

3/5/2011

Assignment 1 is up on the Wiki

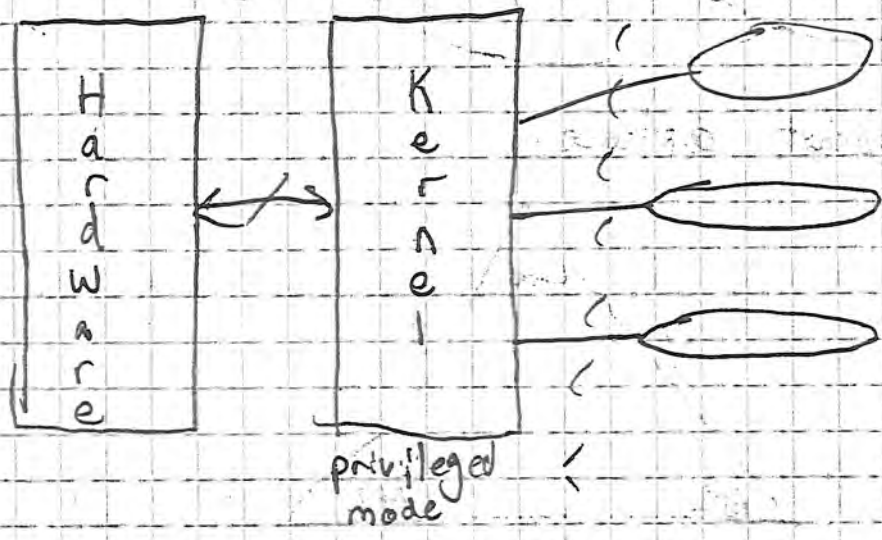
Richard Stallman - GNU (1983)

Linux is just the Kernel

Kernel - guts of the operating system

What makes up a Linux Operating System

- Boot components
- Kernel
  - o Device Drivers
  - o Modules
- Programs
- Libraries
- Filesystem



man -k <keyword>

env lists environment variables

; is a command delimiter

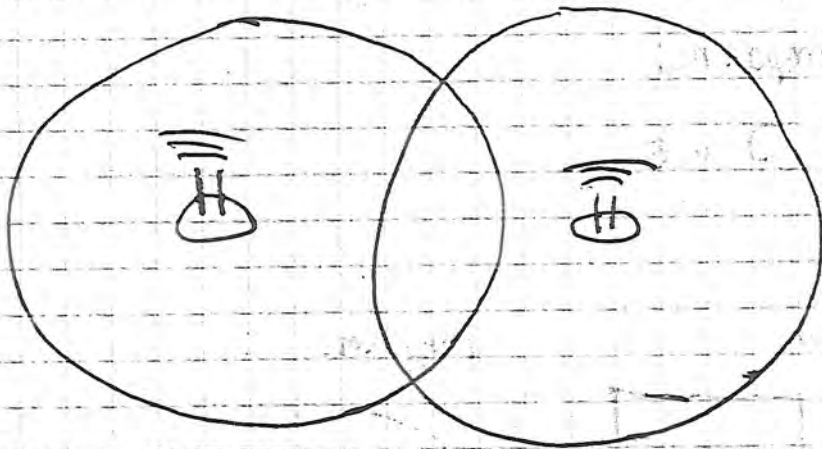
```
while true; do
  ls -lh xyz
  touch xyz echo hello >> xyz
  sleep 10
done
```

Wireless APs features / limitations

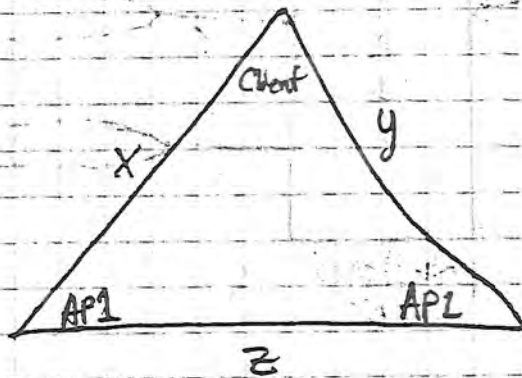
Tasks

Do readings  
Piedmont Park Measurements (attempted 01/29/2011)  
Put radiation patterns up on the Wiki.

Put Seksan's UDP code on SVN (Rich)  
(check w/ Ghailth if there is a wireless subteam repo)



- APs broadcast distance



What happens as  $x, y, z$  vary?

Today Pepe, Martha, Jung, Mohamed, and I tried to take measurements in Piedmont but due to increasingly nice weather and an abundance of people we were unable to take any such measurements.

## understanding linux file permissions

a program is run by some user, that program is associated with that user and has its permissions.

bash (born again shell)

programs inherit the userid of the user that executed the program.

userid unique # for the user

/etc/passwd



programs ask the kernel to do things; these requests have the userid of the program that asked the kernel.

most of linux security is file permissions:

triplet of permissions.

r w x	r w x	r w x
user	group	other

r : read  
 w : write  
 x : execute

groups : kind of like a user id that can be shared by multiple people.

a user can be associated with multiple groups.

hierarchy is user, then group, then other the first match is used as the permissions.

