Assignment 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
    - Device Drivers
    - Modules
  - Programs
  - Libraries
  - Filesystem

```
man -k <keyword>
env lists environment variables
j is a command delimiter
while true; do
  ls -lh xyz
  touch g
  echo hello >> xyz
  sleep 10
  done
```
- Wireless AP features / limitations

Tasks:
- Do readings
- Piedmont Park Measurements (attempted 04/29/14)
- Put radiation patterns up on the Wiki

Put Seksan's UoP code on SVN (Rich)
(check /Ghanti if there is a wireless subteam repo)

- APs broadcast distance

What happens as x, y, z vary?

25/04
Today Pepe, Martha, Jingy, 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.

User id: 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:

- `rwx` for user
- `rwx` for group
- `rwx` for 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.
a file can only have one group associated with it.

Chmod works well with a triplet of octal numbers:

```
  s  s 
 r w x r w x
```

- `s` = set user id
- `s` = set group id

Chmod <triple> filename

can change the owner of a file

default file permissions: uses umask

- read a directory
- list files in the directory
- write a directory
- 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.
```

HW Assignment 2

02/02/2011

Sub-team Meeting

02/03/11

- e-mail jdonald3 @mail.gatech.edu about SVN
- 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
- Prize laser "tape" measure
  Lab 6
Standard Input Keyboard
Standard Output Window
Standard Error Screen
Standard Output redirect ">
ls > (filename)
Standard Input redirect "<"
More (filename)
Connector (pipe) "|
stdout -> stderr
ls -LR | more
"|" sends both stdout and stderr to the other process.
grep Global Regular Expressions
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.
File system concepts

File: 3, 7, 2, 58
List of free: 0, 4, 4, 5, ...

Useful commands

- clear: clear the terminal's contents
- less: j k l 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 list of running commands
  - e: everything, full details
- top: lists the running processes sorted by CPU usage
- niced: renice; help set CPU priority for a process
- pstree: tree structure of processes running.
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 come up with any useful data from the President's...
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 his colleague said that these are the default SSIDs for AT&T's network.

Most of the APs were predictably GTwireless 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, 5, & 9, which means that they are interfering with each other and the GTwireless.

Later in the day, I started to look for an alternative to WifiTofu for the iPhone. During testing it became evident that WifiTofu only displays the strongest AP for an SSID so an SSID like GTwireless in fact has many more APs than were shown. Searching on Cygwin, I found WiFi Analyzer, of which there were two of. I installed the Free one and quite like it. It has many of the same features as WifiTofu but it shows all of the APs that it can see.

Bring up WiFi Analyzer in the sub-term meeting.

Abler Linux Lecture 4

- echo $PATH shows the path variable, a colon delimited string that tells 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: /lib/bins/ls
In Linux the first and only program that the kernel runs is 'init'

- RPM - RedHat, Fedora
- APT - Ubuntu, Debian

What package is called 'gedit'? What packages does gedit depend on?

Assignment

16/2/11

~200 people in President's Suite

Cross Section of Suites

Report (Before Spring Break)

1) Configuration of Suites
   - types
   - sizes
   - number of people

2) Data Usage Forecast
   - bits/sec/user
   - usage

3) Measurements

4) Deployment Options
   - Better to be above than behind
   - From side
   - Cost

Goals
   - Suites have best coverage
   - Better Bandwidth (High throughput, low latency)
   - Fewer dropped connections
   - Suites have other Suites stuff (may not be available in stands)
Abler Linux Lecture 5

1/23/2011

1. `ifconfig -a`
2. `/etc/hosts`
3. `/etc/resolv.conf` The DNS configuration file
4. `/etc/sysconfig`
5. `/etc/init.d`

- `ls -l` List open files
- `~/.ssh/authorized_keys`
- `ssh-keygen` make a Pub/Priv keys

1/24/2011

- March 11 Cisco People are showing up.
- Presentation for Cisco (each sub-team)
