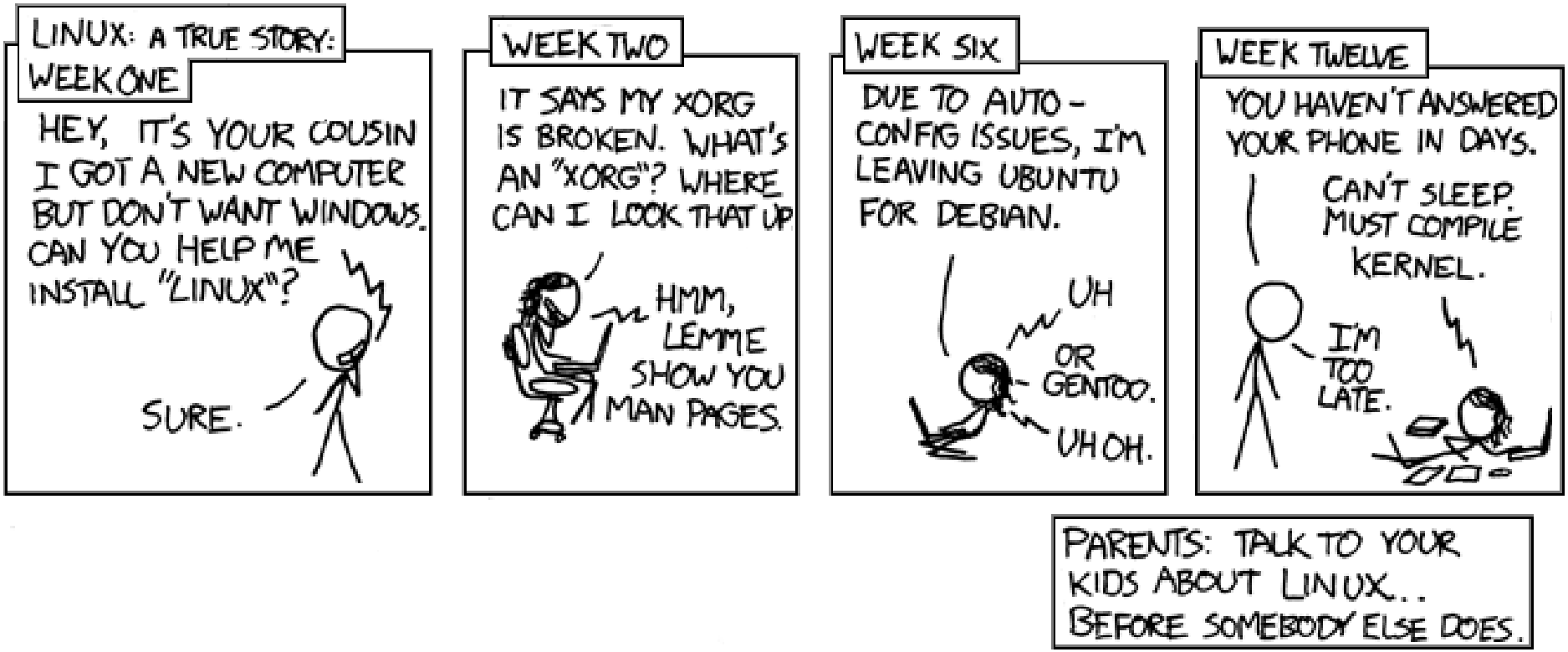

LINUX: A TRUE STORY:
WEEK ONE
HEY, IT'S YOUR COUSIN I GOT A NEW COMPUTER BUT DON'T WANT WINDOWS. CAN YOU HELP ME INSTALL "LINUX"?
SURE.
WEEK TWO
IT SAYS MY XORG IS BROKEN. WHAT'S AN "XORG"? WHERE CAN I LOOK THAT UP
HMM, LEMME SHOW YOU MAN PAGES.
WEEK SIX
DUE TO AUTO-CONFIG ISSUES, I'M LEAVING UBUNTU FOR DEBIAN.
UH
OR GENTOO.
UH OH.
WEEK TWELVE
YOU HAVEN'T ANSWERED YOUR PHONE IN DAYS.
CAN'T SLEEP. MUST COMPILE KERNEL.
I'M TOO LATE.
PARENTS: TALK TO YOUR KIDS ABOUT LINUX.. BEFORE SOMEBODY ELSE DOES.

