Wireless Network Discovery

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Disclaimer

Certain commercial equipment, instruments, or materials are identified in this presentation to specify adequately the experimental procedure. In no case does such identification imply recommendation or endorsement by the National Telecommunications and Information Administration, nor does it imply that the material or equipment identified is necessarily the best available for the purpose.

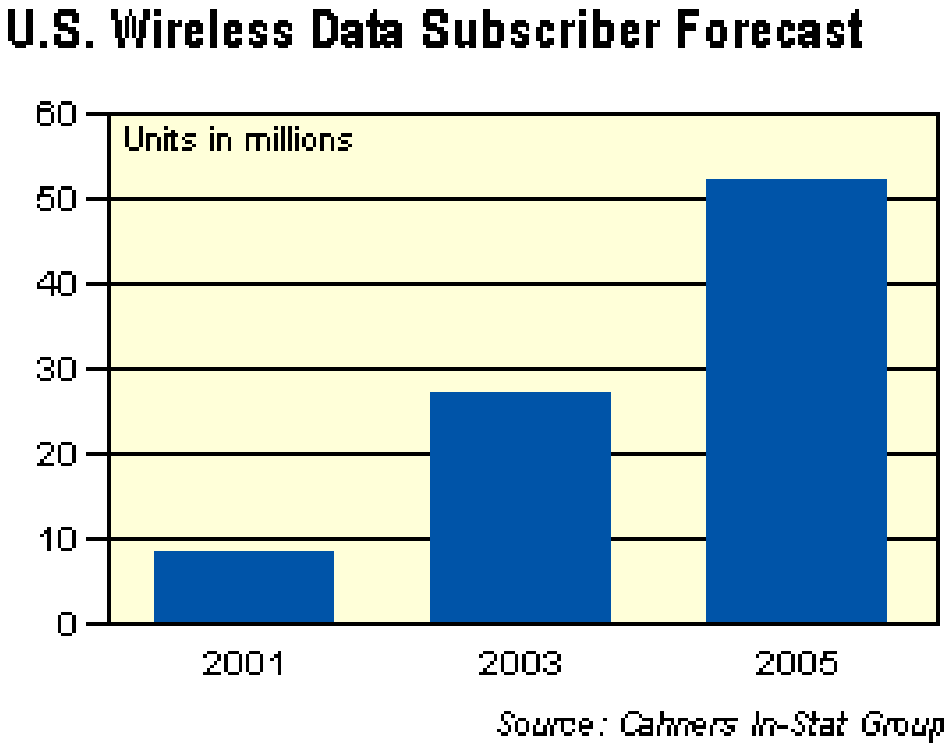
Network Discovery

- Connection Topology
- Temporal Parameters
- Topography (for mobile networks)

Outline of Talk

- Motivation for work
- Test Instruments
- Projects

Growth in Wireless Data Usage



Interference Issues

Wireless tower boom creating local static

Antennas unregulated

By Stacie Oulton

Denver Post Staff Writer

Sunday, April 08, 2001

Priority Access Issues

Priority Wireless Access Urged for Rescuers During Crises

By Robert O'Harrow Jr.

Washington Post Staff Writer

Friday, October 12, 2001; Page E11

Test Instruments

- Field Test Mode on Phones
- Drive Test Tools
- Spectrum Analyzers

Wireless Handset as a Network Measurement Instrument

TDMA (5160)

RSSI = -85 dBm
DVCC = 7
Slot = 1
DCCH = CAMPING
(Dedicated Control Channel)

CDMA (6185)