- Ready to go for next week.

VIP computer Polktes:
- Dr. Abler & Ghaffari fixed 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 Nests:
- Purdue competition contest
- Hand waving, motion.

Wifi:
- Take measurements.
- Got more data

AFM - Association for Computing Machinery.
Sub-Team Meeting

- Avg. Web page size: 320 KB = 2560 KB
- Avg. Time/Visit: .56 seconds
- Commercial APs: 30 users/ AP

- Approximating the presidential suite @ 100 yds x 35 yds and 100 people
  there is 3.5 square yds/person.

- Estimate. During game play

  \[
  \frac{20 \text{ users}}{\frac{350 \text{ KB/s}}{1 \text{ user}}} = 7 \text{ Mb/s}
  \]

  \[
  \frac{7 \text{ Mb/s}}{\frac{4 \text{ Mb/s}}{1 \text{ AP}}} = 1.75 \text{ APs}
  \]

<table>
<thead>
<tr>
<th>Channel</th>
<th># APs</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>8</td>
</tr>
<tr>
<td>4</td>
<td>4</td>
</tr>
<tr>
<td>6</td>
<td>7</td>
</tr>
<tr>
<td>9</td>
<td>1</td>
</tr>
<tr>
<td>11</td>
<td>15</td>
</tr>
</tbody>
</table>

- have references on wiki (papers, measurements, etc.)
- have new students try and read papers weekly run by Drs. Atler & 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 (03/07/2011)

- 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

02/21/11

- 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 Wi-Fi?
- Ethernet locations
- Enable RTS/CTS?

Plan for Friday

- Use suites on floor of President's suite & 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 throughout the suites to see if there are differences.
<table>
<thead>
<tr>
<th>Time Domain</th>
<th>Frequency Domain</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Coyle's Lecture</td>
</tr>
</tbody>
</table>

Modulation Stuff

3/21
A sequence of \( N \) values of \( +1 \) and \( -1 \),
\[ 2, \ldots, N \]
\[ \leq 1 \]

**r codes**

known 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.\(^2\)

| Barker Codes
<table>
<thead>
<tr>
<th>Codes</th>
</tr>
</thead>
<tbody>
<tr>
<td>+1 +1</td>
</tr>
<tr>
<td>+1 +1 +1 -1</td>
</tr>
<tr>
<td>+1</td>
</tr>
<tr>
<td>-1 +1 -1</td>
</tr>
<tr>
<td>-1 -1 +1 -1 -1 +1 -1</td>
</tr>
<tr>
<td>+1 -1 -1 +1 -1 +1 -1 +1 -1</td>
</tr>
</tbody>
</table>

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

itudes of the pulses forming the Barker codes imply the use of biphase modulation; that e in the carrier wave is 180 degrees.
Coyle's Lecture of Spread Spectrum

Frequency Shift Keying

Maxwell's Equations

IS. MS. Band - Unlicensed Communication.

2.4 GHz → Water Absorbs 100 mW
60 GHz → O₂
5 GHz → ?

To spread the signal over a wider band can multiply each data bit by a "pin" sequence.

Use Barker Sequence

Matched Filter

\[ x(t) \rightarrow h(t) \rightarrow \int_{-\infty}^{\infty} x(\tau) h(t-\tau) \, d\tau \]
General Team Meeting

03/03/11

- 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.
  - Easier to donate "consumer" products rather than infrastructure (routers, switches).

Title
- Semester Goals
- Ultimate Goals
- Goals for our team
  - Intro with names and 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 10

28 suites
4 yds - 2 rows of 14 seats
- 4/6/4 seats

Wi-Fi Measurements

Suite 10

<table>
<thead>
<tr>
<th>1</th>
<th>A</th>
<th>Z</th>
<th>5</th>
<th>B</th>
<th>C</th>
<th>D</th>
<th>8</th>
<th>14</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>E</td>
<td>7</td>
<td>6</td>
<td>F</td>
<td>10</td>
<td>11</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

1: 45% (-63)
2: 73% (-63)
3: 60% (-56)
4: 55% (-64)
5: 33% (-77)
6: 45% (-70)
7: 55% (-67)
8: 44% (-62)
9: 23% (-65)
10: 31% (-73)

AT&T  
Pepe's iPhone 8GS

<table>
<thead>
<tr>
<th>mn</th>
<th>Spot</th>
<th>Signal</th>
</tr>
</thead>
<tbody>
<tr>
<td>10</td>
<td>A</td>
<td>54</td>
</tr>
<tr>
<td></td>
<td>B</td>
<td></td>
</tr>
<tr>
<td></td>
<td>C</td>
<td></td>
</tr>
<tr>
<td>11</td>
<td>A</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td>B</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>C</td>
<td>1</td>
</tr>
<tr>
<td>12</td>
<td>A</td>
<td>54</td>
</tr>
<tr>
<td></td>
<td>B</td>
<td></td>
</tr>
<tr>
<td></td>
<td>C</td>
<td></td>
</tr>
<tr>
<td>13</td>
<td>A</td>
<td></td>
</tr>
<tr>
<td></td>
<td>B</td>
<td></td>
</tr>
<tr>
<td></td>
<td>C</td>
<td></td>
</tr>
</tbody>
</table>
We worked on our powerpoint for Cisco.

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