Unix/Linux Induction

or: How I Learned to Stop Worrying and Love the :(){:|:&};:

Jascha Schewtschenko

Institute of Cosmology and Gravitation, University of Portsmouth

October 17, 2022

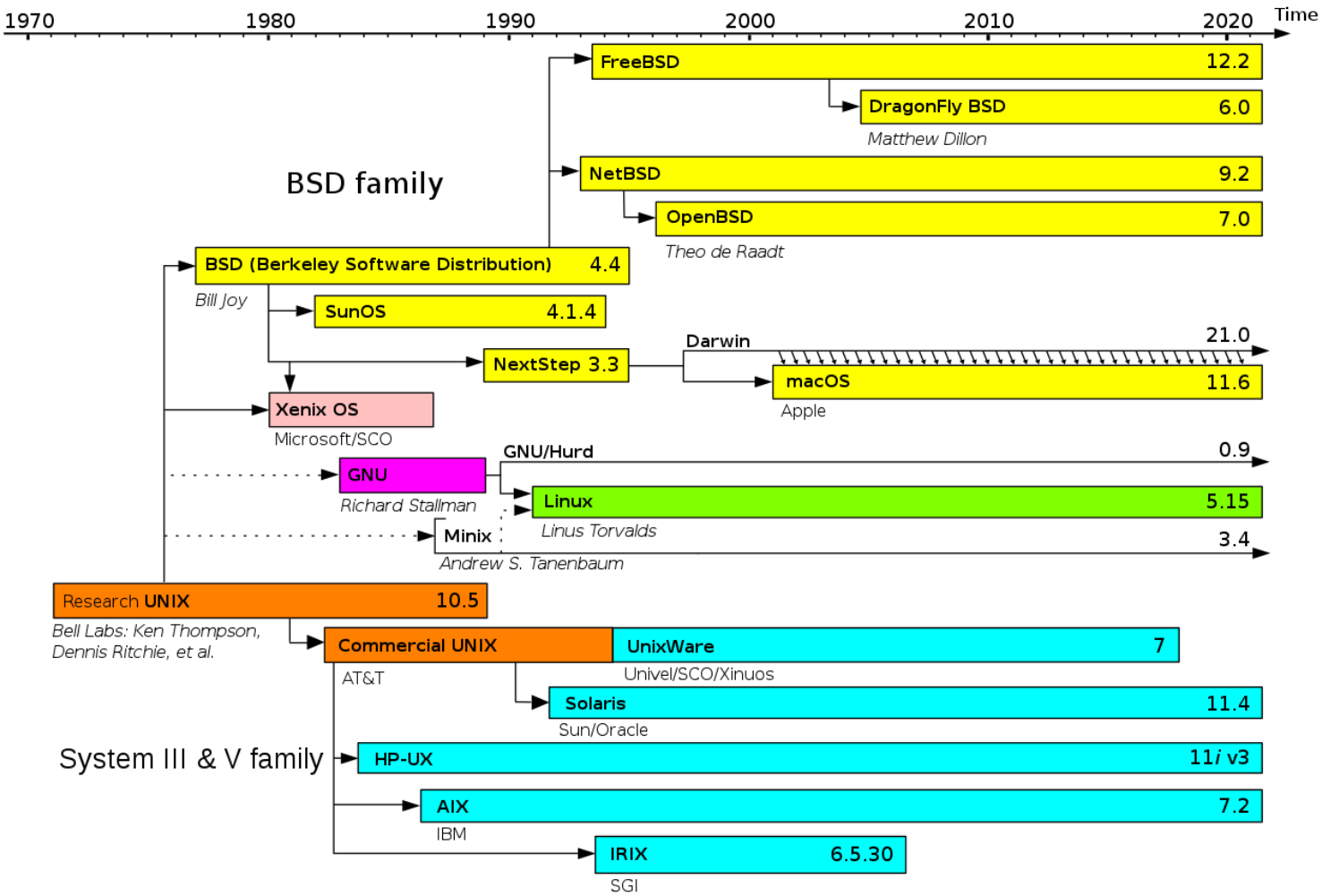
Outline

1. Linux vs Unix vs macOS
2. Shells
3. Filesystem(s)
4. Pipes and input/output control
5. Printing
6. Software
7. Process/Job control
8. Scripting, text editing, etc.
9. Help/Manpages