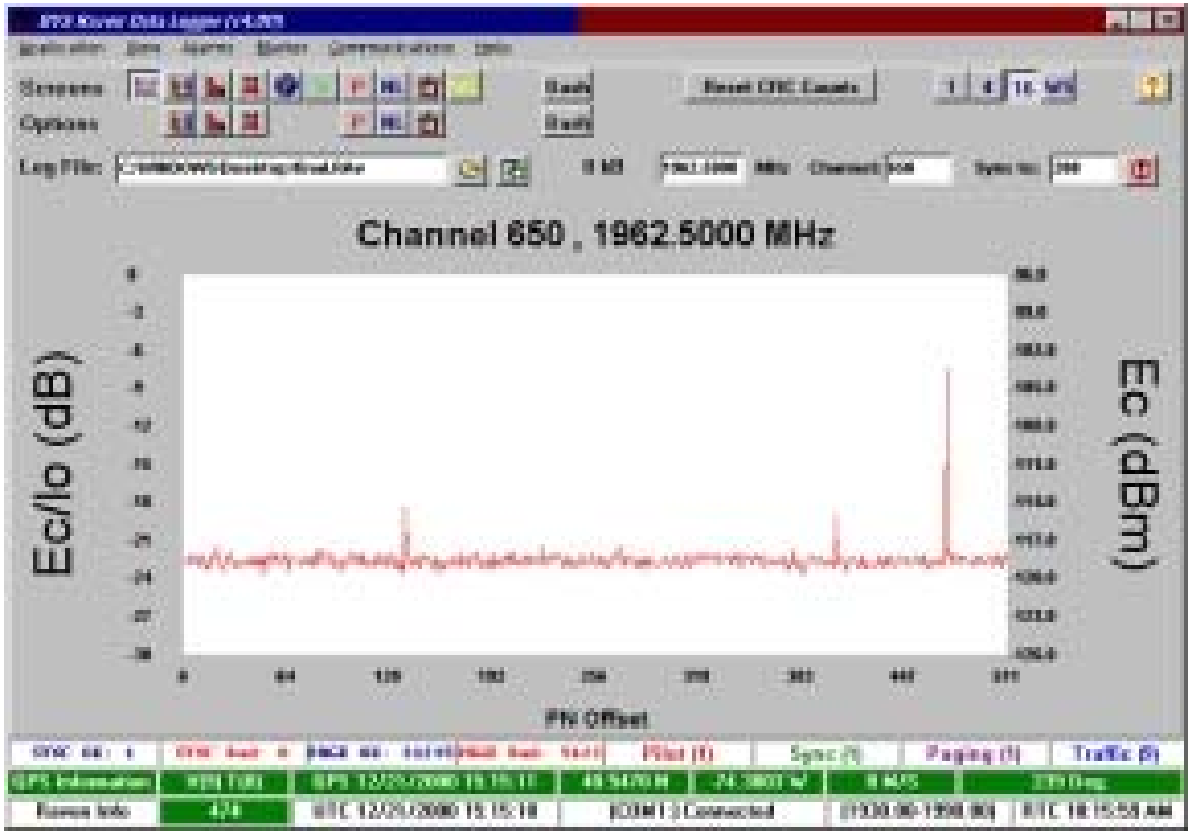
CSST = IDLE
Channel = 750
SP = 1900 MHz
Rx = -78 dBm
Tx = -75 dBm
Ec/Io = 14

GSM (5190)