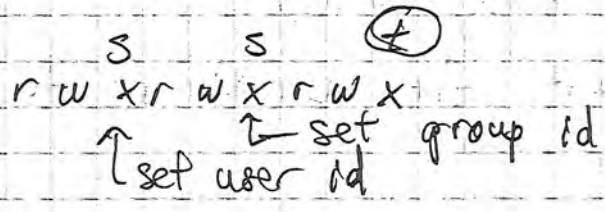
kernel doesn't check file permissions if the user is root

id : <math>id</math> has info about a user

32  
02/04/2011  
Conf

a file can only have one group associated with it.  
root can change the owner of a file

chmod works well with a triplet of octal numbers.



- chmod <triplet> filename
- chown
- chgrp
- id
- newgrp

default file permissions: uses umask

- read a directory: ~~list~~ list files in the directory.
- write a " " : write / delete a file in a directory
- execute a directory: can execute a known file

/etc/passwd  
/etc/group

/etc/shadow: where password hashes are stored.

02/08/2011 ✓

### HW Assignment 2

02/02/2011

### Sub-team Meeting

- 02/03/11 ✓
- 02/04/11 ✓
- 02/04/11 ✓

e-mail jdumond3@mail.gatech.edu about SUNS  
 finish readings  
 Put URL on wiki

- note the physical makeup of the suites

02/06/11 ✓

Freedom Park, Inman Park  
 Sunday: 12 (Noon) meet VL 465

- Price laser "tape" measure
- Lates

- Standard Input Keyboard

Standard Output } Window

Standard Error } Screen

- Standard Output redirect ">"

ls > <filename>

- Standard Input ~~file~~ redirect "<"

more <<filename>

- Connector (pipe) "|"

stdout → stdin

ls -LR | more

"|&" sends both stdout and stderr to the other process.

- grep Global Regular Expressions

~~grep <pattern>~~

grep <pattern>

- ssh secure shell

can also be used to execute a command on the remote machine

- ~~&&~~ && only execute if successful exit status.

ex.: cmd1 && cmd2

- || only execute if unsuccessful exit status.

- /dev/null is kind of like a black hole for bits and just throws the contents away.

1/08/2011  
os. conf.

# file system concepts

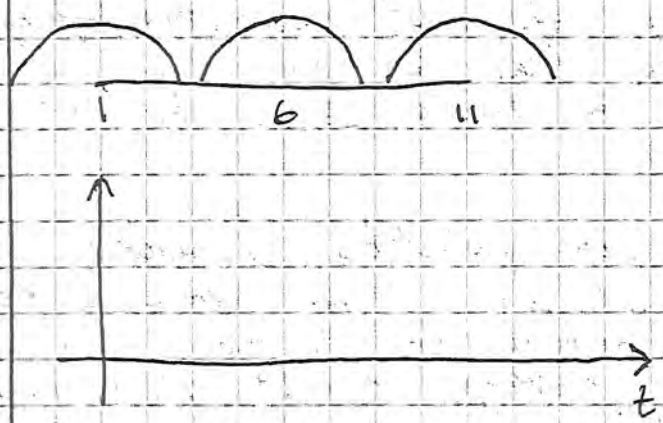
file 3, 7, 2, 58

list of free 0, 4, 5, ...

- 0
- 1
- 2
- 3
- 4
- 5
- 6
- 7
- ⋮

## Useful Commands

- clear : clear the terminal's contents
- less : j, k, space for navigation
- du : disk usage  
ex. du -sh <filename directory>
- the "&" when appended to the end of a command runs the job in the background.
- jobs : show the running jobs.
- kill : kill jobs, % uses local job #
- ctrl-c : abort  
ctrl-z : stop (suspend)
- fg %<#> : resumes stopped process in foreground.
- bg %<#> : resumes stopped process in background.
- ps : shows this list of running commands  
-ef ; everything, full details.
- top : lists the running processes sorted by CPU usage
- nice / renice : help set CPU priority for a process.
- pstree : tree structure of processes running.



User A

User B

Carrier Sense Multiple Access / Collision Avoidance

CSMA/CA

- Random Access Communication Protocol
- Time Division Multiplex
- Frequency Division Multiplex

Collision Avoidance

- Listen Before Transmit
  - Transmit if Channel Idle
  - Reschedule if Busy
- A random time in next  $2^i \times$  seconds where  $i$  is number of collisions suffered.

Send e-mail with instructions on how/where to meet. (I showed them a Google Map in person)

$$\text{Bit Rate} = \text{BW} \times \text{Spectral Efficiency}$$

Bits/sec/Hz

Typ.  $3 \sim 3$

Today we went into the President's Suite and took some measurements. We ran into a few problems with the APs so that limited what we were actually able to accomplish.

We did not get some useful data from the President's

12/22/2011  
cont.

We have screenshots of the networks that we saw that give us an idea of what kind of wifi is already in the building. Perhaps the most interesting thing was the Zwire SSIDs that we saw. Pepe and Mohamed saw that those are the default SSIDs for ATRT's UNIVERSE.

Most of the APs were predictably GT wireless and on the typical channels 1, 6, & 11. There were a few odd things that we saw including the Zwire APs. The Zwire APs were on channels 4, 6, & 9 which means that they are interfering with each other and the GT wireless.

Later in the day I started to look for an alternative to wifi-forum for the iPhone. During testing it became evident that wifi-forum only displays the strongest AP for an SSID so an SSID like GT wireless in fact had many more APs than were shown. Searching on Cydia I found Wifi Analyzer, of which there were two of. I installed the free one and quote like it. It has many of the same features as Wifi-forum but it shows all of the APs that it can see.



