CS197U: A Hands on Introduction to Unix

Lecture 12: Review and Everything Else

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Reminders
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- Assignments 1-5 are graded
  - Check and see if any problems
- Assignment 7 is online (due next Tues 03/18 at 3:00 pm)
  - A bonus problem for additional 4 points
Reminders

• Assignments 1-5 are graded
  • Check and see if any problems
• Assignment 7 is online (due next Tues 03/18 at 3:00 pm)
  • A bonus problem for additional 4 points
• Those who have had 45+ pts,
  • You still need to submit at least 6 assignments
• Need to do “half” of assignment: part-2 and 4 in #7
• Let me know if you are skipping any of them or doing part of th
Today

• Course Evaluations

• **Review of what we’ve learned**

• What’s next
What we’ve learned

• Using the command line:

<table>
<thead>
<tr>
<th>cd</th>
<th>mv</th>
<th>rm</th>
</tr>
</thead>
<tbody>
<tr>
<td>mkdir</td>
<td>pwd</td>
<td>ls</td>
</tr>
</tbody>
</table>

• Reading files

<table>
<thead>
<tr>
<th>head</th>
<th>tail</th>
<th>cat</th>
</tr>
</thead>
<tbody>
<tr>
<td>less</td>
<td>more</td>
<td>grep</td>
</tr>
</tbody>
</table>

• Editing files

<table>
<thead>
<tr>
<th>nano</th>
<th>emacs</th>
<th>vim</th>
</tr>
</thead>
<tbody>
<tr>
<td>awk</td>
<td>sed</td>
<td>shell</td>
</tr>
</tbody>
</table>
and...

• Using pipes

  ```bash
  grep "Romeo" file.txt | head -n 100 | tail -n 10
  ```

• Using output redirection to save output to a file

  ```bash
  grep "Romeo" file.txt > RandJ.txt
  grep "Juliet" file.txt >> RandJ.txt
  ```

• Some special symbols

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Meaning</th>
</tr>
</thead>
<tbody>
<tr>
<td><code>./</code></td>
<td>current directory</td>
</tr>
<tr>
<td><code>../</code></td>
<td>parent directory</td>
</tr>
<tr>
<td><code>*</code></td>
<td>match all files</td>
</tr>
<tr>
<td><code>&amp;</code></td>
<td>run cmd in background</td>
</tr>
</tbody>
</table>
Important concepts

- OS enforces **file permissions** for user, group, and world

  ```
  elnux7> ls -l
  -rwxr-xr-x  1 twood  grad  97  Feb 21 11:33  script.sh
  -rw-r--r--  1 twood  grad  298  Feb 21 11:22  data.txt
  ```

- **chmod** command is used to change permissions

- **Root** user has absolute power, or use **sudo**

  ```
  sudo apt-get install firefox
  ```

- Package managers can help find and install software
About the filesystem

• The filesystem is hierarchical
  • Directories can contain files or other directories
  • / is the root directory, where the hierarchy begins
  • Other important directories to remember:
    /opt/ - third-party software
    /bin/ - executable files
    /sbin/ - privileged executables
    /sys/ - Kernel, device drivers, etc
    /dev/ - devices
    /usr/ - Other OS programs and data
    /etc - system configuration
    /home/ - user home directories
    /var/ - Logs, databases, rapidly-changing file
    /lib/ - libraries
How to get system info

- **ps** and **top** to learn about running processes

```
elnux5> ps
       PID TTY       TIME CMD
 17786 pts/0 00:00:00 tcsh
 17830 pts/0 00:00:00 bash
 17832 pts/0 00:00:00 top
 17833 pts/0 00:00:00 ps
```

- Lots of log and system files with OS information

```
tail /var/log/messages
cat /proc/cpuinfo
```
Programming and scripting

- C / C++ tools

<table>
<thead>
<tr>
<th>Tool</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>gcc</td>
<td>c compiler</td>
</tr>
<tr>
<td>g++</td>
<td>c++ compiler</td>
</tr>
<tr>
<td>gdb</td>
<td>debugger</td>
</tr>
<tr>
<td>make</td>
<td>build automator</td>
</tr>
</tbody>
</table>

- Python, perl, ruby, and many more

- Shell scripting

```bash
# Command line arguments:
dir=$1

if [ -d "$dir" ];
then
    echo "Reading files in $dir"
else
    echo "Not a directory"
    exit
fi

for f in $dir/*.csv
    do
        awk -F "\," '{print $3+$4}' $f
    done
```
awk

• Awk is a scripting language for processing structured data
  • Log files, experimental results, etc

• Can use on the command line or write in a file:
  awk -F "," -f script.awk data.txt
  awk -F "," '{print $2}' data.txt

• Very powerful!