General Meeting

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

TI is coming March 28, 3-5 pm.

Where are RT-45 in the PressBox.

Look at the Press box tomorrow (3-W @ Noon) w/ Martha & Aylor.

We presented our initial findings to the team today.

The measurements were 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 presentatons again with the entire team.

Have resumes ready.

Resume site for each subteam.

~ 15 minutes per presentation.

Suite @ the future mock suite setup somewhere is a possibility.

3-11-2011

\* RJ-45

\* X = ethernet jacks

\* Pressbox
<table>
<thead>
<tr>
<th>Date</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>4/6/2011</td>
<td>Date Usage Model</td>
</tr>
<tr>
<td>20/11</td>
<td></td>
</tr>
<tr>
<td>06/2011</td>
<td>Tai Ret</td>
</tr>
<tr>
<td>1/13/2011</td>
<td>Dr</td>
</tr>
<tr>
<td>12/12/2011</td>
<td>Don talked about stack (stack trace) a useful debugging tool</td>
</tr>
</tbody>
</table>
\[
\frac{65 \text{ ppl}}{A_p} = \frac{16 \text{ ppl}}{A_p}
\]

\[
\frac{7 \text{ Mbps}}{16 \text{ persons}} = 0.4375 \text{ Mb/s per person}
\]

\[
\frac{36 \text{ ppl}}{3 \text{ APs}} = \frac{12 \text{ ppl}}{A_p}
\]

\[
\frac{7 \text{ Mbps}}{12 \text{ persons}} = 0.583 \text{ Mb/s per person}
\]

\[
\frac{50 \text{ ppl}}{A_p}
\]

\[
\Rightarrow 12.5 \text{ ppl per AP}
\]
Today we went and took a quick look around the press box at 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 dot 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. Int'l
- 14,519 clients before game, 12,911 during game, 6,750 peak
- almost 1,000 APs used. 2TX antennas, 3RX and 30% overlap. 30° antenna.
- Clean Air to monitor actual RF spectrum, freq monitoring (WEP)
- 51 APs changed power levels, 11 changed channel
- 473 unique rogue APs (Mi-Fi, sprint ondemand)
- Advertising for WiFi, Mesh Networks for outdoor applications

30/2/11

We had a meeting. No one showed up.

We went to Waldo and Ate.

06/2/11

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

- No split the paper up into sections.
  - Have draft ready for next week (Apr 13)
  - Send out email with assignments

Suite Configurations: Martha
Data Usage: Forecasts: Rich (not)
Measurements: Mike, Jung

Deployment Options: Meghan
Goals: Gaetano, Pepe

1/12/2011

Worked on draft of paper.

1/13/2011

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

1/14/2011

- Dr. Adler talked w/ sensor nets about the Motes & SIMPLEx
- Dr. Adler talked about Stack (stack trace) a useful software tool
Sub-Team Meeting

To-do:
- End-of-semester paper
- Cisco paper (Donation Report/Request)
- Athletics Proposal (will do after SupeR7 demo)
- Competition Paper (Due Friday)

Competition Paper: Talked to Able about papers.
- Park measurements > Appendices
- Stadium Measurements
- What Challenges we’ve had & what we’ve done
- Lots of people
- High demand
- Antenna Types
- Existing networks (Law, Athletics)
- Types of users
- Retro fit Bobby Dodd
- Shared Spectrum
- Handoffs
- Cost/Benefits of RPs
  (Nice Cisco vs. Consumer)

2/21/2011
- Talked about Intellectual Property
- Talked about SupeR7 at the future

Team Dinner next Thurs. 7PM Gordon Biersch

2/21/2011
- We worked on the competition paper. Wayyy to late.

2/23/2011
- We worked on the Cisco competition presentation. There is finally a plan for least stands

Intentionally left blank
Toby Krohn - GT Account Manager, Cisco
Romy Harrell - College Stadium Sales, Cisco
Kyle Shiflet - 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. 300)

Dan Goldenberg - Director of Technology
Andy Blanton - Director of Video Production

- NCAA Rights Holder
  - All rights on air, Radio + TV

- Large AT&T contract
- Cisco
  - Specialized antennas and other products becoming available
    - 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?

Walters Competition Presentation, SuiteTV 2nd 1/25, 2011
Athletics Presentation

Dr. Coyle, Dr. Aber, Pepe, Mo, and I went to dinner with two Cisco people.

context

the problem

actually have

they want a

box

Dinner
Dr. Coyle, Dr. Abercrombie, and I went to dinner with two Cisco people.

Bill (short, bearded guy) > Cisco
Moff (tall guy)

More business as usual presentations. Give context and then the solutions.

27-2014
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.

18-2014
- Suite TV gave a demo
- Dinner is now @ 7:30 PM