Bring up Wifi Analyzer in the sub-team meeting

1/15/2011

### Abler Linux Lecture 4

- echo \$PATH shows the path variable, a colon delimited string that shows where the OS will look for programs to run.
- export makes a variable a global variable in the shell
- PATH=\$PATH:/home/<username>/bin  
export PATH
- LD\_LIBRARY\_PATH
- ldconfig
- ldd tells you what libraries are required to run a program. (ex: ldd /bin/rs)



13/2011  
t.

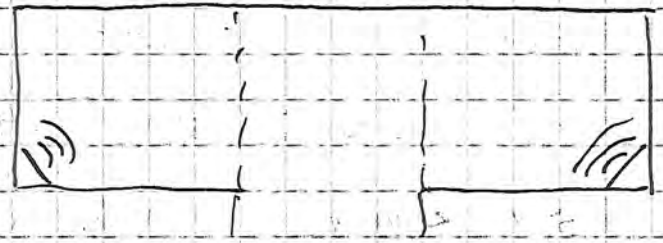
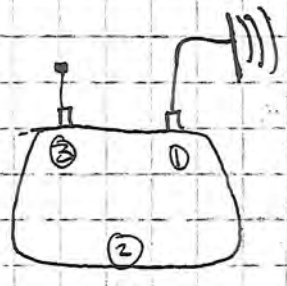
In Linux the first and only program that the kernel runs is init.

RPM - RedHat, Fedora  
APT - Ubuntu, Debian

What package is falls gedit? What packages does gedit depend on?

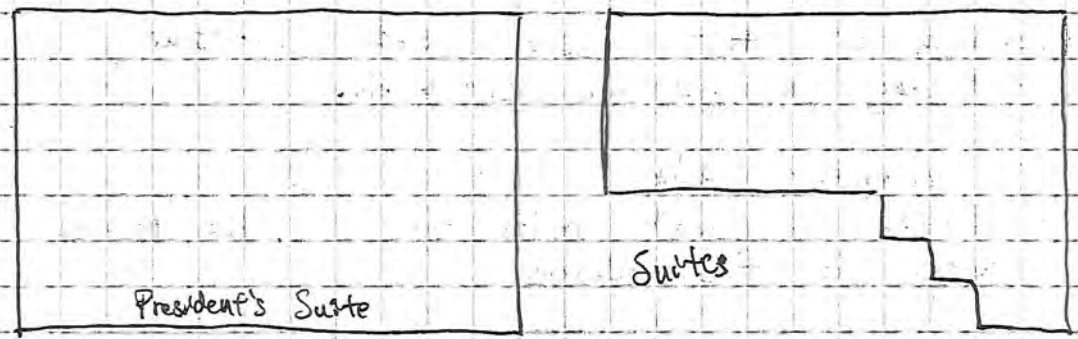
Assignment

16/2011



~ 200 people in President's Suite

Cross Section of Suites



Report (Before Spring Break)

- |  |  |
|--|--|
| <p>1) Configuration of Suites</p> <ul style="list-style-type: none"> <li>- types</li> <li>- sizes</li> <li>- number of people</li> </ul> | <p>4) Deployment Options</p> <ul style="list-style-type: none"> <li>- Better to be above than behind</li> <li>- From side</li> <li>- Cost</li> </ul>   |
| <p>2) Data Usage Forecast</p> <ul style="list-style-type: none"> <li>- bits / sec / user</li> <li>- Usage</li> </ul>                     | <p>Goals</p> <ul style="list-style-type: none"> <li>- Suites have best coverage</li> <li>- Better BW (High throughput, low latency)</li> <li>- Fewer dropped connections</li> <li>- Suites have other <del>Suites</del> stuff (may not be avail. in stands)</li> </ul> |
| <p>3) Measurements</p>   |  |

# Abler Linux Lecture 5

1/22/2011

- ifconfig - a
- /etc/hosts
- /etc/resolv.conf      The DNS configuration file
- /etc/sysconfig
- /etc/initfab

- |sof      List open files
- ~ / <user name> / .ssh / authorized\_keys
- ssh-keygen      make a Pub/Priv keys

1/24/2011

11 AM meeting

- March 11 Cisco People are showing up.
- Presentation for Cisco (each sub-team)
  - Ready to go for next week.
- VIP computer Polkeys
  - Dr. Abler & Ghant redid the PC. We no longer have admin access to the machines.
- Notebook check is next week. Peer evaluations are also likely to happen.

## Web Apps

- Individual pages have been made

## Sensor Nets

- Purdue Competition contest
- hand waving, motion.

## WiFi

- Take measurements.
- Get more data
- A/RM - Association Pointing Machines.

- Avg. Web page Size : 320 KB = 2560 Kb
- Avg. Time / Site : 56 seconds
- Commercial APs : 30 users / AP
- Approximating the presidential suite @ 10yds x 35yds and 100 people there is 3.5 square yds / person.
- Estimate During Game Play

$$\frac{20 \text{ users} \mid 350 \text{ Kb/s}}{1 \text{ user} \mid 1000 \text{ Kb/s}} = 7 \text{ Mb/s}$$

$$\frac{7 \text{ Mb/s}}{4 \text{ Mb/s}} \mid 1 \text{ AP} = 1.75 \text{ APs}$$

Channel	# APs
1	8
4	4
6	7
9	1
11	15

- have references on wiki (papers, measurements, etc.)
- have new students try and read papers weekly run by Drs. Abler & Coyle
- find size of videos to figure out throughput of network
- Make plans to measure the suites and send to Dr. Coyle
- Enable RTS/CTS; find recommendations online, when to use and when not.
- When do devices fall down in data rate? Are all users affected?

