Computer Systems and Architecture

Introduction to UNIX

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Outline

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)

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
  - `chmod +x` *`file`* Add execute permissions for everyone

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

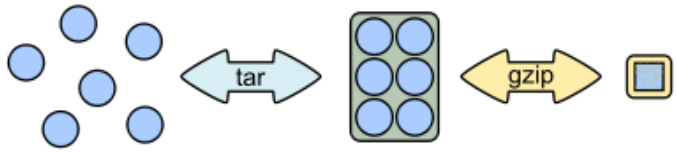
Basic UNIX commando's - files

`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
`uniq`	report or filter out repeated lines in a file
`file` *file*	show the file type of a file
`du` *file*	show the disk size of a file or directory

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`*
  - List files: `tar -tf` *`tarball.tgz`*
  - Update files: `tar -uf` *`tarball.tgz files`*
- 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`*
  - List files: `tar -tzf` *`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

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
```

Exercises

- http://msdl.cs.mcgill.ca/people/hv/teaching/ComputerSystemsArchitecture/#CS1