• Often used with grep and pipe
  • `<COMMAND> | grep <KEYWORD> | head –n 10 | awk –F"":" '{print $n}'`
Version Control

• Version control systems are used to store and track source code
  • Subversion is an open source version

• Important concepts:
  • **Repository** - stores history of all files being tracked
    • You never edit these files directly
  • **Local copy** - “check out” files from repository to edit them
    • Modify the files as you like
  • **Update** - updates your local copies
    • Detects if another user modified the same file
    • Attempts to merge changes (only works for text files)
  • **Commit** - sends your versions of the files to the repository
    • Will only update repository if there are no conflicts
Working with Files

- `tar` command creates one file that is an archive of other files
  - also allows you to compress files

- `scp` command allows you to copy files to or from a remote machine

- `rsync` synchronizes files and directory
Managing Processes

- `screen`: detach/attach to terminal sessions
  - Useful for running long processes
- `ctrl-z`: Suspend a job
- `jobs`: Provides status of suspended jobs
- `bg`: Runs jobs in the background
- `fg`: Runs jobs in the foreground
- `nohup`: run jobs in detached manner from terminal
- `disown`: detach running jobs from terminal
- `cron`: schedule reoccurring jobs
- `nice` and `renice` allow you to control process priority
## Your network

<table>
<thead>
<tr>
<th>Command</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><code>ifconfig/if up</code></td>
<td>Information about interfaces</td>
</tr>
<tr>
<td><code>ifconfig/if down</code></td>
<td></td>
</tr>
<tr>
<td><code>iwconfig/iwlist</code></td>
<td>Wireless connection/association</td>
</tr>
<tr>
<td><code>dhclient</code></td>
<td>Getting an IP address from DHCP server</td>
</tr>
<tr>
<td><code>ping</code></td>
<td>Checking out a remote host</td>
</tr>
<tr>
<td><code>host</code></td>
<td>Resolve the name/IP address of a site</td>
</tr>
<tr>
<td><code>traceroute</code></td>
<td>Tracking a packet’s end-to-end path/delay</td>
</tr>
</tbody>
</table>
## Network security and traffic monitoring

<table>
<thead>
<tr>
<th>Command</th>
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<tbody>
<tr>
<td>arp</td>
<td>Address resolution protocol (IP vs. MAC)</td>
</tr>
<tr>
<td>ifstat</td>
<td>Real time bandwidth monitoring on all interfaces</td>
</tr>
<tr>
<td>iftop</td>
<td>Monitoring details of specific interface</td>
</tr>
<tr>
<td>ftp/scp</td>
<td>(Un)secure file transport</td>
</tr>
<tr>
<td>wireshark</td>
<td>Packet sniffing</td>
</tr>
</tbody>
</table>
Random useful commands

- `find` - prints the path to a file
- `locate` - finds system files
- `whereis/which` - locate a binary file
- `diff` - compares two files
- `sort` - sorts a file alphabetically or numerically
- `uniq` - removes identical adjacent lines
- `cd` - moves to the last directory you were in
- `export` - declare and export variables
- `alias` - creates a shortcut to a command for the bash shell
Today

• Course Evaluations
• Review of what we’ve learned
• What’s next
What you can do next

- **Experiment!**
- Setup a new VM with the newest Ubuntu or a different distribution
  - Ubuntu has new releases every April and October
  - Set up Ubuntu for your parents, siblings…
    - How to use a browser, Word/OpenOffice, basic things in the UI
- Dualboot your system with Windows/Mac and Linux
  - Back things up first...
  - Install Windows first, then Linux
    - grub is used as the boot loader
    - Let’s you choose which system to boot
  - If you install Windows after Linux, must fix grub
    - Typically with live CD or USB disk
For Windows users: Install Cygwin

• Gives you a Linux style command line

• Lets you install many common Linux utilities
  • ssh, gcc, grep, awk, sed
  • Install tool has hundreds of apps, but need to choose which you want
  • Can easily add more apps later

• Learn to use the “X” platform to run apps on a remote host and export display
  • Windows for GUI apps will show up on your screen
  • Can be slow if you don’t have fast network...

www.cygwin.com
Use Subversion to track files

• Setup an SVN repository on the edlab for your next big programming HW
  • `svnadmin create /path/to/repository`
• Add files and periodically commit your changes
• Use `svn diff file.java` to compare two versions
• Great SVN Cheat sheet: [http://www.abbeyworkshop.com/howto/misc/svn01/](http://www.abbeyworkshop.com/howto/misc/svn01/)

• If you use eclipse, setup the Subversion plugin
  • Integrates SVN into menus
  • Easily commit files
  • Excellent history viewer for comparing different revisions
Open Source Software Resources

• http://sourceforge.net/
  • Large collection of open source projects

• http://github.com/
  • Git is an alternative to Subversion (SVN)
  • github will host your projects for free

• http://code.google.com/
  • Google has many open source projects
  • Also provides free hosting
Take some more classes

• 377 Operating Systems
  • Learn how the Linux kernel works

• 453 Networking and 491G Networking Lab
  • Networking protocols, routing configuration

• 365 Digital Forensics
  • Learn about security and low level forensics