Needed By Tomorrow (03/02/2011)

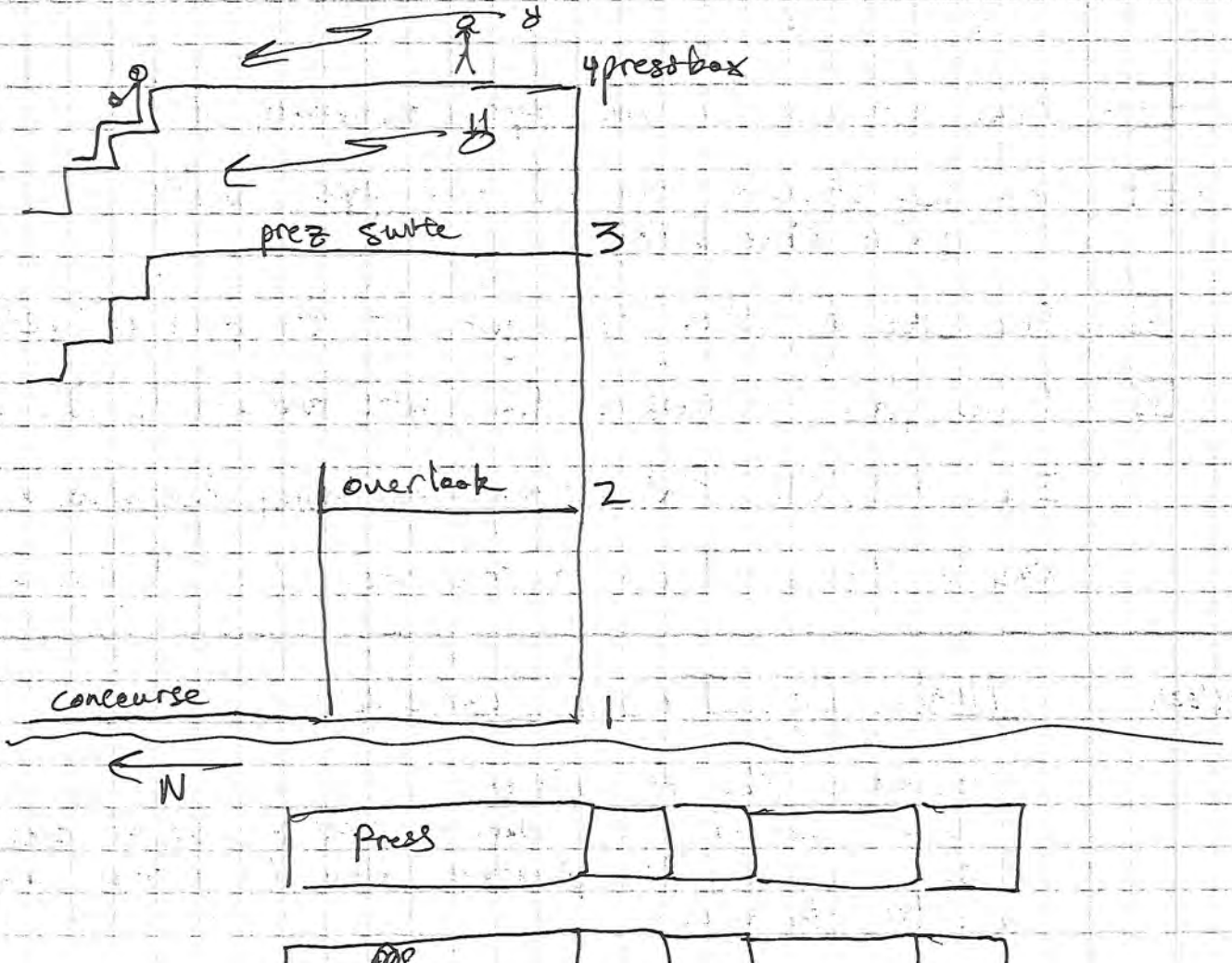
- Measurement Plans for Friday
  - What suites? Have redundant plans in case of conflicts.
- Answer Dr. Coyle's questions from his e-mail about modulation techniques.

# Sub-Team Meeting

- 02/20/11 - New students read papers weekly
- figure out what happens when someone walks away from AP - Burger Bowl
- Need to find out from Friday Measurements
- Do the floors block RF?
  - what is the dB loss floor-to-floor?
- What impact do the suite walls/windows have on int-fl?
- Ethernet Locations
- Enable RTS/CTS?