DVCC = 622
RSSI = -73 dBm
CCCH = Common Control Channel

Drive Test Tools

PN Code Scanner

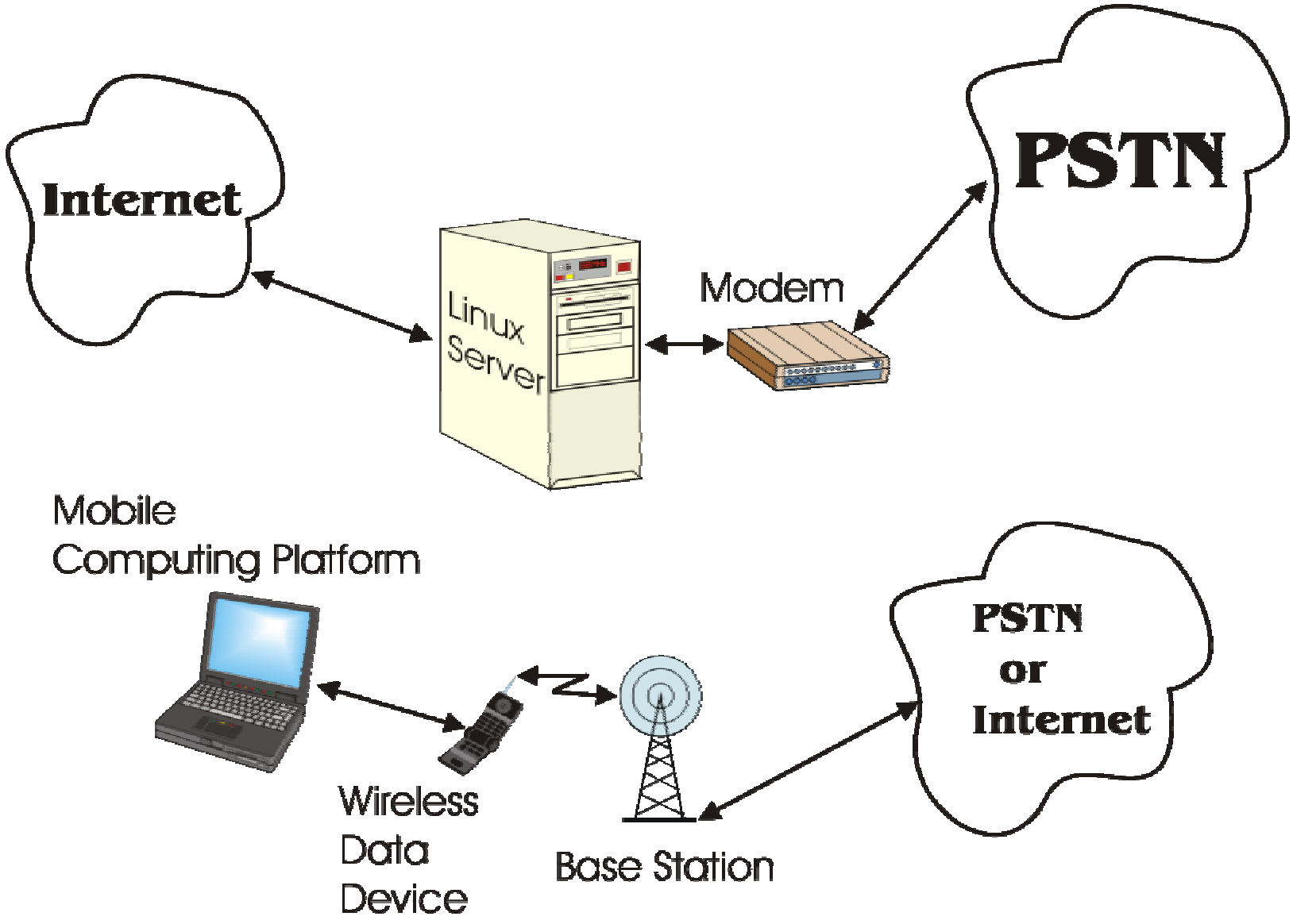


Walsh Code Scanner

Projects

- Wireless Data Throughput
- Propagation Mapping
- Base Station Location
- Congestion Studies

