Computer Systems and Architecture

Introduction to UNIX

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Outline

What is Unix?

Getting started

Streams

Exercises

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Exercises

UNIX

- Operating system
- Servers, desktops, laptops
- Different types
  - Sun Solaris
  - FreeBSD
  - GNU/Linux (Ubuntu, OpenSUSE, Debian, CentOS, ...)
  - MacOS X

UNIX Shell

- Three parts:
  - Kernel
    - Central component, manages the computer's hardware (CPU, memory, filestore...)
  - Shell
    - Interface between user and kernel
    - Command Line Interpreter (CLI)
  - Programs

UNIX Shell

- Interprets commands
- Commands are themselves programs
- Filename completion (use the [tab] key)
- History (use the cursor keys)

Student server

- FreeBSD
- Login using SSH
  - Windows: Putty
  - UNIX: `ssh username@radix.cmi.ua.ac.be`
- Radix
  - Login: `p10xxxx` (roll number)
  - Password: change with command `passwd`
- Webserver
  - Put files in directory `~/public_html`
  - Access through `http://radix.cmi.ua.ac.be/~username/`

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Files and processes

- Everything in UNIX is a file or a process
  - A process is an executing program (unique PID)
  - A file is a collection of data
- Directory structure
  - Root: `/`
  - Home dir: `~/`
  - Current dir: `./`
  - Parent dir: `../`
  - Absolute path: `/home/p10/p101234/oefeningen.html`
  - Relative path: `./oefeningen.html`

File permissions

- Users
  - Unique username
  - Member of one or more groups
  - `/etc/passwd` and `/etc/group`
- Files
  - Owner (and associated group)
  - Set of permission flags: `r` (+4), `w` (+2), `x` (+1) for owner, group, other
  - Change with `chmod`, `chown`, `chgrp`
- Examples:
  - `chmod 755` *`file`* Owner can do everything, group and others can read/execute
  - `chmod 777` *`file`* Everyone can read, write and execute
  - `chmod 600` *`privatefile`* Owner can read/write, others can't do anything
  - `chmod 664` *`file`* Owner and group can read/write, others can only read

Basic UNIX commando’s - browsing

`ls`	list files and directories
`ls -a`	list all files and directories
`mkdir`	make a directory
`cd` *directory*	change to named directory
`cd`	change to home directory
`cd ~`	change to home directory
`cd ..`	change to parent directory
`pwd`	display the path of the current directory
`find`	search through directory tree

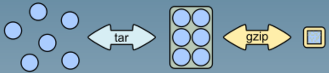
Basic UNIX commando's - files

cp *file1 file2*	copy file1 and call it file2
mv *file1 file2*	move or rename file1 to file2
rm *file*	remove a file
rmdir *directory*	remove a directory
cat *file*	display a file
less *file*	display a file a page at a time
head *file*	display the first few lines of a file
tail *file*	display the last few lines of a file
grep 'keyword' *file*	search a file for keywords
wc *file*	count number of metrics in file
ln -s *from to*	make softlink from to
unique	Report or filter out repeated lines in a file

Basic UNIX commando's - Varia

man *command*	display manual pages for a command
date	display date and time
who	info on all currently logged on users
whoami	info about yourself
echo *hello world!*	display characters in the terminal
sort text	sort its input
finger	Lookup user info

Archiving



- Tar
  - Uncompressed
  - Create: `tar -cvf` *`tarball.tar files`*
  - Extract: `tar -xvf` *`tarball.tar`*
- Gzip
  - Compression
  - Create: `gzip` *`tarball.tar`*
  - Extract: `gunzip` *`tarball.tar.gz`*
- `tar.gz` or `tgz`?
  - Tar + compression
  - Create: `tar -cvzf` *`tarball.tgz files`*
  - Extract: `tar -xvzf` *`tarball.tgz`*

Processes

- Jobs are connected to terminal which started them
- Foreground or background
- `Ctrl+C`: kill current job

kill [-9] *process_id*	Kill job with pid process_id
pkill *process_name*	Kill job with name process_name
command &	Run command in the background
ps [-ef]	Display process info
top	Display process info interactively
jobs	Display user's jobs
fg *pid*	Bring process to the foreground
bg *pid*	Bring process to the background

Basic UNIX commando's - Network

`ssh` *username@host*	Login with a remote shell
`scp` *from username@host:to*	copy files over network
`wget` *http://url/file.jpg*	download files from the web

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Standard in- and output

- Processes write to the standard output, and take their input from the standard input.
- Keyboard and terminal
- Standard error (terminal)
- Redirection is possible
    - >, >>, <, 2>

Redirection

- `ls -alrF > listing.txt` : store ls output in listing.txt
- `sort < listing.txt` : feed listing.txt to sort program
- `echo HOI >> listing.txt` : append string HOI to listing.txt
- `echo hello > /dev/null` : suppress output
- `who 2> errors.txt` : store errors in file

Pipes

- Pipes redirect output from one process to the following one
- Without pipes:

```
who > names.txt
sort < names.txt
```

- With pipes:

```
who | sort
```

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- http://msdl.cs.mcgill.ca/people/hv/teaching/ComputerSystemsArchitecture/#csw2