



Aalto University  
School of Science

# A Brief Primer on Linux

*T-110.5102 Laboratory Works in  
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# Traversing Directories

- **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

**Use the tab key for auto-completion!**

# Files and Directories on Linux

- **By default, all file names are case sensitive!**
  - Foo.txt is different than foo.txt (unless working with FAT32)
- **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

## **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

## 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)

## 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/`
- Passwordless sudo **saves time!**

# Important directories

- **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

- **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

- **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

- **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

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

# Volumes and Disks

- **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

- **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

- **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

- **Is “cups” service running?**
  - service cups status
- **Stop “cups” service**
  - service cups stop
- **Start “cups” service**
  - service cups start
- **Stop + start “cups” service**
  - service cups restart
- **Reload configuration**
  - service cups reload
- **Old style invocation**
  - /etc/init.d/cups start
- **In Debian, services are in**
  - /etc/rc2.d/
  - S – start in boot
- **“runlevel” tells the run level**

# SSH Access

- Login `ssh user@hostname.domain`
  - Exiting: `exit` (if unresponsive, press `alt-gr+~+.`)
  - Clear terminal: `reset`
  - 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`)**
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# Miscellaneous

- **System Information**
  - `uname -a` (processor architecture)
  - `lsb_release -a` (linux release)
- **Crontab – execute binaries periodically**
- **Chroot (or jail) sandbox**
  - Execute processes in constrained environment
- **Apparmor and SELinux – security enhancements**
- **Screen**
  - Exiting ssh kills running processes
  - Screen avoids this (e.g. for IRC sessions)
    - `screen programname` *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



- **Recommended**

- ip addr, ip neigh
- ip route
- ip xfrm
- ip iw

- **Old skool**

- ifconfig, arp
- route
- setkey (ipsec)
- iwconfig

- **DNS look-up**

- host
- dig
- nslookup (depr.)
- hosts file

- **Firewall**

- iptables
- ip6tables
- No DNS: -n flag
- **ping, ping6, traceroute**

- **Netmasks**
  - netmask nw/mask
- **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



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# Questions?

# Was something missing?