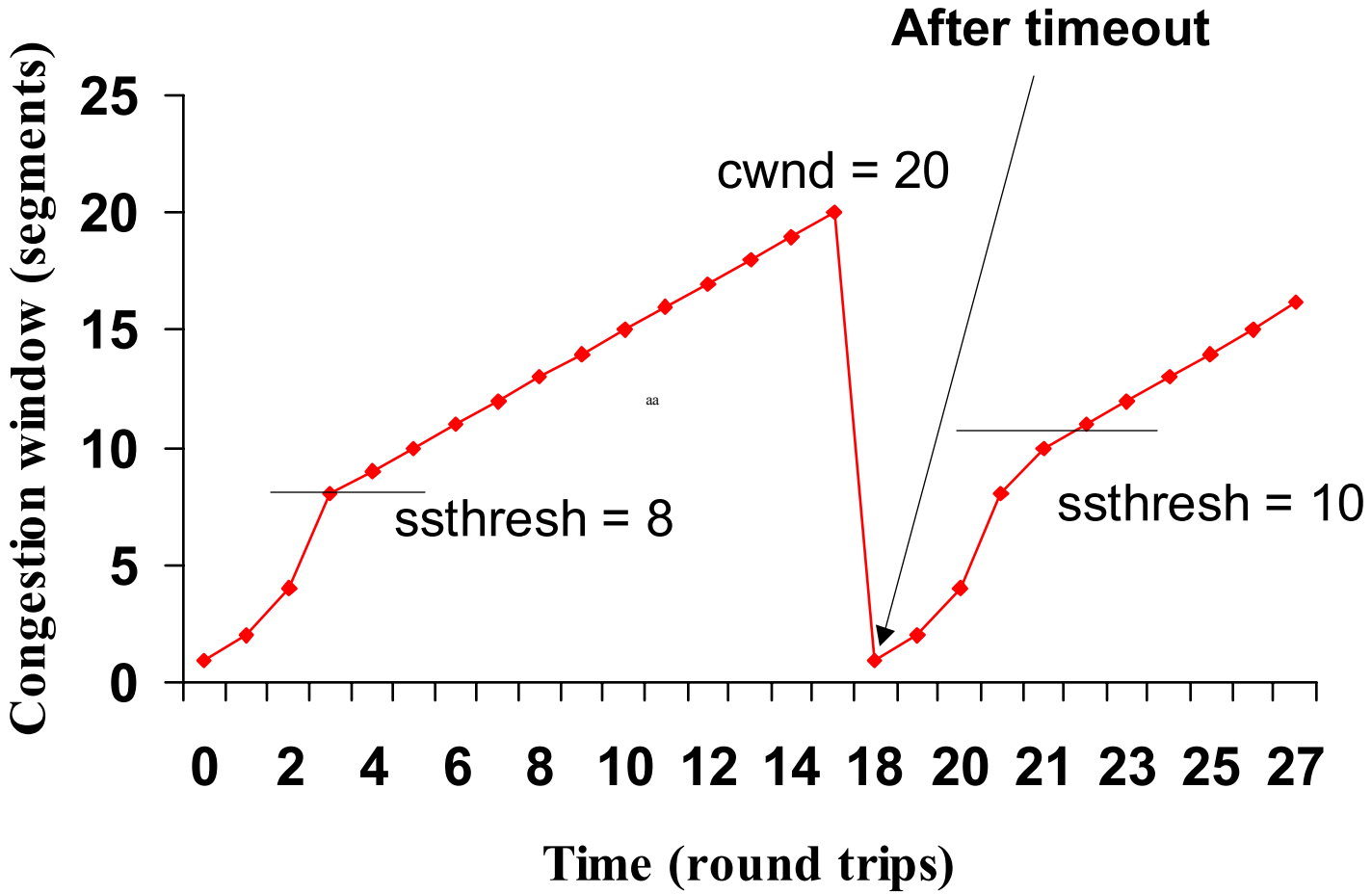
Measurement Set up



Medium	MODE	File Size (kB)	Throughput (kbps)	Std Dev. (kbps)	95% Confidence Interval (kbps)
Wireless PDA	**Stationary**	10	1.4	0.01	0.01
		100	1.4	0.01	0.01
Cellular Digital Packet Data	**Mobile**	10	1.5	0.54	0.33
	Stationary	10	2.1	0.20	0.11
		100	2.1	0.15	0.09
IS-95	**Mobile**	10	8.4	0.87	0.30
		100	10.7	0.47	0.17
	Stationary	10	8.7	1.14	0.41
		100	11.3	0.23	0.10
GSM	**Mobile**	10	7.0	0.62	0.21
		100	7.9	0.39	0.14
	Stationary	10	7.3	0.04	0.01
		100	8.5	0.00	0.00
Microcell	**Stationary**	10	44.4	15.60	4.83
		100	97.8	27.43	8.50
9.6 kbps Wireline Modem	**Stationary**	Mixed	7.2	0.72	0.32

