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# CS-E4160 - Laboratory Works in Networking and Security

## Linux Command Line Basics



# Getting Help

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- *man* – Manual pages
  - man <command>
- Searching online
  - “What I want to achieve”  
Ubuntu/Debian/Linux/Arch
- The Arch Linux Wiki is a good resource

**The TAB key is your friend!**

HELLO, 911? I JUST TRIED TO TOAST  
SOME BREAD, AND THE TOASTER GREW  
AN ARM AND STABBED ME IN THE FACE!

DID YOU READ THE  
TOASTER'S MAN PAGE FIRST?  
WELL, NO, BUT ALL  
I WANTED WAS—





# Traversing Directories

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- **cd – Change Directory**
  - Change to a directory
  - Give the directory as an argument
  - With no arguments, changes to your home directory
- **pwd – Print Working Directory**
  - Displays your current working directory



# Files and Directories on Linux

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- **By default, all file names are case sensitive!**
  - Foo.txt is different than foo.txt (unless working with Windows Partitions)
- **Dot “.”**
  - Means current directory
  - Example: find .
- **Double dot “..”**
  - The previous directory
  - Example: cd ..
- **Asterisk “\*”**
  - Matches zero or more characters (use “?” for a single character)
  - Example (list all files ending in “txt”): ls \*.txt



# More on Files and Directories

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## **cp – copy files**

- cp source dest

## **mv – move files**

- mv source dest

## **rm – remove file/dir**

- rm file
- rm -rf directory
- **Use with care!**

## **ls – list files**

## **mkdir – make directory**

- mkdir mydir

## **head – front of a file**

## **tail – tail of a file**

- tail /var/log/syslog
- default is 10 lines
- follow: -f



# Access Privileges

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## Check file permissions

- ls –ld filename
- ls –la

## Change file permissions

- chmod ugo+rwx
- User, Group, Others
- Add +, remove –
- Read, Write, eXecute
- S = Set user id or Set group id (extra rights)
- Checkout the chmod [numeric\_mode] file syntax

## What are my groups?

- groups

## Change ownership

- chown – change user
- chgrp – change group

## Switch to root shell

- su
- sudo –s
- See also /etc/sudoers.d/



# Important directories

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- **Your personal home directory is tilde: “~”**
  - Usually maps to /home/myaccountname
- **Superuser home directory is /root**
- **Temporary storage in /tmp**
  - Wiped out on reboot!
- **Configuration files usually located in /etc**
  - Sometimes in /var (as with BIND DNS server)
- **Log files in /var/log**
  - Important in diagnosing problems with services



# Usage of Files

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- **What type of file is it?**
  - file filename – displays file type
- **System executables**
  - System applications: just type the command, e.g. “ls”
  - Non-system applications: “./my\_binary”
- **Text files**
  - cat file – displays the contents
  - less file – displays scrollable contents (q=quit)
  - Text editors: nano, emacs, vi(m)



# Searching for Files

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- **Locate**
  - Searches file names using a precreated index
  - Fast, but may not be up-to-date
  - Example: `locate foo.txt`
- **Find**
  - Searches file names without a precreated index
  - Slow but always up-to-date
  - Example: `find /etc -name "*cfg"`
- **Grep**
  - Search file contents (always up-to-date)
  - Example: `grep -r ssh /etc`



# Searching for Executables

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- **Where is tool xyz located?**
  - which xyz – displays the path of xyz
- **What was the tool related to “keyword”?**
  - man –k keyword
  - Note: manual pages describe command line use
  - Start with the examples in the manual pages
- **What was the command I used yesterday?**
  - history – displays all typed commands



# Installing software in Debian based Linux distributions

- **apt-get or apt**
  - Use one of them but don't mix them!
  - Here, the syntax is the same for both
- **Searching**
  - apt-get search softwarename
  - apt-cache search softwarename
  - apt search softwarename
- **Installation**
  - apt-get/apt install softwarename
- **Uninstalling**
  - apt-get/apt remove softwarename



