Linux Environment

Shell Commands

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Commands

```
command [options] [arguments]
```

- Unix-like command syntax
- The name of the command is associated to the action performed
- The options (optional, 0 or more) have conventionally two formats
  - The character '-' followed by only another character
    - -ch_1 -ch_2 ...
  - The two characters "--" followed by a string
    - --str_1 --str_2 ...
- Arguments are optional

Also
-ch_1 ch_2 ch_3

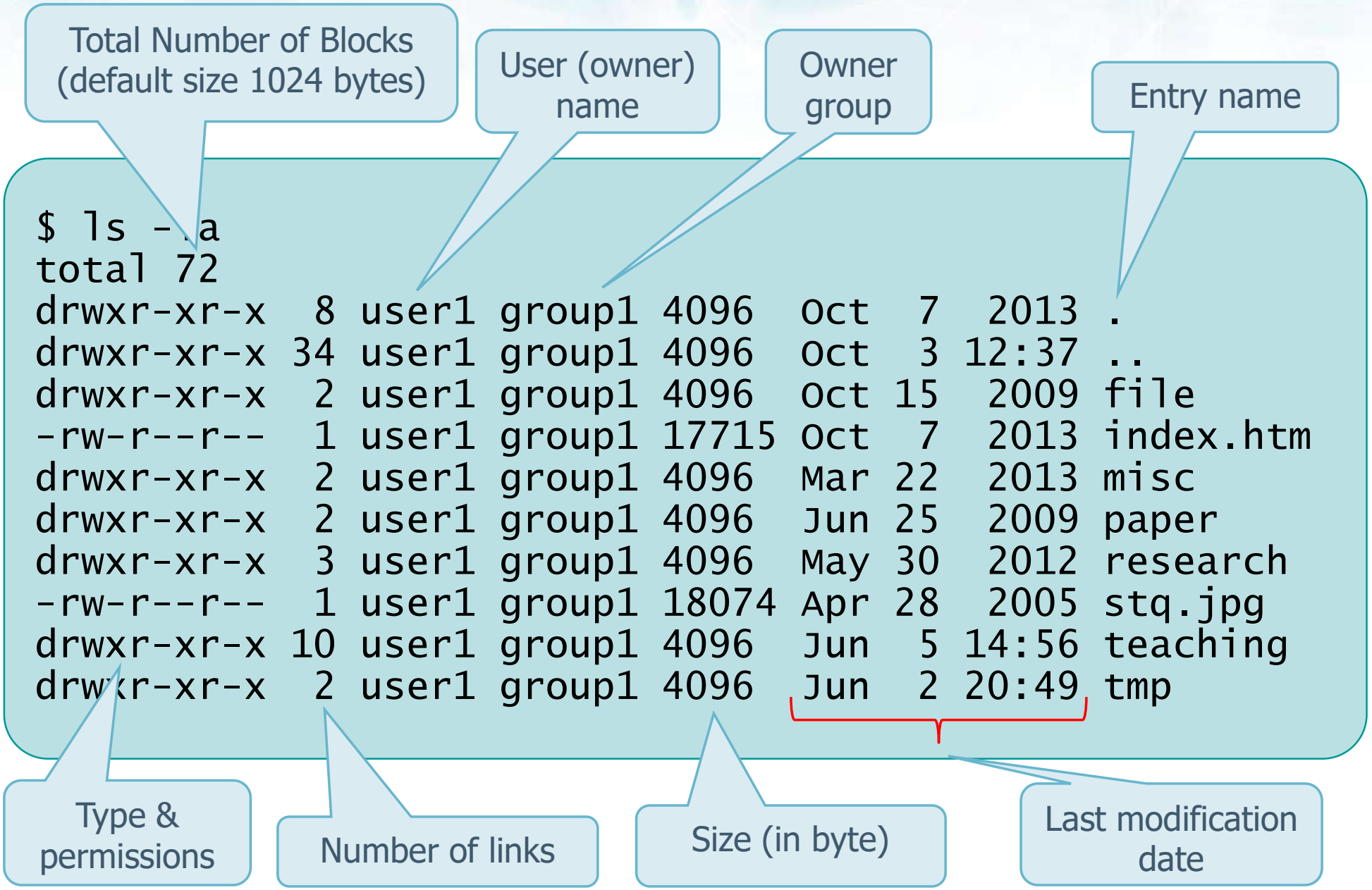
Regular file management: ls

- Command **ls** provides information about a file according to the specified options
  - If the pathname is a directory, **ls** lists the files and subdirectories contained in that directory (i.e., the 'entries' of a directory)
    - ls [-options] [file ...]
  - Options
    - --help
      - in-line help
    - --all, -a
      - Shows also hidden files (filenames beginning with '.')
    - -l
      - Long list format (extended output)

Regular file management: ls

- --group-directories-rist, -g
  - Included group info before those related to files
- -t
  - Sort files by date (newest first)
- --reverse, -r
  - Reverse order (alphabetic/date)
- --recursice, -R
  - Recursive (includes files in subdirectories)