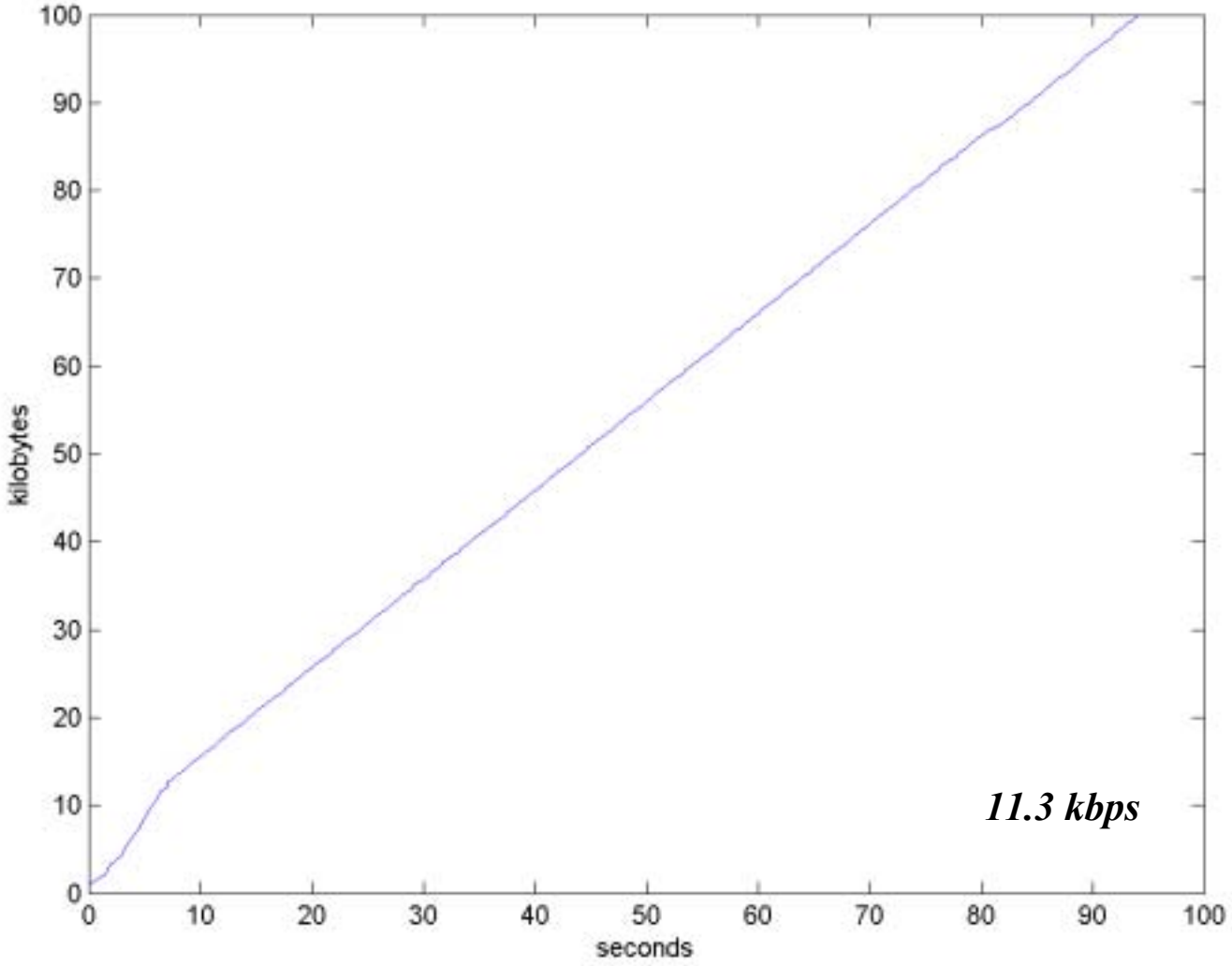
IP Data Channel Throughput

TCP Congestion Behavior

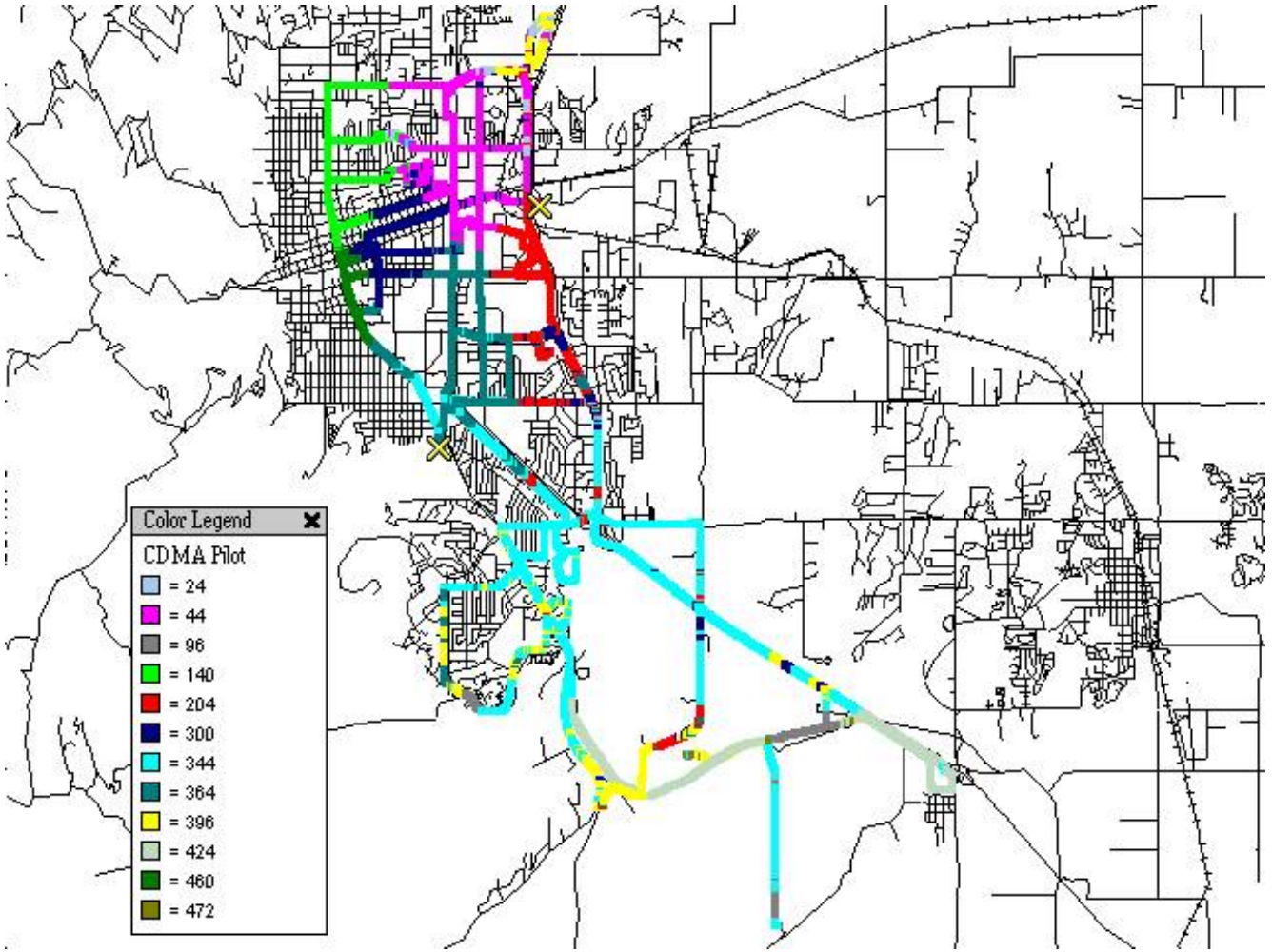


Nitin Vaidya Associate Professor, Department of Electrical and Computer Engineering University of Illinois at Urbana-Champaign