# Volumes and Disks

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- **mount – attaches a volume to a directory**
- **umount – detaches a volume**
- **df – how full is the disk?**
  - Human readable: df –h



# Reading and Writing I/O

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- **Read from an unnamed input stream <**
  - grep “abc” <file
- **Redirect normal output of a tool to a file >**
  - find . >file
  - cat > foo.txt
  - Ctrl+d ends stdin!
- **Redirect error output of a tool to a file 2>**
  - find /etc 2> file
- **Just redirect everything to a file**
  - find /etc >file 2>&1
- **Appending is >>**
  - echo “foo” >>file
  - Note: > overwrites the file
- **Piping |**
  - find /etc | less
- **Stop/resume output**
  - Ctrl+s / Ctrl+q



# Process Management

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- **Process running?**
  - ps axu | grep ssh
  - Or just “top”
- **Kill process**
  - kill process id
  - kill ‘pidof processname’
  - killall processname
- **Start in background &**
  - processname &
- **Bring a background application to the foreground**
  - fg
- **Put the application to the background**
  - bg
- **Suspend: Ctrl+z**
- **Terminate Ctrl+c**



# Service Management

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- **Is “ssh” service running?**
  - `systemctl status ssh`
- **Stop “ssh” service**
  - `systemctl stop ssh`
- **Start “ssh” service**
  - `systemctl start ssh`
- **Stop + start “ssh” service**
  - `systemctl restart ssh`
- **Reload configuration**
  - `systemctl reload ssh`
- **Start at boot**
  - `systemctl enable ssh`
- **Old style invocation**
  - `service ssh status`
- **In Debian, services are in**
  - `/etc/systemd/system`



# SSH Access

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- **Login** ssh user@hostname.domain
- **Exiting:** exit (if unresponsive, press alt-gr+~+.)
- **Clear terminal:** reset/clear
- **Upload:** scp local\_file user@remotemachine:dir/
- **Download** scp user@remotemachine:remote\_file .
  - Recursive copy: -r
- **Annoyed by password prompts?**
  - man ssh-keygen, man authorized\_keys
  - Make sure ~/.ssh permissions are correct!
  - Spend 5 minutes now to set up, save countless minutes later!
- **SSH tunneling / proxying (ssh -L)**



# Miscellaneous

- **System Information**
  - `uname -a`  
print all system information
  - `lsb_release -a` (linux release)
- **Cron & Crontab**  
schedule periodic execution of a binary
- **Docker Containers**
  - Execute processes in an isolated environment
- **Apparmor and SELinux –**  
security enhancements  
-> mandatory access control (mac)

- **Screen**
  - Exiting ssh kills running processes
  - Screen avoids this (e.g. for IRC sessions)
    - screen program *zxname opens up the program inside a screen*
    - *Ctrl+a+d to detach*
    - *screen -r to reattach*
    - *screen -list lists all opened screen sockets*
- **TMUX**
  - Alternative for screen



# Networking Commands

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- **Recommended**
  - ip addr, ip neigh
  - ip route
  - ip xfrm
  - iw
- **Old skool**
  - ifconfig, arp
  - route
  - setkey (ipsec)
  - iwconfig
- **DNS look-up**
  - host
  - dig
  - nslookup
  - hosts file
- **Firewall**
  - nftables
  - iptables/ip6tables
- **ping, ping6, traceroute, mtr**



# Networking commands

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- **Netmask generation or conversion**
  - netmask
- **Traffic capture**
  - tcpdump
  - wireshark
- **Fine tune n/w stack**
  - /proc/sys/net
  - /proc/net
- **What service is up?**
  - netstat (local)
  - nmap (remote)
- **Web testing**
  - lynx
  - wget (note -r)
  - curl
- **Performance**
  - iperf, netperf
  - t-stat, httpperf, jperf

# A?

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## Questions?

## Was something missing?