Linux vs Unix vs macOS

Meet the family

Linux vs Unix vs macOS



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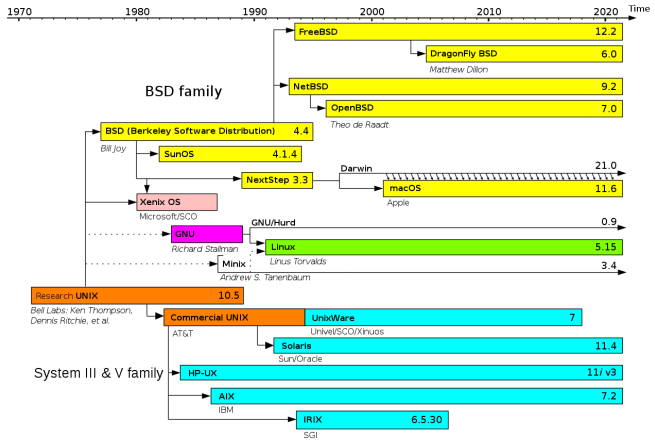

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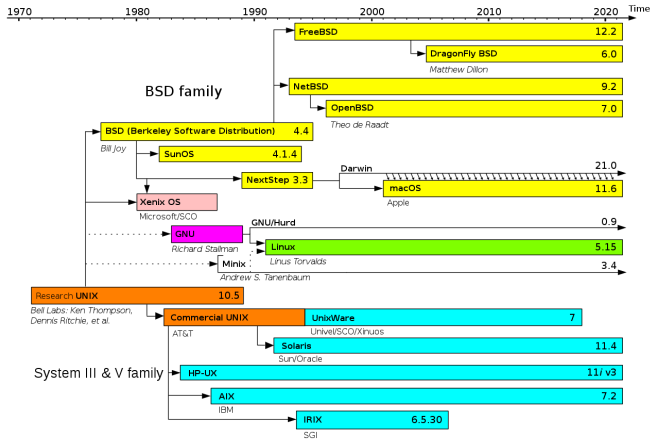

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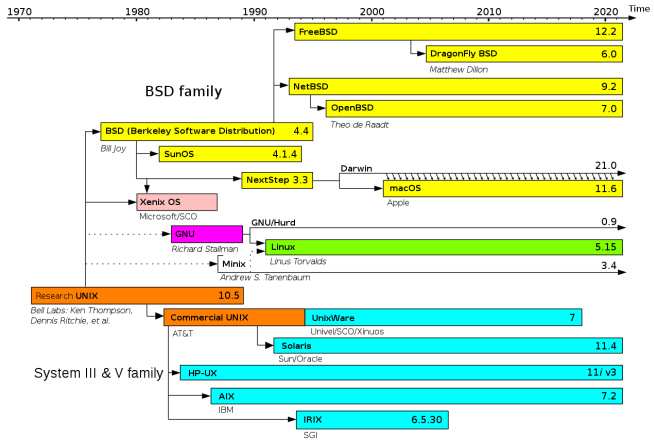

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macOS Unix-based OS developed in early 2000s exclusively* for Apple's Macintosh computers (not to be confused with 'classic' MacOS !); *Darwin is open-source for many modern architectures

Linux vs Unix vs macOS (cont.)