CDMA 100 kB File Transfer



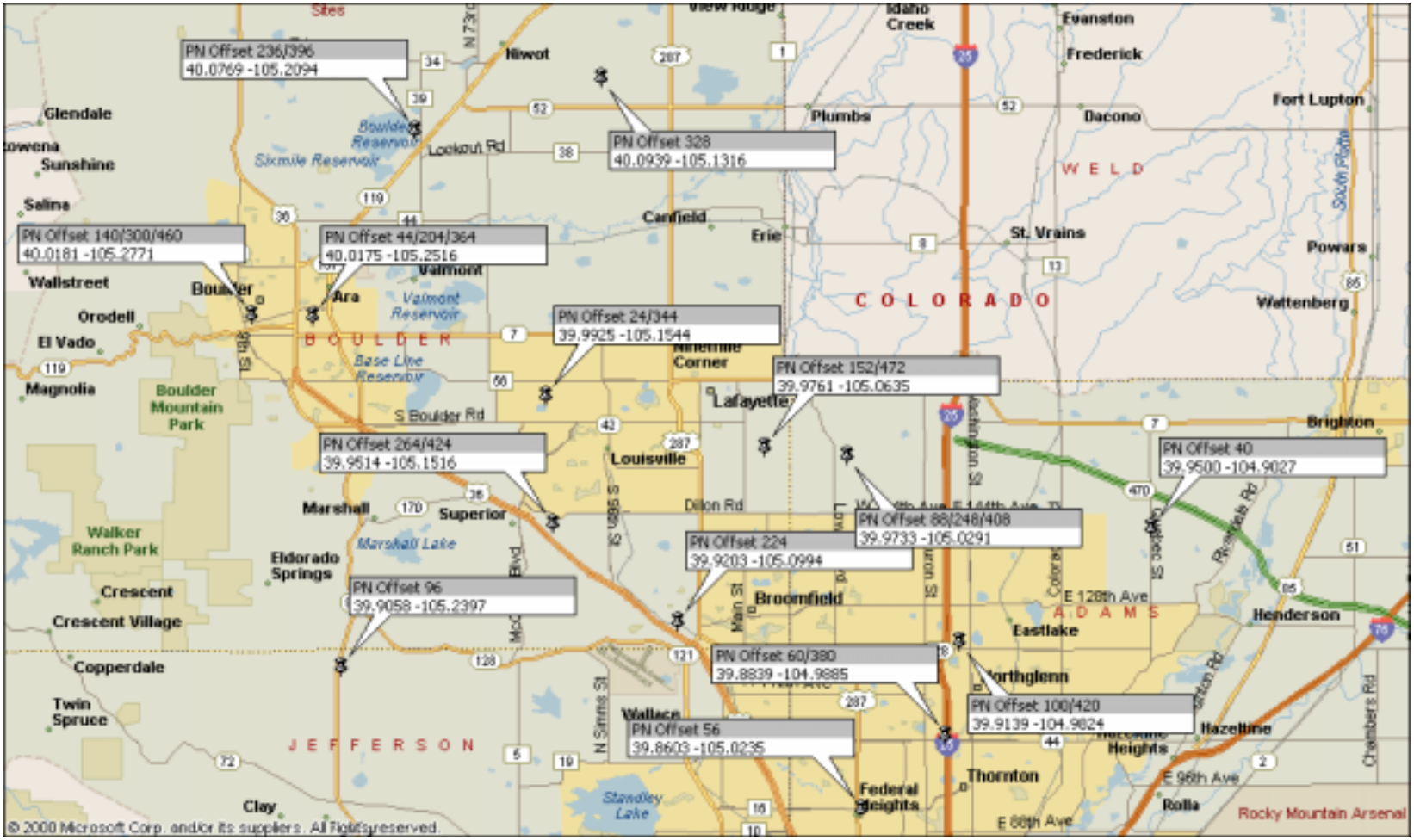
Propagation Mapping



Base Station Location

- CDMA
  - Optional field in access parameters message provides GPS coordinates of base station
  - Time difference of arrival information is also known