## Plan for Friday

- use suites on floor of President's suite or press box above
  - use suites to left
  - if occupied use the suites to the right.
  - if can't use west use east suites.
- take measurements through out the suites to see if there are differences.



time domain

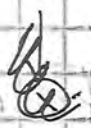
frequency domain

13/02/2011

Coyle's Lecture

# Modulation Stuff

3/2/11



IS.M

2

60

To  
by

Use



Mat

x(t)

Barker-7

S

de  
see encyclopedia

sequence of  $N$  values of  $+1$  and  $-1$ ,  
 $2, \dots, N$

$$\leq 1$$

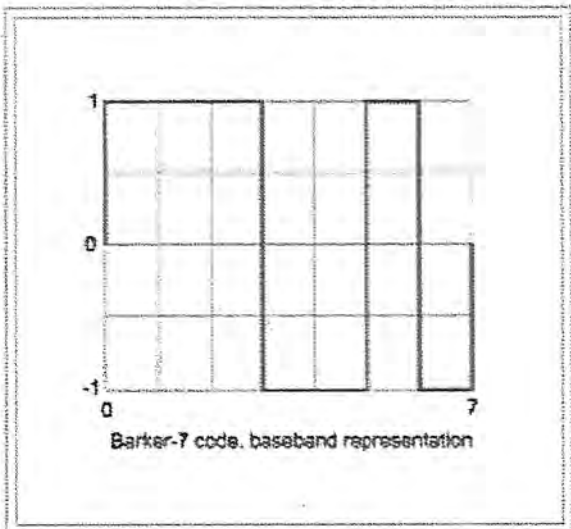
1]

### er codes

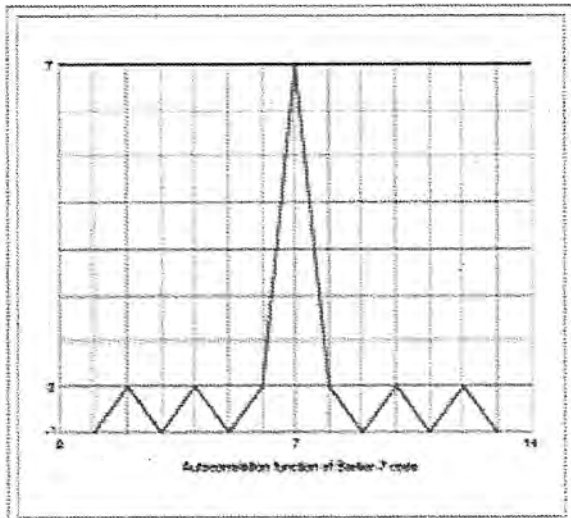
nown Barker codes, where negations and  
have been omitted. A Barker code has a  
tion sequence which has sidelobes no larger than  
better RMS performance than the codes below.  
s all known Barker codes; it is conjectured that  
y phase codes exist.<sup>[2]</sup>

### 1 Barker Codes

Codes
+1 +1
+1 +1 +1 -1
+1
-1 +1 -1
-1 -1 +1 -1 -1 +1 -1
+1 -1 -1 +1 +1 -1 +1 -1 +1



Graphical representation of a Barker-7 code



Autocorrelation function of a Barker-7 code

h 11 and 13 are used in direct-sequence spread spectrum and pulse compression radar  
eir low autocorrelation properties.

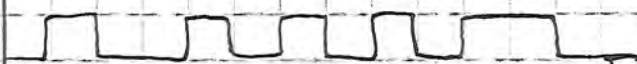
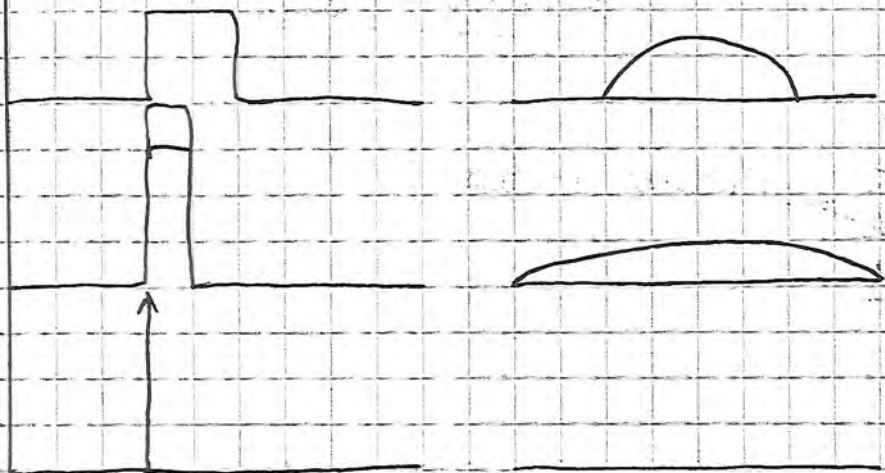
litudes of the pulses forming the Barker codes imply the use of biphas modulation; that  
e in the carrier wave is 180 degrees

03/02/2009

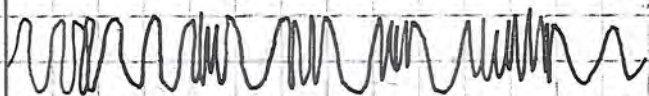
time domain

frequency domain

# Coyle's Lecture of Spread Spectrum



⊗ Frequency Shift Keying



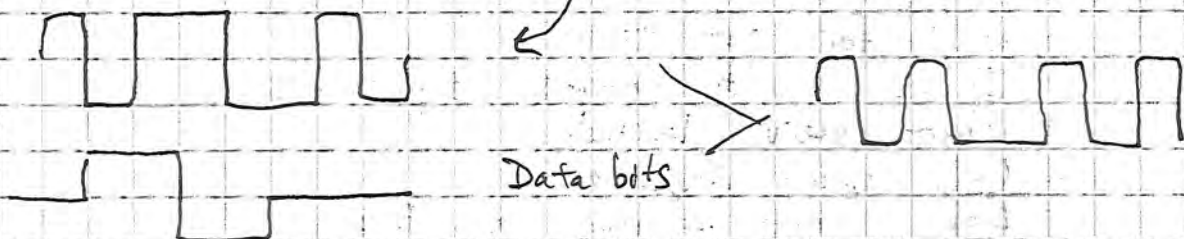
Maxwell's Equations

IS.M. Band - Unlicensed Communication.