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- Close relationship between OSs makes it possible to port programs from one to another, e.g. macOS supports many of the libraries found in Linux which allows to easily* compile Linux programs on MacOS (*adjustments have to be made; reverse portability not that easy)
- Most astrophysics software will work fairly straightforwardly on either OS

Shells

How to "communicate" with your machine

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- In this course, we will focus on `GNOME3` and `bash`, as they are pre-installed shells on our CentOS7 / Ubuntu Linux distros (tutorials on other shells can be found online)

Graphical shell: GNOME

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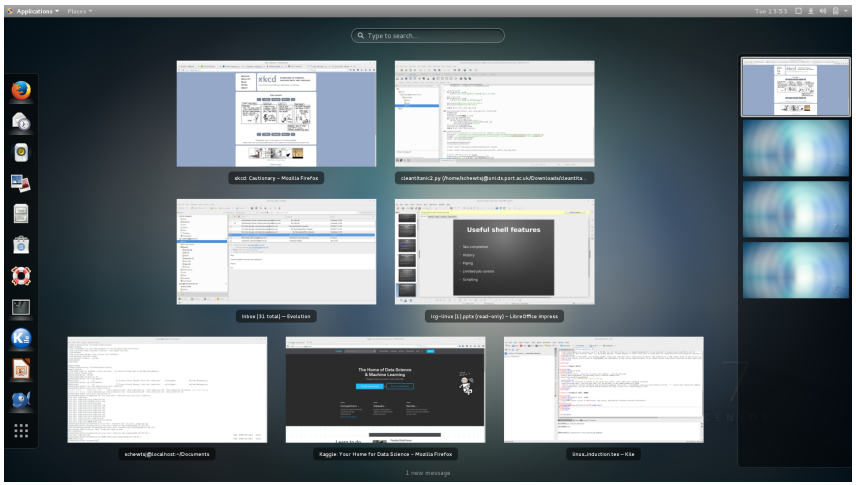

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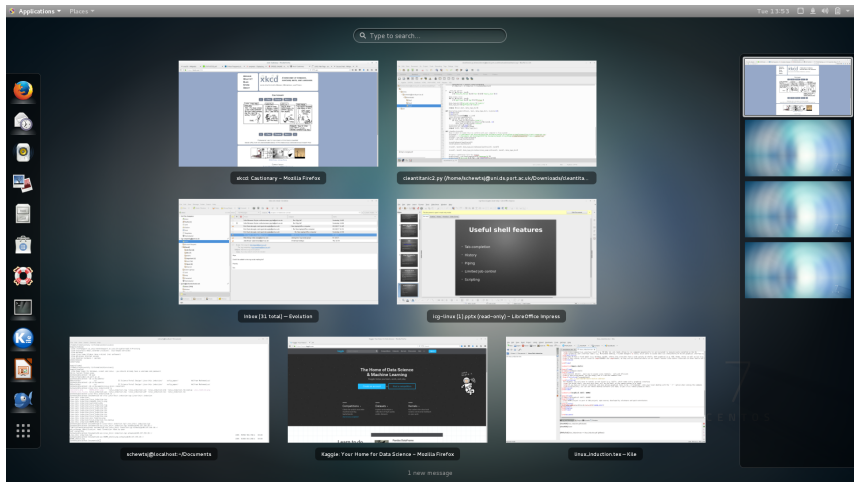

- useful features:

  online services many tools tie in with cloud services like Google Drive or DropBox

  mouse-buffer Mark text anywhere and insert this text anywhere else by clicking onto the middle mouse button (or alternativly, left and right button)

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- We will have a look at useful built-in commands and shell scripting a bit later.

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- Alternatively, you can use remote desktop software like X2Go, to get a full remote graphical shell.

I/O

How to store, access and manage data

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- if you connect a device formatted for a specific filesystem, your OS has to support it in order to access it

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/tmp/	Temporary data

Filesystem(s): Layouts (cont.)

- Some locations may vary depending on the OS, e.g. for the users' home directories:

  /home/ common location on Linux (on our systems, it's actually `/home/UNI/<username>` for your network-based home directories)

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- There are also some shortcuts defined:

  . points to same directory

  .. points to parent directory

  ~ location of your home directory

  ~<username> location of the home homedirectory of user <username>

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- a relative path is given with the current directory as its base, e.g. if the current directory is `/home/juser`, then the relative path to the same data file goven above would be simply `Documents/test.dat`, but also alternatively `./Documents/test.dat` or even `../../etc/../home/juser/Documents/test.dat`

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- alternatively, you can use quote marks i.e. '`'sh*tty filename?'`'

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mkdir,rmdir	creates/removes (empty) directories (if not empty, use `rm` instead)

Filesystem(s): Management (cont.)