CDMA Base Stations



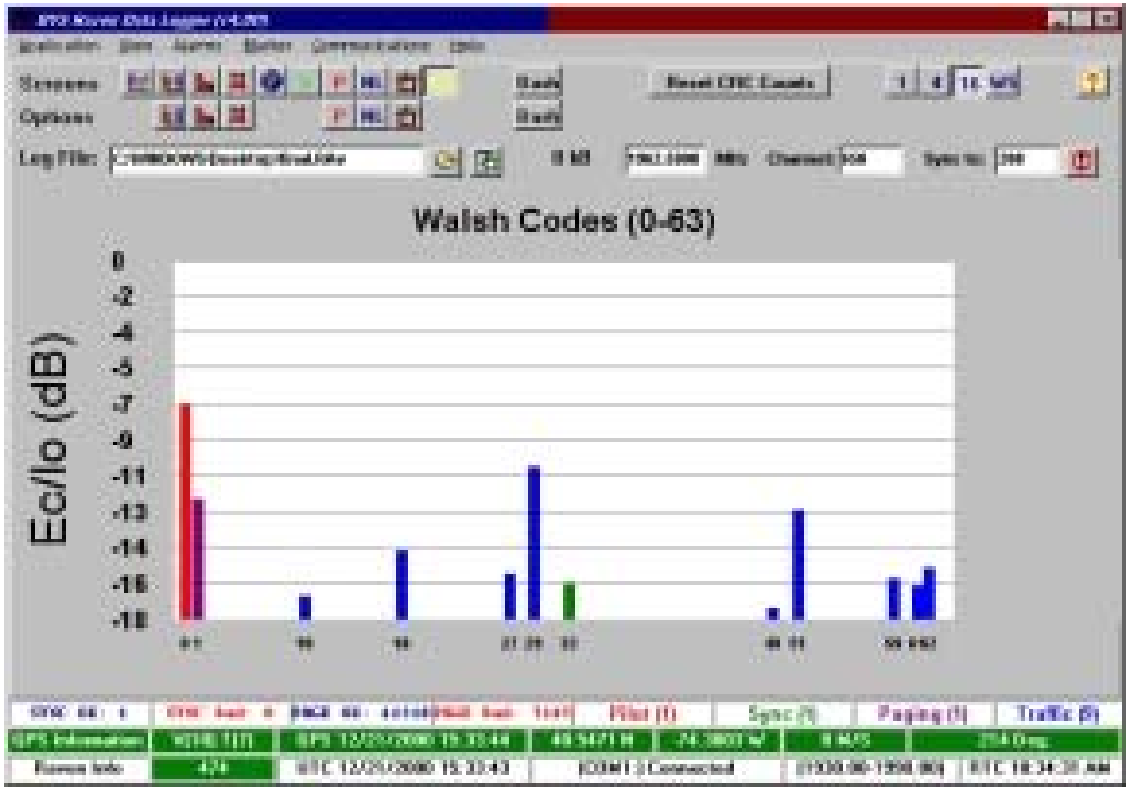
Base Station Location

- GSM
  - Timing advance parameter gives distance to base station in 550 meter (1800 ft) increments
  - Phone must be in operation for timing advance to become available

Base Station Location

- Other Cases
- Power Models
  - Power exponent variable
- Trilateration
  - Time of Arrival (TOA)
  - Time Difference of Arrival (TDOA)
- Triangulation
  - Angle of Arrival (AOA)

Congestion Studies



Future Projects

- PCS Interference
- 802.11b Wi-Fi
- Bluetooth