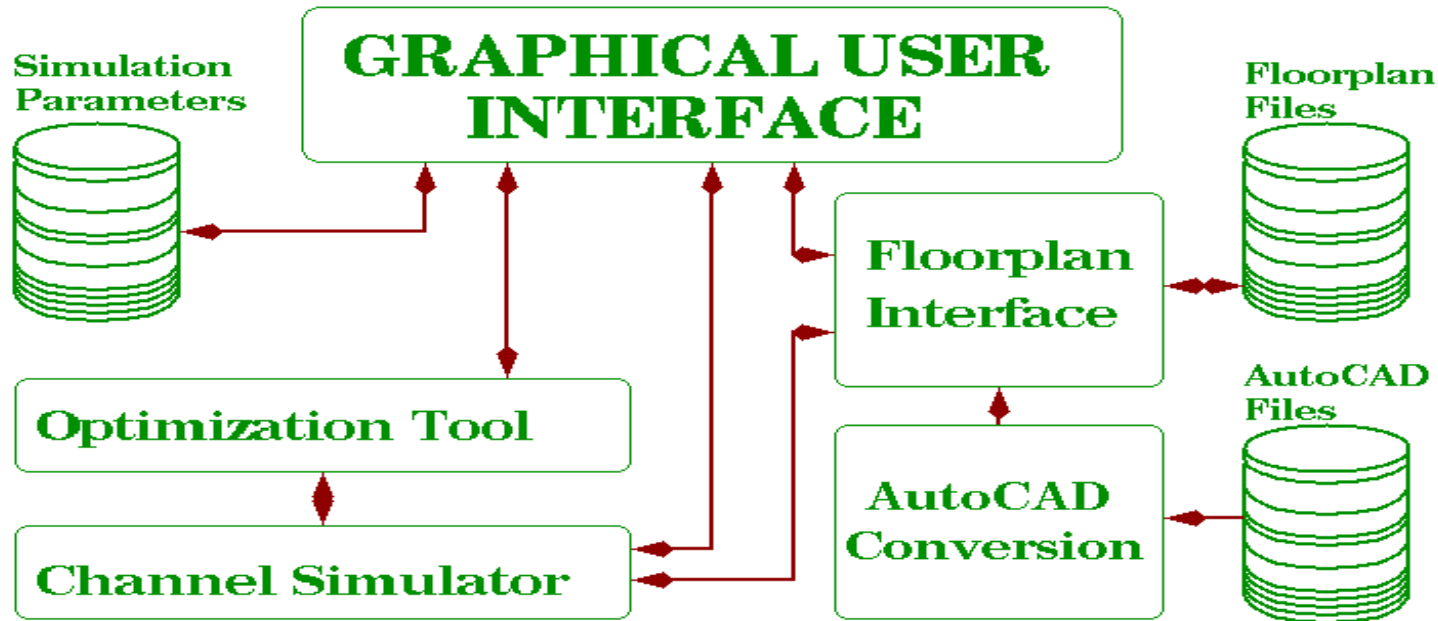

Objective:

coverage region
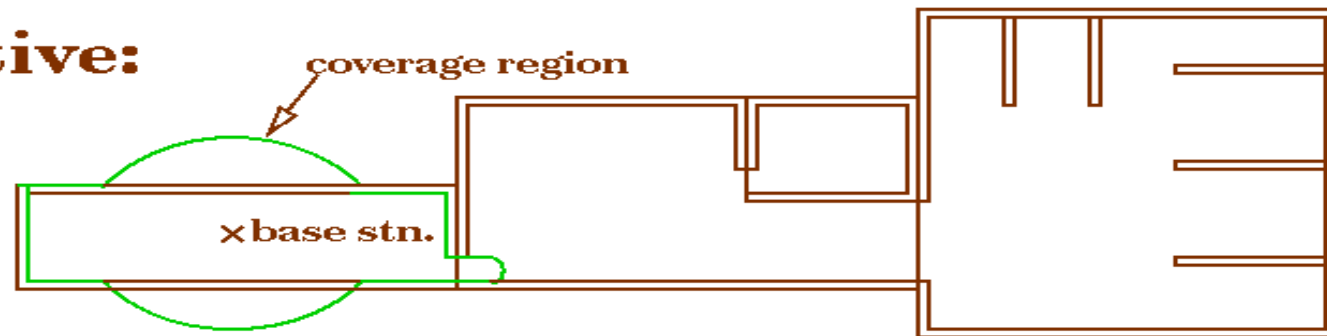
× base stn.

Given sufficient data about a building such as its floorplan, wall locations and composition, system parameters how many base stations must be positioned, at what locations and of what power to provide coverage to the entire region at the same time minimizing the number of base stations?

Center for Wireless Information Network Studies (CWINS)

Software Tool (CWINS)

Block Diagram of Wireless Lan Antenna Placement Tool

Simulation Parameters

GRAPHICAL USER INTERFACE

Floorplan Files

Floorplan Interface

AutoCAD Files

Optimization Tool

AutoCAD Conversion

Channel Simulator

Center for wireless information network studies (CWINS)

Propagation Models

- Accurate Site Specific Models
    - Ray Tracing
    - FDTD
- Fast statistical models:
    - JTC Recommendation
    - Wall dependent
- Direction of Research
    - Fast Ray Tracing algorithms
    - Hybrid models

Algorithms for Optimal Deployment

- Direct search (simplex) method (AT&T/CWINS)
  - Simple for programming
  - Fast convergence
- Simulated annealing method (EDX)
  - Complicated for programming
  - Slow convergence
- Neural Network Method (U. of Maryland)
  - Convergence is not gauranteed

E.g. of Software Implementation