- There are also tools to give you informations about used/available disk space:

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- results are given in bytes; add '`-h`' argument to get "human-readable" numbers with SI-prefixes

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- if you want to list them, you have to use `ls` with the `-a` argument, or configure your graphical file manager to also show hidden files

Filesystem(s): Ownership/Permissions

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[jschewts@login5(sciama) ~]$ ls -l test.dat
-rwxr----x 1 jschewts users 0 Oct 10 19:39 test.dat
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- the filesystem distinguishes between three different permission types for each file/directory:

r(ead)	allows to read content of file / to list content of directory
w(rite)	allows to change content of file / to manipulate file list of directory (i.e. create, remove, rename files)
(e)x(ecute)	allows to execute file / to enter directory

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- for changing permissions, you can either add/remove permissions using a string e.g. `chmod g+rw <filename>` for adding read/write permission to the file for the group who owns it

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other user group

- ownerships/permissions can be changed using the commands `chown`, `chgrp` and `chmod` respectively
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- alternative you can set the permissions for user/group/others using a numeral expression based on a bit mask (r=4,w=2,x=1): so set the permissions for 'test.dat' as shown, you would have to use `chmod 741 test.dat`

Filesystem(s): Ownership/Permissions

```
[jschewts@login5(sciama) ~]$ ls -l test.dat
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- all three commands support the argument '-R' for a directory which changes the ownership/permission for all files/dirs in it recursively

Pipes and input/output control

- standard streams

  STDIN is usually your keyboard input, but be also redirected output from other devices/a file/other program

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- '< <filename>' can be used to use the content of a file for STDIN, e.g. `qsub < submission.batch`

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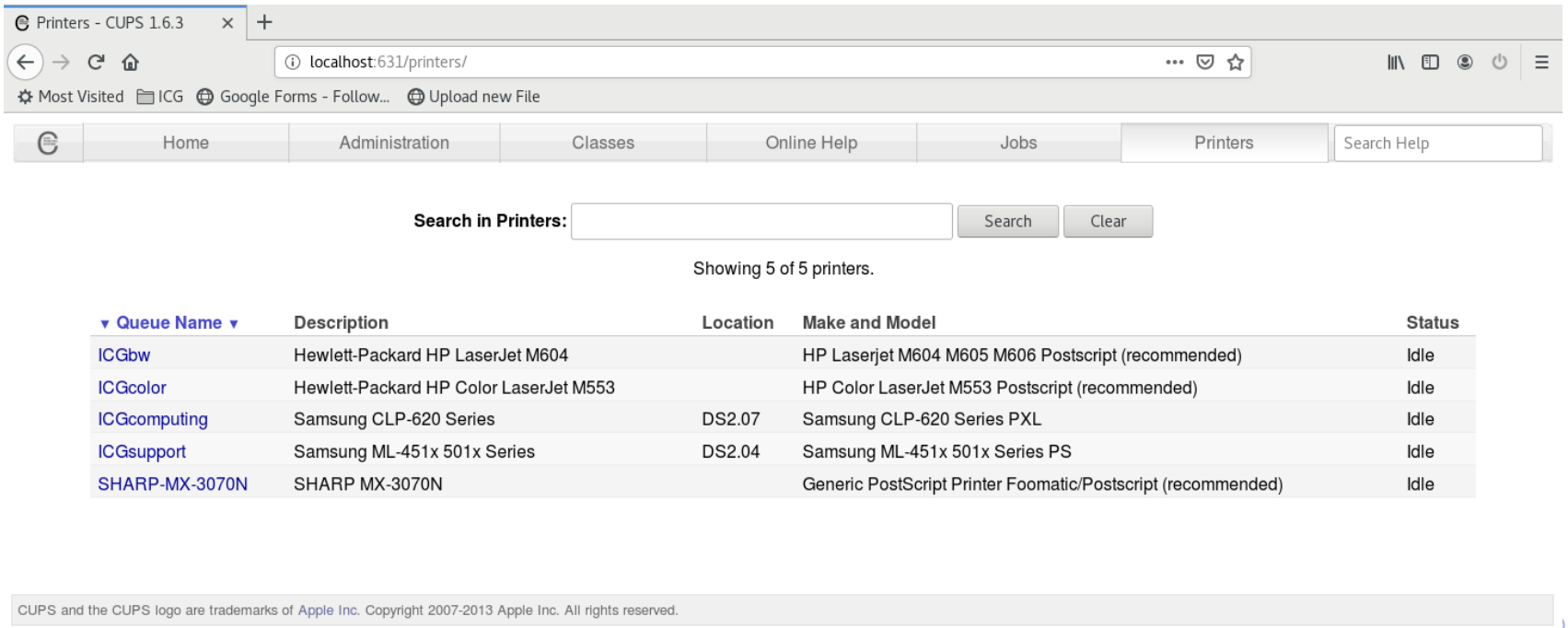
- It is usually wrapped by your distro's configuration tools, but can also be directly accessed via its local web interface (port 631).



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- you can, of course, print from graphical programs (Acrobat, GhostView, text editors, etc.)

Software

How to build, install and manage programs

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- Software may be installed from managed package trees using tools like e.g. aptitude or yum on Linux (or graphical programs like Synaptic) or e.g. homebrew on macOS

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- Alternatively, software/libraries can be compiled from source code.

Software: File compression

- when dealing with source code, you usually will encounter it in form of a (gzip-compressed) tar (*.tar,*.tgz,*.tar.gz,*.tar.bz2) archive

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- to uncompress/unpack a gzip-compressed tar archive, use `tar xvzf <archive filename> <list of files to be included>` (if bzip2-compressed, replace z with j, or omit it for uncompressed archives)

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- if you want to obtain the most recent version of the source code for a program, you can often find it on such a server. To get a copy e.g. from a git repository, you would simply call:

```
git clone <URL to repository>
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- In any case, check the `README` or `INSTALL` file shipped with the source for further information on how to compile/install the software

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- if you installed your software into a custom directory, you have to make sure that the binaries and libraries are in a directory listed in `PATH` and `(LD_)LIBRARY_PATH` respectively.

Process/Job control: Jobs

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- `CTRL-z` suspends a foreground job (it will be stopped then and you can use `bg [<jobnumber>]` to make it run in the background)

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  e.g. `kill -19 1923` stops the process with the pid 1923, while `kill -SIGCONT 1923` will resume it again.

Process/Job control: Processes (cont.)

- you can also *renice* processes to affect how greedy they are when using the computation time (e.g. a non-urgent non-interactive calculation does not have to be responsive to sudden new input and also does not need to finish as quickly as possible)

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- Levels of niceness run from -20 to +19, 0 is the default level

Scripting, text editing, etc.

- Some handy tools

  emacs, vim, gedit text editor

  more, less pages through a file

  cat <file> [<file2> ...] concatenates files and writes them to STDOUT

  head, tail show top/bottom of a file (`tail -f` keeps updating bottom, handy e.g. for log files of active program)

  grep <pattern> [<files>] parses STDIN or files for pattern (regex) and returns matching lines

  sed, awk very powerful CLI stream/text processors; can be used to post-process output from a program or quickly replace strings in a file (perfect for scripting)

  screen allows you to detach a shell from the terminal/login (e.g. to keep it running while you close the terminal or ssh connection and to reattach it to a new session)

Scripting, text editing, etc. (cont.)

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- do not forget to make your script executable (see file permissions) before trying to run it
- for more information on (shell) scripting, please be referred to the plentiful resources online

Help!

Where to get it ...

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- Google!/Bing!/DuckDuckGo! - Loads of information out there (and if not there are forums like stackoverflow with helpful people)

QUESTIONS?


LINUX
"In a world without walls and fences,
who needs Windows and Gates?"