- 2.4 GHz → Water Absorbs 100 mW
- 60 GHz → O<sub>2</sub>
- 5 GHz → ?

To spread the signal over a wider band can multiply each databit by a "p/n" sequence.

Use Barker Sequence



Matched Filter

$$x(t) \rightarrow \boxed{h(t)} \rightarrow \int_{-\infty}^{\infty} x(\tau) h(t-\tau) d\tau$$



03/03/11

~~XXXXXXXXXXXXXXXXXXXX~~ General Team Meeting

- ✓ Make a PPT for Cisco.
- ✓ Put model Numbers into PPT showing that we are using Cisco products.
- Kyle Shields (Suite of the Future) Contact
- DHS has installed an IP based CCTV network into the stadium.
- Athletics is interested in North End zone if we can provide wireless internet to the Edge building.
- Easter to donate "consumer" products rather than infrastructure (routers, switches).

- Title
- Ultimate Goals
- Semester Goals

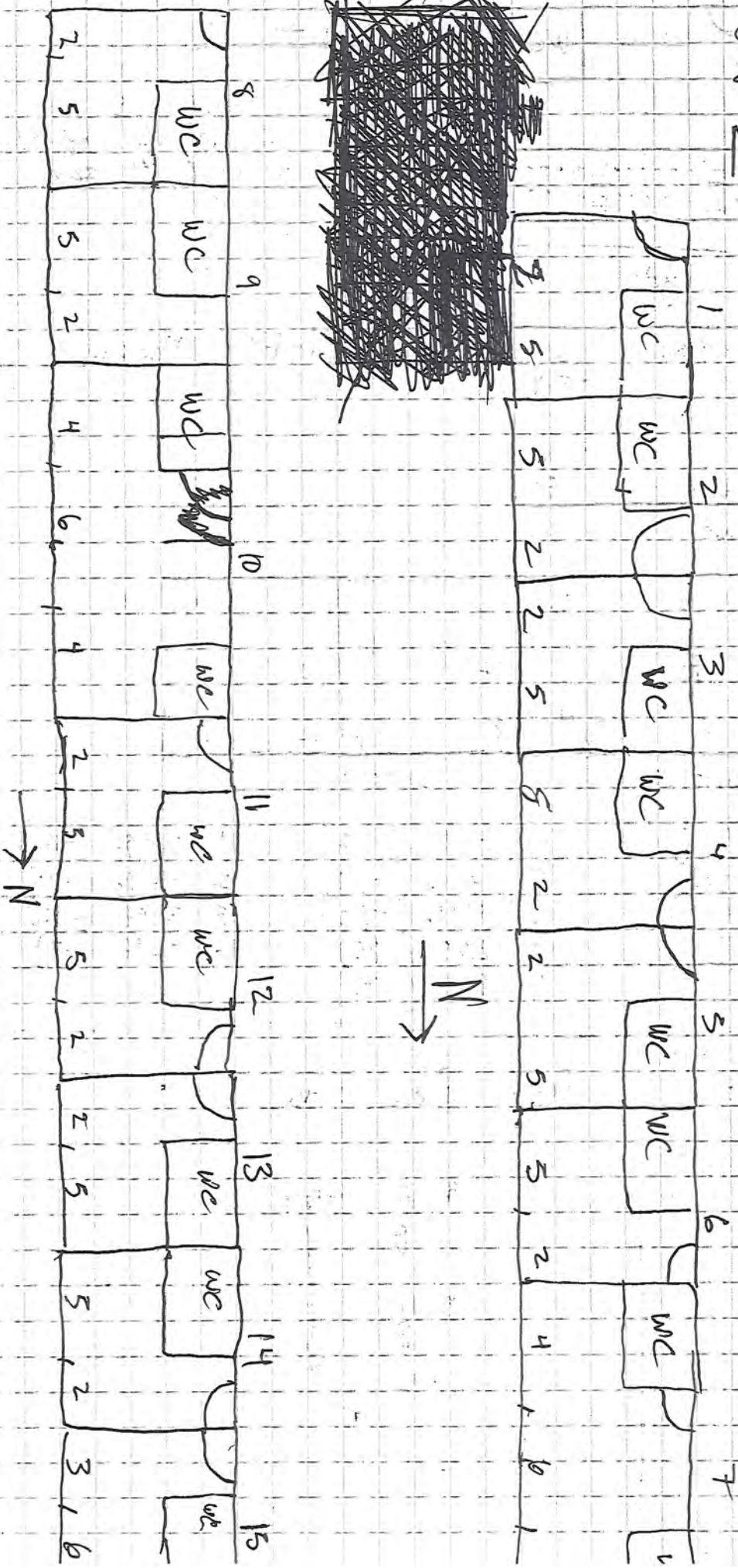
- Goals for our team
- Intro with names departments.
- What we've learned
- Ask about superbowl
- Ask about # users on APs.

- Problems w/ sensor Nets same ISM band

- Earlier semesters numbers w/ w/o people to show impact of people on propagation.