Example


Total Number of Blocks (default size 1024 bytes)
User (owner) name
Owner group
Entry name
$ ls -la
total 72
drwxr-xr-x 8 user1 group1 4096 Oct 7 2013 .
drwxr-xr-x 34 user1 group1 4096 Oct 3 12:37 ..
drwxr-xr-x 2 user1 group1 4096 Oct 15 2009 file
-rw-r--r-- 1 user1 group1 17715 Oct 7 2013 index.htm
drwxr-xr-x 2 user1 group1 4096 Mar 22 2013 misc
drwxr-xr-x 2 user1 group1 4096 Jun 25 2009 paper
drwxr-xr-x 3 user1 group1 4096 May 30 2012 research
-rw-r--r-- 1 user1 group1 18074 Apr 28 2005 stq.jpg
drwxr-xr-x 10 user1 group1 4096 Jun 5 14:56 teaching
drwxr-xr-x 2 user1 group1 4096 Jun 2 20:49 tmp
Type & permissions
Number of links
Size (in byte)
Last modification date

Regular file management

- Copy a file
  - cp [options] src1 src2 ... dest
  - Example
    - cp file1 file2 file3 ... dir
- Remove a file
  - rm [options] file1 file2 …
- Move (rename) a file
  - mv [options] file1 file2 ... dest

Regular file management

- Options
  - --help
    - in-line help
  - --force, -f
    - does not ask confirmation (force)
  - --interactive, -i
    - ask confirmation for each file (interactive)
  - --recursive, -r, -R
    - Apply command recursively on all the subdirectory files
- Directories can often be managed as regular files

rm over objects without write rights requires confirmation

Directory management

- Change current directory
  - cd dir
- Print working directory
  - pwd
- Create a directory
  - mkdir dir
- Remove a directory
  - rmdir dir

  ➢ A directory can be removed only if it is empty, unless the options -rf are used with command
  - rm -rf dir

Permissions for files

- The meaning of the permission "rwx" is different between files and directories
  - File
    - r
      - Read permission (of the file)
    - w
      - Write permission (of the content of the file)
    - x
      - Execution permission (the file can be executed)

cp file1 file2
fails if file1 has not read permissions or if file2 has not write permissions

Permissions for directories

- The meaning of the permission characters is different for directories.
  - Directory
    - r
      - Directory content can be listed
    - w
      - Create, rename, or delete files within the directory
    - x
      - Directory can be crossed or **cd** command can be performed (to access it, not to list)

cd dir
fails if dir has not
execution permissions

Permission management

- To change file permissions use
  - chmod [options] permissions file
- Permissions can be specified in different ways
  - Absolute, by means of three octal digits
    - chmod 775 filename
  - Symbolic, by means of a string of three (or more) characters
    - chmod g+r filename
    - chmod +x filename
    - chmod +xw filename
    - chmod uo+rx filename

u (user), g (group), o (other), a (all) → r, w, x → +, -, =

uo+rx: Add (+) to user (u) and other (o) the read (r) and execute (x) permissions

Permission management

- To change the owner of a directory entry
  - chown [options] user entry
- To change the group of a directory entry
  - chgrp [options] group entry
- These command can be combined
  - chown [options] user[:group] entry
  - chown [options] uid[:gid] entry

Output the content of a file

- Output and concatenate files
  - cat filename$_1$ filename$_2$ …
- Output the first **num** lines of a file
  - head [options] filename …
- Output the last **num** lines of a file
  - tail [options] filename …
- Additional output commands
  - pg [options] filename ...
  - more [options] filename ...
  - less [options] filename ...

File comparison

- Difference between two files
  - diff [options] file1 file2
  - Lists the line number of the lines
    - a
      - added
    - d
      - deleted
    - c
      - changed
- Difference between two directories
  - diff [options] dir1 dir2

File comparison

- Options
  - --brief, -q
    - Reports only when files differ (default)
  - --ignore-space-change, -b
    - Ignores spaces at the end of the line, merges the others
  - --ignore-case, -i
    - Case insensitive
  - --ignore-all-space, -w
    - Ignores completely al white spaces
  - --ignore-blank-lines, -B
    - Ignores all blank lines

Counts

- Outputs the number of lines, words, and bytes of a file
  - wc [options] [file...]
  - Options
    - --lines, -l
      - Outputs only the number of lines
    - --words, -w
      - Outputs only the number of words
    - --bytes, -c
      - Outputs only the number of bytes
    - --chars, -m
      - Outputs only the number of characters
      - Option typically not used

Warning: it also outputs the filename as its first line

Hard and Soft Link

- There are two types of links in UNIX
  - Symbolic or soft link
    - Particular type of file that simply contains a path (i.e., the name) of another object (file or directory)
    - Allows references between different file-systems (partitions)
    - If you remove the file the link remains pending
  - Physical or hard link
    - Association between an object name and its content (pointer from directory-entry to i-node)
    - It is not possible to create hard links between different file-systems, or hard links to a directory
    - The file is removed only when it is removed the last of its hard links

Hard and Symbolic Links

- Link creation
  - ln [options] source [destination]
  - Default behavior
    - Creates a hard link
    - If the destination is not present, creates a link with the same filename on the working directory

Hard and Symbolic Links

- Options
  - --help
    - in-line help
  - --symbolic, -s
    - Creates a symbolic link (soft link)
  - --force, -f
    - Force creation, removes file if already exist
  - --directory, -f, -F
    - allow the superuser to attempt to create a hard link to a directories (note: will probably fail due to system restrictions, even for the superuser)