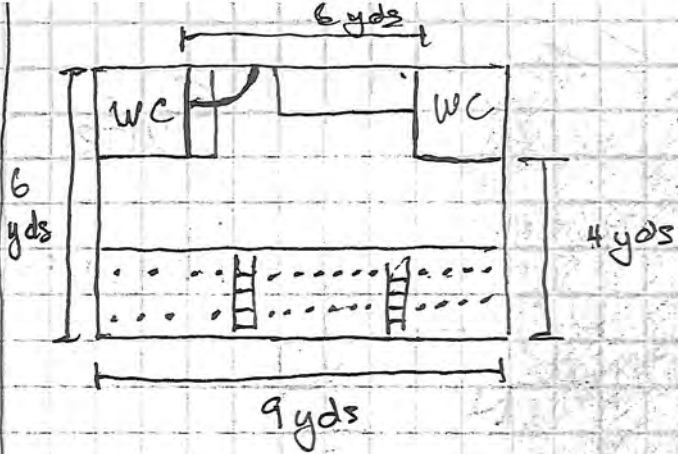


# Suite Measurements



04/2011

03/04/2011  
Stadium  
conf.



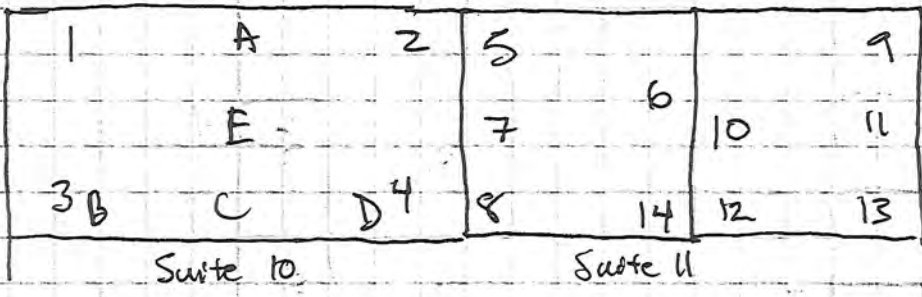
Suite 10

28 suites  
- 2 rows of 14 seats  
- 4, 6, 4 seats

45%, -68dbm	60%
	-56dbm
73%	-64dbm
55%	

Suite 10

Wi-Fi Measurements



1: 45% (-68)	6 48% (-70)	11 30% (-81)
2: 73% (-63)	7 55% (-67)	12 40% (-70)
3: 60% (-56)	8 49% (-62)	13 30% (-82)
4: 55% (-64)	9 23% (-85)	14 52% (-71)
5: 33% (-77)	10 31% (-77)	

AT&T

Pepe's iPhone 3Gs

Rm	Spot	Signal
10	A	-54
	B	
	C	
	D	
11	A	
	B	
	C	
12	A	
	B	
	C	
13	A	

14	A	-54
	B	
	C	
15	A	
	B	
	C	

3/08/2011

3/09/2011

~~XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX~~

We worked on our powerpoint for Cisco.

Dr. Coyle & Dr. Abler couldn't join us due to conflicts. We continued working on the Cisco presentation.

General Meeting

3/10/2011

Cisco presentation has been rescheduled to next Thursday, same time.

TI is coming March 28, 3-5pm.

- 
- 

Where are RJ-45 in the PressBox.

Look at the Press box tomorrow (3-11 @ Noon) w/ Martha & Kantan

We presented our initial findings to the team today at the measurements we took in the west suites.

- 

Did cisco provide full internet access or some local service @ the Cowboy's Stadium during Superbowl?

Web Apps & Sensor nets went over their presentations again with the entire team.

Have Resumes ready.

- 

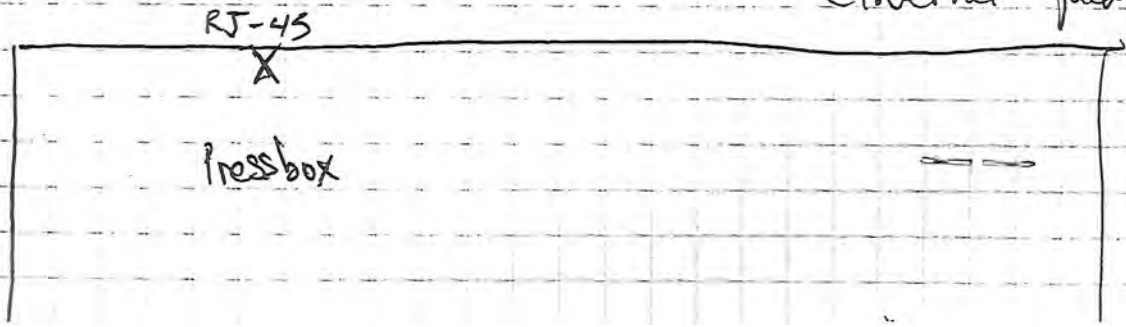
Resume site for each subteam

~ 15 Minutes per presentation

Suite of the future mock Suite setup somewhere is a possibility.

3-11-2011

X = ethernet jacks



11-2011  
cont.

To  
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et  
at

4/6/2011

# Data Usage Model

-16 Ne

-17 Cos

- mul
- trig
- 14,
- atan
- Clea
- 51
- 473
- Adde

30/2011 W  
W

06/2011

Ta  
re

Wo

Have

Se

Suite  
Data  
Meas

1/12/2011

1/13/2011 Di

1/14/2011 - Dr.

- Dr. Attor talked about stack (stack trace) a useful debugging

$$= \frac{65 \text{ ppl}}{AP}$$

$$\bar{n} \rightarrow \frac{16 \text{ ppl}}{AP}$$

$$\frac{AP}{6 \text{ ppl}} = \frac{7 \text{ Mbps}}{16 \text{ persons}} = .4375 \frac{\text{Mb/s}}{\text{person}}$$

$$n \rightarrow \frac{36 \text{ ppl}}{3 \text{ APs}} = \frac{12 \text{ ppl}}{AP}$$

$$\frac{AP}{2 \text{ ppl}} = \frac{7 \text{ Mbps}}{12 \text{ person}} = .583 \frac{\text{Mb/s}}{\text{person}}$$

$$= \frac{50 \text{ ppl}}{AP}$$

$$\text{equation} \rightarrow \frac{12.5 \text{ ppl}}{AP}$$

Stack (Stack trace) a user's debugging  
 Dr. Hider talked about Linux program for Linux (cond; cond2; cond3) & script B  
 Rich Rose  
 GTM

-11-2011  
cont.

Today we went and took a quick look around the press box of the stadium looking for ethernet jacks. I drew a diagram (on previous page) of where they were located.

During the examination we noticed that none of the jacks work. We also noticed slight offset in the floor plan between the first and second floors.

-16

No Meeting!

-17

Cisco presentation

- multicast doesn't work well over wireless
- they had indoor & outdoor networks in Dallas. No encryption. Inte
- 14,519 clients before game; 12,924 during game, 6,500 peak
- almost 1000 APs used, 2Tx antennas, 3Rx ant, 30% overlap, 30° antenna
- Clean Air to monitor actual RF spectrum, freq. monitoring (UHF)
- 51 APs changed power levels, 11 changed channel
- 473 unique rogue APs (Mi-Fi, sprint onardrone)
- Advertising for WiFi, Mesh networks for indoor Applications

30/2011

We had a meeting no one showed up!  
We went to Walto and AFE.

06/2011

Talked w/ Dr. Adler about priorities for the remainder of the semester.

We split the paper up into sections.

✓

Have draft ready for next week.

(Apr 13)

✓

Send out email with assignments.

Suite Configurations: Martha  
Data Usage Forecast: Rich (MO)  
Measurements: Mike, Jung

Deployment Options: Mohamed  
Goals: Gaetan, Pepe

1/12/2011

Worked on draft of paper.

1/13/2011

Dr. Coyle looked over our draft of the end-of-semester p

1/14/2011

- Dr. Adler talked w/ sensor nets about the notes. & simplified
- Dr. Adler talked about stack (stack trace) a useful debug

20-2011

# Subteam Meeting

## To-do

- End-of-semester paper
- Cisco paper (Donation Report / Request)
- Athletics Proposal (will do after SwireTV demo)
- Competition Paper (Due Friday)

### Competition Paper

Talked w/ Abler about papers.

- Park measurements → Appxes
- Stadium Measurements
- What Challenges we've had & what we've done
  - Lots of people
  - High Demand
  - Antenna Types
  - Existing networks (Lawn, Athletics)
  - Types of users
  - Retro fit Bobby Dodd
  - Shared Spectrum
  - Handoffs
  - Cost Benefits of APs (Nice Cisco vs. Consumer)

-21-2011

LTM

- Talked about Intellectual Property
- Talked about Swire of the Future
- Team Dinner next Thurs. 7 PM Gordon Bierich

21-2011

We worked on the competition paper. Wlaggy to late.

-25-2011

We worked on the Cisco competition presentation. There is finally a plan for west stands

Intentionally left blank

26-11

Toby Krohn - GT Account Manager, Cisco  
 Romie Harrell - College Stadium Sales, Cisco  
 Kyle Shields - Premium Sales (Suites) Basketball & Football

70 Suites  
 15-34 people

Club chair back seats

Letter winners Lounge (North)

Terrace (South)

New BBall No Suites all club seats (approx. 500)

Dan Goldberger - Director of Technologies

Andy Blanton - Director of Video Production

IMG Rights Holder  
 - All rights on air Radio + TV

CISCO  
 BILLY  
 HILARY

- Large AT&T contract

- Cisco -  
 Specialized Antennas and other products becoming available now/near future. Stuff that was used in Dallas.

- Concessions & Camera Angles for Suites

- History of Stats for comparisons between now & then

- Concessions are currently outsourced.  
 - Revenue share

Radio Feed Stream?

On Demand Device in the home?

26-2011

~~Will be held...~~  
 Cisco competition presentations.  
 - Suite TV 2nd / \$250 4 Jan!!



50

4-26-2011

Dinner

Dr. Coyle, Dr. Abler, Pepe, Mo, and I went to  
dinner with two cisco people.

# Athletics Presentation

context

the problem

actually  
have  
they want a  
team  
a-Box.

48 4  
26-2011  
Dr. Coyle, Dr. Abler, Pepe, Mo, and I went to dinner with two Cisco people.

Bill (Short bearded guy) > Cisco  
Matt (Tall guy)

More business oriented presentations. Give context

Don't just jump into the problems explain the problem and then the solutions.

27-2011

Wireless presented to Athletics today. It actually went very well. It seems that we have finally explained what eStadium does. They want a more formal written report. They seem very interested in supporting the Press-Box.



Send a formal report to Athletics.

18-2011  
TM

- Suite TV gave a demo.

- Dinner is now @ 7:30 PM